

Sovereign Debt Restructuring and Reduction in Debt-to-GDP Ratio

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How effective have sovereign debt restructurings been in reducing debt-to-GDP ratios? We explore this empirically based on a newly assembled comprehensive dataset that covers 115 countries between 1950 and 2021. We show that debt restructuring has a significant and long-lasting impact on the debt-to-GDP ratio. The impact is even larger when combined with fiscal consolidation. In the short run, restructurings with face value reduction and higher creditor coordination tend to be more effective, compared to the average. In the long run, however, the depth of treatment is important, irrespective of how restructuring is executed. (JEL F34, F41, H63)

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Public debt as a ratio to GDP (“debt ratio” henceforth) soared across the world during COVID-19. In 2020, the global average of this ratio approached 100 percent, and it is projected to remain high, and at above pre-pandemic levels for about half of the world. (IMF, 2023a; Arslanalp and Eichengreen, 2023). High public debt ratios pose a growing challenge for policymakers, particularly under modest growth prospects and tight financial conditions. While fiscal consolidation, growth, and inflation can help reduce debt ratios, they may not be sufficient for countries facing disruptive levels of debt. In such cases, debt restructuring, or renegotiation of terms of existing debt, is often employed by countries in debt distress, as a strategy to reduce debt ratios.¹ While there is a growing literature that studies the effects of debt restructurings on GDP, there is little evidence on the impact of restructurings on debt ratios. Since debt restructurings can impact both debt and GDP, the overall effect of restructurings on debt ratios is far from obvious. The long-run effects are even more elusive. Even if a reduction in the face value of debt (commonly referred to as “nominal haircut”) has an immediate impact in reducing the debt stock, a restructuring could also reduce incentives for countries to commit to fiscal consolidation in the future.²

We compile a novel dataset covering restructuring episodes with a wide range of creditors (external private, official Paris Club, official non-PC, and domestic) across 115 countries between 1950 and 2021. Because the occurrence of debt restructuring is likely to be endogenous to overall macroeconomic conditions in a country, we follow Jorda and Taylor (2016) and use an Augmented Inverse Probability Weighted estimator (AIPW) to attenuate the selection bias in the estimation of the average treatment effect (ATE). The AIPW estimator first

¹ As of August 31, 2023, out of the Poverty Reduction and Growth Trust (PRGT)-eligible countries, 10 countries are in debt distress, 26 countries are at high risk, 26 countries are at moderate risk, and 7 countries are at low risk of debt distress. (IMF, 2023b).

² Belize and Mozambique, for example, struggled with high public debt ratio even after a series of sovereign debt restructurings (IMF (2023a)).

computes the probability of a restructuring event taking place, and then uses this information in a second stage to obtain an ATE. One of its key features is that it is doubly robust, so if either the first or the second stage are correctly specified, the estimator is consistent.

Our main finding is that, on average, sovereign debt restructuring has a significant and, surprisingly, long-lasting impact on the debt ratio. A typical sovereign debt restructuring event leads to a decline in debt-to-GDP by 3.8 percentage points in the first year and 7.2 percentage points in the fifth year. The impact is even larger when the treatment group is restricted to restructuring events that happen along with fiscal consolidations, those that involve a reduction in the face value of debt, or a large-scale creditor coordination initiative. The long-run impact (after five years or later), however, is most evident when restructurings are combined with fiscal consolidation, suggesting the importance of continued fiscal efforts.

One caveat of our estimation is that it does not consider the different “sizes” of treatment—e.g., some debt restructurings involve larger interventions than others. To overcome this issue, we calculate the ATE per unit of treatment for restructurings with face value reduction and those with cash flow relief only. We find that the initial impact of ATE per unit of treatment is larger when a face value reduction is involved, but the long-run impact of those involving cash-flow relief is comparable, suggesting the importance of deep enough treatment in the long run, irrespective of whether a face value reduction is involved.

Literature

Our findings contribute to several strands of academic literature. First, we contribute to the large body of empirical literature on debt restructurings, which has focused primarily on its relationship with sovereign defaults (Sturzenegger and

Zettelmeyer, 2008; Reinhart and Rogoff, 2009, 2011; Cruces and Trebesch, 2013; Kaminsky and Vega-Garcia, 2016; Reinhart and Trebesch, 2016, among others). Reinhart and Rogoff (2011), for example, using a new long-term historical database including debt covering 70 countries, find evidence for public debt surges prior to external sovereign defaults.³ Similarly, Reinhart and Trebesch (2016) compare two samples with sovereign default spells: advanced economies (AEs) in 1920–39 and emerging market countries (EMs) in 1978–2010, and show that debt relief was substantial in both eras, averaging 21 percent of GDP for spells in advanced economies in the 1930s and 16 percent of GDP for those in emerging markets in recent decades.⁴ Our paper contributes to this literature by asking a different question – how do restructurings impact debt ratios, on impact and over a longer horizon? While there is a growing literature on the effects of sovereign restructurings on GDP, the evidence on the effects on debt-to-GDP ratio is scarce. Reinhart and Trebesch (2016), for example, compare simple averages of debt-to-GDP ratio before and after restructuring events for a sample of private external debt restructurings in EMs over 1978–2010 and official (bilateral) debt restructurings in AEs during 1920–1939, and find significantly higher debt ratios post-restructuring in both the samples.⁵ This paper complements Reinhart and Trebesch (2016), and advances the literature by employing the most comprehensive database to date (that includes a much larger coverage of EMs and low-income countries (LICs) compared to existing datasets) combined with state of the art empirical methods

³ Reinhart and Rogoff (2009) analyze external and total public debt as ratios of revenues during default episodes.

⁴ Reinhart and Trebesch (2016) use Reinhart and Rogoff (2011) dataset to define a “sovereign default spell” as time from default until debt settlement.

⁵ Cheng et al. (2018) employ a sample of official (Paris Club) debt restructurings over 1956–2015 in EMs and LICs, and use local projection methods, to find the stock of debt to decline and real GDP growth to increase following restructurings with nominal haircuts. In related work, Reinhart et al. (2015) explore a menu of options to reduce public debt ratios in the long run that include: (i) growth above the interest rate, (ii) fiscal consolidation (e.g., primary balance improvement), (iii) privatization, (iv) debt restructuring and default, (v) unanticipated inflation, (vi) wealth taxes and financial repression. They find that AEs relied more on “heterodox” policies, including restructuring debt contracts, generating unexpected inflation, taxing wealth, and repressing private financing. In recent work, Patel and Peralta-Alva (2023) evaluate the effect of fiscal consolidations on debt ratios using a Structural Vector Autoregression (SVAR) methodology and find nearly zero average impact across a sample of 17 advanced economies.

that help address the issue of selection into restructuring. Additionally, the interaction between debt restructurings and fiscal consolidation, as well as heterogenous effects across types of restructurings (i.e., debt treatment and creditor coordination) have not yet been studied in the literature.

Second, there is a growing empirical literature that uses the AIPW estimator to measure the effects of fiscal consolidation and debt restructurings on GDP. The AIPW estimator has an advantage over other estimators in helping to attenuate selection bias and being doubly robust compared to other estimation methods.⁶ Jorda and Taylor (2016) use the AIPW to analyze the effects of fiscal consolidation episodes on GDP in AEs. They show that fiscal consolidation results in a cumulated GDP decline of 3.5 percentage points over five years when implemented in a recession rather than that of only 1.8 percentage points during a boom. Asonuma et al. (2022) apply the method to sovereign debt restructurings and find that their impact on GDP, investment, and bank credit depend on both restructuring strategies and the extent of the country's reliance on bank intermediation. Our paper fills a gap in the literature by applying the AIPW estimator to evaluate the effects of a comprehensive set of sovereign debt restructuring events on debt-to-GDP ratio.

Third, our empirical findings also provide insights to the ongoing policy discussion on both elevated public debt and sovereign debt restructurings (IMF 2021; 2023a). Specifically, we find that debt restructuring can have a large and, importantly, long-lasting impact on a country's debt ratio, particularly if the restructuring is combined with fiscal consolidation, executed through face value reductions, and as part of a coordinated initiative.

⁶ Alternative estimation methods such as an Inverse Probability Weighted (IPW) estimator (Kuvshinov and Zimmermann 2019) and local projections (Cheng et al. 2019) have also been used in the sovereign debt literature.

I. Data

Definition of Sovereign Debt Restructuring

Sovereign debt restructuring is a “debt distress” event in which the terms of contractual payments of some outstanding government instruments are renegotiated, typically with a net present value loss for the creditors (Asonuma and Papaioannou, forthcoming; Das et al., 2012).⁷ The definition applies to both domestic and external debt, and to debt held by both private and official (multilateral and bilateral) creditors, and is also in line with what credit rating agencies use. While an external restructuring involves outstanding debt instruments issued under foreign jurisdiction and held by external creditors, a domestic one includes instruments issued under domestic jurisdiction and held mainly by domestic creditors. Online Appendix I contains more details.

Although sovereign debt restructuring may be correlated with sovereign default (or a failure of a sovereign to make a principal and/or interest payment by the time specified in debt contracts), they do not necessarily happen at the same time, as a debtor could approach the creditors and engage in restructuring preemptively. Asonuma and Trebesch (2016) distinguish two types of restructuring strategies: (i) preemptive restructurings, defined as those which are implemented with no missed payments (i.e., no legal default) or with some missed payments but only over a short period after the start of renegotiation process with creditors (i.e., no unilateral default); (ii) post-default restructuring, defined as those where payments are missed unilaterally and without the agreement on debt settlement with creditors (i.e., a unilateral default ahead of negotiations).

⁷ “Under debt distress” refers to a circumstance where a sovereign government loses market access and/or faces difficulty in servicing principal and interest payments. Debt distressed exchanges should be differentiated from regular liability management operations (LMOs) such as debt swaps or debt buybacks, which are voluntary market exchanges often implemented during normal times and not as a part of crisis resolution.

The implementation of debt restructuring can also take different forms. While there is no universally agreed taxonomy, this paper follows Das et al. (2012), Asonuma and Papaioannou (forthcoming) and considers two types: (i) face value reduction—also called principal (nominal) debt reduction—defined as a cut in the nominal amount of the old (existing) instruments; and (ii) debt rescheduling—also called a reprofiling, or cash flow relief without face value reduction—, defined as maturity extension of the old instruments, sometimes with a coupon rate (interest rate) reduction which results in a change in cash flow streams of the old debt.⁸

Sources

We assemble a novel dataset that covers (i) private external debt restructurings; (ii) official bilateral external debt restructurings—by both the Paris Club creditors and China—; (iii) domestic debt restructurings from 1950 to 2021. The dataset is compiled from several sources including: (i) Asonuma and Trebesch (2016) for private external debt restructurings, which contains information also on timing of restructurings; (ii) Horn et al. (2022) and Paris Club database for official bilateral external debt restructurings; and (iii) IMF (2021) for domestic debt restructurings. We complement these data with additional sources that provide granular information on face value reduction and rescheduling, such as Asonuma et al. (2023), Asonuma and Wright (2022), Cheng et al. (2018), and Cruces and Trebesch (2013).

Country-level economic indicators, including GDP, general government debt, general government primary balance, inflation, and exchange rates, are obtained

⁸ Alternative classifications for sovereign debt restructuring types include the one employed by Paris Club creditors, which focus on (i) restructurings that reduce the present value (PV) of debt, whether through face value reduction or other modalities including maturity extensions and/or coupon rate reductions; and (ii) restructurings that do not reduce the PV of debt. Note that a classification based on PV of debt is not employed in this paper due to the lack of data on the present values of debt for a broad sample.

from the October 2022 vintage of the World Economic Outlook database, published by the IMF.

A First Look

Drawing from the compiled database, 709 restructuring events were reported from 1950 to 2021 across 115 countries. Almost all events were in emerging market economies and low-income countries, which is where we will focus our attention.⁹ Table 1 documents stylized facts. Debt restructurings typically involve cash flow relief with no face value reduction, tend to happen preemptively rather than post-default, and most frequently involve official creditors, especially in low-income countries. Restructurings with domestic creditors are rare and may reflect intentions to avoid risks in the domestic financial sector. These are also less likely to involve face value reduction; even when they do, the reduction tends to be shallower compared to restructurings with external creditors.

[Insert Table 1 Here]

Fiscal consolidations, measured by an increase in primary-balance-to-GDP ratio, are commonly implemented prior to debt restructuring. In the sample with available data on primary balances, 60 percent of debt restructuring events are preceded by an increase in the primary-balance-to-GDP ratio, indicating that countries often undertake fiscal measures before resorting to debt restructuring.

⁹Restructuring events involving advanced economies (AEs) are rare in our database over the sample period of 1950–2021 and include only three episodes: Slovenia in 1992–96, Greece in 2011–12, and Cyprus in 2013. We drop these in our analysis because public debt in AEs exhibit very different features compared to EMs and LICs (e.g., governing law, currency denomination, creditor composition); the structure of economies and their tolerance for debt are distinctive too. The main findings remain qualitatively similar if we include the three AE episodes.

II. Empirical Strategy

This section presents a framework to estimate the average impact of a debt restructuring event on a country's debt-to-GDP ratio. We estimate an ATE through a local projection of changes in the debt-to-GDP ratio onto a restructuring dummy (treatment) and its interaction with other controls. Specifically, we estimate the following specification:

$$(1) \quad \Delta^h y_{c,t} = \alpha_c^h + \alpha_t^h + (\beta_0^h + x'_{c,t} \beta_1^h) T_{c,t} + x'_{c,t} \gamma^h + \epsilon_{c,t}^h,$$

where h is the horizon of the impact, ranging from 0 to 5 years, $\Delta^h y_{c,t} = y_{c,t+h} - y_{c,t-1}$ indicates changes in the debt ratio over different horizons, and $T_{c,t}$ is a treatment dummy indicating whether country c starts restructuring at year t . The covariates $x_{c,t}$ include two lags of: the treatment dummy (to capture restructuring events that happen in close sequence), GDP growth, and the change in debt-to-GDP ratio; it also includes one lag of: the change in exchange rate (measured by home currency per US dollar), inflation, and global output gap, which captures variation in global economic conditions. The specification interacts the covariates with the treatment to account for heterogeneous impacts based on macroeconomic conditions, and includes country and year fixed effects, α_c^h and α_t^h .

Debt restructuring, however, does not occur randomly. Instead, it is only observed when countries undergo severe debt distress and find the need to renegotiate their public debt. In turn, those conditions are likely to be correlated with other factors that could impact the debt ratio, including depressing GDP growth. To account for this selection, we use an AIPW estimator, following Jorda and Taylor (2016).

The first step in the AIPW procedure is to estimate the probability that a country will go into debt restructuring. We estimate this propensity score using a saturated probit model

$$(2) \quad P(T_{c,t} = 1 | x_{c,t}, z_{c,t}, d_{c,t-1}) = \Phi(x'_{c,t}\theta + z'_{c,t}\pi + \mu_c d_{c,t-1} + \eta_c),$$

where Φ is the cumulative distribution function of the standard normal distribution. The predictors include not only the same set of covariates as (1), denoted by $x_{c,t}$, but also additional covariates $z_{c,t}$ that include one lag of US short and long interest rates, the effective interest rate (defined by the government interest expense over the previous period's debt stock), primary-balance-to-GDP ratio, and current-account-balance-to-GDP ratio. We also include the *level* of debt-to-GDP ratio, $d_{c,t-1}$, as countries with low debt ratios tend not to restructure. However, because the threshold for countries to consider debt restructuring might be different, we interact debt-to-GDP ratio with country dummies in the term $\mu_c d_{c,t-1}$. Lastly, we add a second set of country dummies, η_c , to capture remaining country-specific features. We use $\hat{p}_{c,t}$ to denote the estimated probability from equation (2). To avoid excessively large weights, we only use observations for which $\hat{p}_{c,t} \in (10^{-4}, 1 - 10^{-4})$.

Second, we estimate the outcome model in Equation (1) using Ordinary Least Squares. Once the coefficients in that model are obtained, we derive two sets of predicted changes in debt-to-GDP for each country and each year: one in which the treatment dummy equals 1, and one in which the treatment dummy equals 0, denoted by $\hat{m}_{c,t}^h(1)$ and $\hat{m}_{c,t}^h(0)$ respectively. To ensure that the same data are used to obtain all treatment effects, the sample on which both the propensity and outcome models are estimated only include the country-year pairs for which $y_{c,t+h}$ is observed for all horizons $h \in \{0, \dots, 5\}$. The ATE is calculated as

$$(3) \quad ATE^h = \frac{1}{n} \sum_{c,t} \left\{ \left[\frac{T_{c,t} \Delta^h y_{c,t}}{\hat{p}_{c,t}} - \frac{(1-T_{c,t}) \Delta^h y_{c,t}}{1-\hat{p}_{c,t}} \right] - \frac{T_{c,t} - \hat{p}_{c,t}}{\hat{p}_{c,t}(1-\hat{p}_{c,t})} \left[(1 - \hat{p}_{c,t}) \hat{m}_{c,t}^h(1) + \hat{p}_{c,t} \hat{m}_{c,t}^h(0) \right] \right\},$$

where n is the number of observations in the data. The AIPW consistently estimates the average treatment effect under the assumption of selection-on-observables, i.e., the treatment and potential outcomes are independent conditional on the covariates. The estimator is also “doubly robust”, meaning that if either the treatment or the outcome models are correctly specified, then the estimated ATE is consistent (Glynn and Quinn, 2010).

III. Results

Estimation of Propensity Score and Average Treatment Effect of Restructuring

Table 2 reports the results from the probit estimation in the first step and the AIPW in the second step. We find a negative and significant effect of the lagged treatment on the propensity score, suggesting that countries that have recently restructured their debt are less likely to do so in the near future (potentially as creditors might be less inclined to negotiate multiple restructurings in sequence). Similarly, countries that start restructuring debt are more likely to have decreased their debt-to-GDP ratio in the two years preceding the restructuring start. This could reflect the discussion above, where the majority of countries undergo fiscal consolidation before starting to restructure debt (debt restructuring is frequently a “last resort” for countries that are not able to sufficiently reduce debt by other means). Our estimation also suggests that restructurings are more likely to happen when global conditions are favorable (measured by higher global output gap) and when countries experience lower GDP growth, though in those cases the p-values are relatively high (close to 0.10). The former could reflect creditors’ willingness to restructure, while the latter could make it harder for countries to “grow out of debt.” Surprisingly, we find no clear impact of interest rates in the probability of restructuring, with opposite sign for coefficients on long- and short-run US rates,

and large standard errors.¹⁰ The model predicts the probability of a country going into restructuring well, with the area under the receiver operating curve (AUROC) above 0.85.¹¹ Other statistics and robustness checks to assess the estimation of the propensity score can be found in the Online Appendix II.

[Insert Table 2 Here]

The AIPW estimation of the ATE of restructuring suggests that debt restructuring in emerging market economies and low-income countries has a negative, statistically significant, and importantly, long-lasting impact on debt ratios. This effect is also economically significant: on average, debt ratios decrease by 3.8 percentage points in the first year of restructuring, increasing to 7.2 percentage points in five years.¹²

[Insert Figure 1 Here]

Heterogeneity in the Impact of Restructuring

Until now, the reported estimates represent averages across all restructuring events in the sample. However, it could be the case that restructuring is more effective in particular environments. We consider three dimensions that could be important in making policy choices for countries in debt distress: restructuring

¹⁰ A higher value for the short-run interest rate could reflect a higher cost for countries to roll over their debt, thus increasing the probability of restructuring. Long-run interest rates, on the other hand, might reflect the opportunity cost of creditors: when long-run rates are high, creditors have a higher cost of renegotiating debt as they would rather invest their capital in other long-run projects, decreasing the probability of restructuring. Note that in neither case, the coefficients are statistically significant.

¹¹ We also find significant overlap between the distribution of propensity scores across the treatment and control groups, with both distributions displaying close to full support in the [0,1] interval.

¹² We use a five-year horizon for brevity, with longer horizons addressed in Appendix II, Figure 1. As shown in the Appendix, the impact of restructuring on the debt ratio is consistently negative, although in some cases not statistically significant at the 5 percent level, partly due to a smaller sample that includes data on all 10 years ahead of each restructuring episode.

events that occur jointly with fiscal consolidation, events with face value reduction, and those with large-scale creditor coordination.

To calculate the joint effect of restructuring and fiscal consolidation, we re-estimate the AIPW model using a subset of restructuring events – namely those for which the average cyclically adjusted primary balance is positive for the duration of the restructuring. The restructuring events without fiscal consolidation are dropped from the estimation sample, but no changes are made to the control group. As a robustness check, Online Appendix II reports the same estimates when an alternative definition of fiscal consolidation is used—namely a positive average *change* in the cyclically adjusted primary balance while restructuring takes place.

A similar strategy is adopted when we calculate the impact of debt restructuring with face value reduction (FVR). We subset the events in the treatment group to those with face value reduction at any point during the restructuring event. As before, the restructuring events without face value reduction are dropped from the sample. For robustness checks, the Online Appendix II considers two alternative ways to subset the events. First, to remove outliers, we consider an even more restricted treatment group where we drop events in which the ratio of the face value reduction in public debt to the country’s GDP (in the year prior to debt restructuring) is on the top or bottom 10 percent of the distribution (considering only events where the face value reduction is strictly positive). Our findings are robust to this alternative sample, with results reported in Appendix II.

Second, since governments often do not know whether there will be a face value reduction in advance, we instead use the likelihood that an FVR will occur to define the treatment group. We first estimate the probability that a face value reduction occurs in each restructuring episode based on the information available in the year before restructuring begins. This is again estimated using a probit model, where the explanatory variables include a set of variables designed to capture global financial conditions (global output gap, US interest rates), whether the current restructuring

negotiations involve official creditors and whether the country is undergoing sequential restructuring events (measured by dummy that indicates whether the country is in a debt restructuring event in year “t”, prior to the start of a second restructuring in year “t+1”). We also include the country’s level of debt-to-GDP interacted with dummies that indicate if that country is eligible for participation in programs such as the Highly Indebted Poor Countries (HIPC) or Multilateral Debt Relief Initiative (MDRI), as countries in those programs might start restructuring after reaching different thresholds in their debt ratios (relative to countries excluded from the programs). Finally, we include a full set of country dummies to capture other country-specific fixed features (see Appendix II for results). The treatment variable is then set to 1 if the estimated probability exceeds 50 percent.

For large-scale creditor coordination, we restrict the treatment group to the restructuring events under HIPC and MDRI. Once again, the restructuring events that are not under HIPC and MDRI are dropped from the sample.

[Insert Figure 2 Here]

Figure 2 shows that the impact of restructuring when it is combined with fiscal consolidation ranges from 4.7 percentage points in the first year to 11.9 percentage points in the fifth year.¹³ The results highlight the importance of continued fiscal efforts, to enhance the effects of debt restructuring in reducing debt ratios.

Restructuring events that include face value reduction also have a large impact on the debt-to-GDP ratio, compared to the average. Most of this additional effect is visible in the first year of restructuring, as face value reduction provides immediate debt relief. In the first year, the impact of restructuring with face value reduction is 8.9 percentage points, compared to an average impact of 3.8 percentage points in

¹³ Online Appendix II Table 9 reports that the initial impact of restructuring on debt ratios is similar when we use an alternative definition of fiscal consolidation.

the typical event. The immediate effect of restructurings with face value reduction ranges from 8.1 to 12.3 percent in alternative specifications (Online Appendix II Table 9). Notably, the impact is not merely mechanical: even if a face value reduction reduces the value of debt (numerator), there could be an impact on GDP as well (denominator), which means the impact on the debt ratio is not obvious. Indeed, in our estimation sample, the average face-value-reduction-to-GDP ratio is about 6 percent per year, over the period while the restructuring event lasts—considerably smaller than the estimated ATE.¹⁴ This finding may reflect that the restructuring event could be associated with higher nominal GDP growth, including higher real growth from macro policies, and higher inflation during a crisis.

The average long-run impact of a face value reduction on debt ratio after five years is 5.0 percent. Unlike the subsample with fiscal consolidation, the impact of a face value reduction is more frontloaded, and the impact is smaller in the long run compared to restructuring with fiscal consolidation, highlighting the importance of fiscal efforts in sustaining the impact of restructuring.

Finally, the restructuring events with large-scale creditor coordination also has a larger effect on reduction in debt-to-GDP ratio, compared to the average. The ATE in the first and fifth year is 5.4 and 6.4 percent, respectively.

To summarize, debt restructuring in emerging market economies and low-income countries can have a large, negative, and long-lasting effect on debt ratios. This effect is heightened when the restructuring is accompanied by fiscal consolidation. Restructurings with face value reduction and creditor coordination are also more effective compared to the average, particularly in the short run.

¹⁴ We note that this average is calculated after removing potential outliers (top and bottom 10 percent of the distribution). While we divide the FVR-to-GDP by the duration of restructuring, we note that over three quarters of restructuring events last a single year.

ATE per Unit of Treatment

One caveat of the baseline estimation is that it does not consider the different sizes of treatment. To overcome this issue, we calculate the ATE per unit of treatment by dividing the ATE by the average size of treatment. For the restructuring events with face value reduction, we estimate the size of treatment using the average nominal reduction in face value of debt in percent of GDP. As mentioned above, the average size of the treatment for restructuring events with face value reduction is approximately 6 percent of GDP.

For the restructurings without face value reduction, we have information only on private external restructuring events. As a back-of-envelope calculation, we estimate the size of treatment for events with cash-flow relief only as

$$(4) \quad S_{CFR} = S_{FVR} \times \frac{\eta_{CFR}}{\eta_{FVR}},$$

where S_{FVR} is the size of the treatment with FVR (discussed above), η_{CFR} is the net present value of the reduction in debt-to-GDP for restructuring events with cash-flow relief only and η_{FVR} is the same quantity for events with face-value reduction. As mentioned, η_{CFR} and η_{FVR} (5 and 10.6 percent, respectively) are calculated only for private external restructurings and taken from Asonuma et al. (2023). The estimated size of treatment for cash flow relief without face value reduction is 2.8 percent of GDP.

Table 3 compares the ATE and ATE per unit of treatment for restructurings with and without face value reduction. The ATE of restructurings without face value reduction is small and positive in the first year but turns negative after five years. The ATE per unit of treatment, however, is similar after four years for restructurings with or without a reduction in face value. The findings indicate the importance of depth of the treatment in the long run, irrespective of how the restructuring is executed.

[Insert Table 3 Here]

IV. Conclusion

This paper studies the impact of sovereign debt restructurings on debt-to-GDP ratio by compiling a comprehensive dataset and applying well-established methods in the empirical literature. Our analysis suggests that debt restructuring has a significant and long-lasting impact on reducing debt ratios, especially when it is combined with fiscal consolidation. We also find that restructurings with face value reduction and those with large-scale creditor coordination are relatively more effective in reducing debt ratios, particularly in the short run. In the long run, whether face value reduction is involved or not does not change ATE per unit of treatment very much, suggesting the importance of the depth of treatment rather than how restructuring is executed.

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Tables

TABLE 1—BREAKDOWN OF RESTRUCTURING IN PERCENTAGE

		Emerging Market Economies	Low-income Countries
Treatment	Cash flow relief without face value reduction	85.8	73.5
	Face value reduction	14.2	26.5
Timing	Preemptive	58.4	54.3
	Post default	21.6	31.1
	Both and unidentified	20	14.6
Creditor Type	Paris Club	48.1	73.5
	China	8.4	5.6
	Private external	54.8	10.1
	Private domestic	6.8	4.8
	Jointly	11.9	6.3

Notes: Data are based on the number of restructuring events, which can last for several years. The sample includes 310 restructuring events in emerging market economies and 396 in low-income countries from 1950 to 2021.

Source: Asonuma et al. (2023), Asonuma and Trebesch (2016), Asonuma and Wright (2022), Cheng et al. (2018), Cruces and Trebesch (2013), Horn et al. (2022), IMF (2021).

TABLE 2—AIPW ESTIMATION OF THE IMPACT OF DEBT RESTRUCTURING ON DEBT-TO-GDP

First Stage to Estimate Propensity Score		Second Stage	
Variable	Coefficients	Horizon	ATE
Treatment (t-1)	-0.490 (0.156)	0	-3.100 (1.119)
Treatment (t-2)	-0.419 (0.153)	1	-3.838 (1.289)
GDP growth (t-1)	-0.022 (0.014)	2	-5.137 (1.537)
GDP growth (t-2)	-0.004 (0.013)	3	-6.248 (1.803)
Change in Debt/GDP (t-1)	-0.019 (0.005)	4	-6.715 (1.884)
Change in Debt/GDP (t-2)	-0.013 (0.005)	5	-7.237 (1.885)
Change in FX rate (t-1)	0.004 (0.003)		
Inflation (t-1)	0.000 (0.006)		
Global Output Gap (t-1)	-0.073 (0.046)		
US Short Rate (t-1)	-0.013 (0.053)		
US Long Rate (t-1)	0.041 (0.069)		
Effective Interest Rate (t-1)	-0.092 (0.123)		
Primary Balance/GDP (t-1)	-0.019 (0.369)		
Current Account/GDP (t-1)	-0.004 (0.008)		
Observations	1233		1069
Pseudo R-squared	0.295		
AUROC	0.85		

Notes: Standard errors are reported in the parentheses.

Source: Author calculations.

TABLE 3—COMPARISON OF RESTRUCTURING WITH AND WITHOUT FACE VALUE REDUCTION

Size of Treatment		Horizon						
		0	1	2	3	4	5	
Face Value Reduction (FVR)	6.0 p.p.	ATE	-10.6	-8.9	-9.7	-8.1	-7.3	-5.0
		Per Unit Effect	-1.77	-1.48	-1.61	-1.35	-1.22	-0.83
Cash Flow Relief (No FVR)	2.8 p.p.	ATE	3.6	1.6	0.1	-2.1	-3.8	-5.7
		Per Unit Effect	1.29	0.57	0.04	-0.75	-1.36	-2.04

Sources: Cruces and Trebesch (2013), Asonuma et al. (2023), and authors' calculation.

Notes: Per unit effect obtained by dividing ATE by size of treatment.

Figures

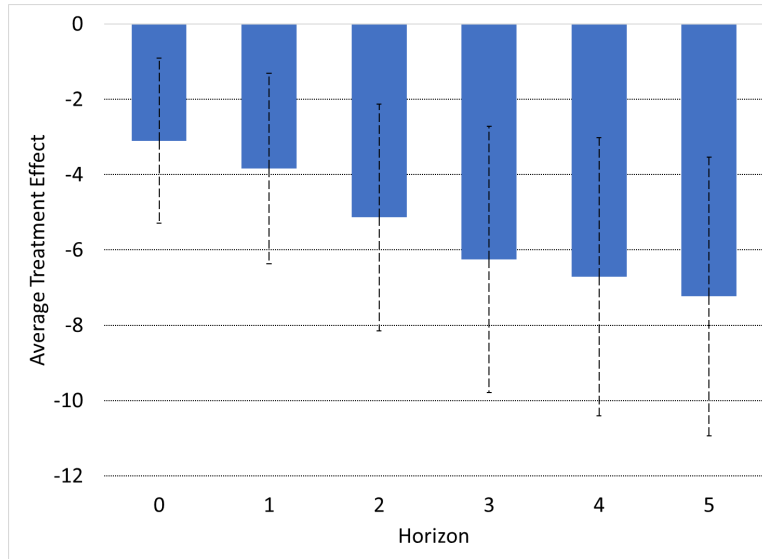


FIGURE 1. IMPACT OF RESTRUCTURING ON DEBT-TO-GDP RATIO

Notes: The lines denote 95 percent confidence interval.

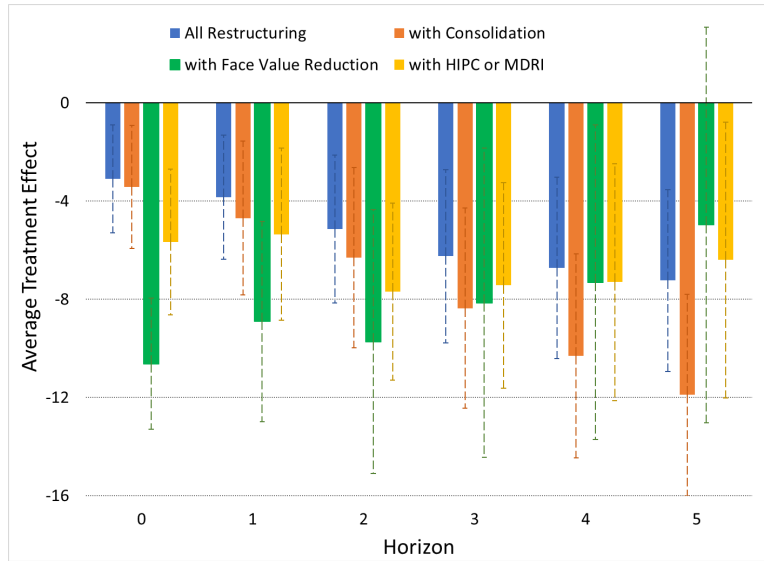


FIGURE 2. HETEROGENEITY IN THE IMPACT OF RESTRUCTURING ON DEBT-TO-GDP RATIO

Notes: The lines denote 95 percent confidence interval.

Online Appendix for Sovereign Debt Restructuring and Reduction in Debt-to-GDP Ratio

By SAKAI ANDO, TAMON ASONUMA, PRACHI MISHRA, AND ALEXANDRE SOLLACI

Appendix I. Definition of Debt Restructuring

A "sovereign debt restructuring" is defined as a debt distressed exchange, i.e., an exchange of outstanding sovereign debt instruments, such as syndicated (bank) loans or bonds, of a sovereign debtor under debt distress for new debt instruments and/or cash through a formal renegotiation process. It typically involves a net present value (NPV) loss for creditors (Asonuma and Papaioannou, forthcoming; Das et al., 2012).¹

"Sovereign debt" is defined as debt issued/contracted or guaranteed by the central or general government of a sovereign country.

"Under debt distress" refers to a circumstance where a sovereign government loses market access and/or faces difficulty in servicing principal and interest payments. Debt distressed exchanges should be differentiated from regular liability management operations (LMOs), i.e., debt swap including debt buybacks. LMOs are voluntary market exchanges and often implemented under normal times and are not generally implemented as a part of crisis resolution (Das et al. 2012).

In principle, the definition of debt restructuring applies to both domestic and external debt—a debt obligation governed by domestic and external law—and to debt held by both private and official (multilateral and bilateral) creditors. Specifically on a domestic debt restructuring, the definition is broader to include

¹ Credit rating agencies usually define restructurings as distressed debt exchanges at terms less favorable than the original bond or loan.

cases of changes to contractual payment terms to the detriment of the creditors through legislative/executive acts (IMF, 2021).

A sovereign default is highly correlated with a debt restructuring, but they may not always happen at the same time. This is because a sovereign debtor could approach the creditors and engage in restructuring preemptively (discussed below). A sovereign default is generally defined as the failure of a sovereign government to make a principal and/or interest payment by the time specified in debt contracts (i.e., beyond a grace period).²

While there is no universally agreed taxonomy on debt restructuring types, the chapter follows Das et al. (2012), Asonuma and Papaioannou (forthcoming) and considers two types: (i) face value reduction—also called as principal (nominal) debt reduction—defined as a cut in the nominal amount of the old (existing) instruments; and (ii) debt rescheduling—also called a reprofiling—, defined as maturity extension of the old instruments, sometimes with a coupon rate (interest rate) reduction which results in a change in cash flow streams of the old debt.

Alternative classifications for debt restructuring types include the one employed by the Paris Club creditors, which focus on (i) restructurings that reduce the present value (PV) of debt, whether through face value reduction or other modalities including maturity extensions and/or coupon rate reductions; and (ii) restructurings that do not reduce the PV of debt. Note that a classification based on PV of debt is not employed in the chapter due to lack of data on present values of debt for a broad sample.

² Credit rating agencies, e.g., Moody's (2008) define a sovereign default either (i) a missed or delayed payments of principal and/or interest or (ii) a distressed debt exchange. Defaults can be full (complete), when a suspension of all debt payments to creditors occurs or partial, when only a fraction of the sovereign country's debt is not being serviced.

Appendix II. Additional Findings

TABLE I—ALL RESTRUCTURING EVENTS

Horizon	1 st stage	2 nd stage					
		0	1	2	3	4	5
Treatment (t)		-7.234 (1.855)	-4.842 (2.601)	-6.469 (3.178)	-8.715 (3.661)	-9.716 (3.913)	-11.478 (4.246)
Treatment (t-1)	-0.490 (0.156)	-1.764 (1.068)	-2.777 (1.497)	-4.617 (1.830)	-5.144 (2.108)	-5.062 (2.253)	-5.222 (2.445)
Treatment (t-2)	-0.419 (0.153)	-2.383 (1.050)	-2.675 (1.472)	-2.940 (1.799)	-2.059 (2.072)	-3.447 (2.215)	-2.605 (2.403)
GDP growth (t-1)	-0.022 (0.014)	-0.185 (0.086)	-0.030 (0.120)	-0.100 (0.147)	-0.191 (0.170)	-0.208 (0.181)	-0.192 (0.197)
GDP growth (t-2)	-0.004 (0.013)	-0.057 (0.061)	-0.084 (0.085)	-0.140 (0.104)	-0.108 (0.120)	-0.101 (0.128)	0.038 (0.139)
Change in Debt/GDP (t-1)	-0.019 (0.005)	0.034 (0.038)	0.086 (0.053)	0.062 (0.065)	0.061 (0.074)	0.137 (0.080)	0.117 (0.086)
Change in Debt/GDP (t-2)	-0.013 (0.005)	-0.089 (0.034)	-0.091 (0.048)	-0.103 (0.059)	-0.039 (0.068)	-0.094 (0.072)	-0.102 (0.078)
Change in FX rate (t-1)	0.004 (0.003)	-0.070 (0.021)	-0.134 (0.029)	-0.172 (0.036)	-0.186 (0.042)	-0.191 (0.044)	-0.182 (0.048)
Inflation (t-1)	0.000 (0.006)	-0.139 (0.041)	-0.164 (0.058)	-0.164 (0.071)	-0.201 (0.082)	-0.218 (0.087)	-0.218 (0.095)
Global Output Gap (t-1)	-0.073 (0.046)	-2.795 (4.393)	-12.579 (6.159)	-1.493 (7.527)	-4.613 (8.669)	5.498 (9.267)	-3.793 (10.056)
US Short Rate (t-1)	-0.013 (0.053)						
US Long Rate (t-1)	0.041 (0.069)						
Effective Interest Rate (t-1)	-0.092 (0.123)						
Primary Balance/GDP (t-1)	-0.019 (0.369)						
Current Account/GDP (t-1)	-0.004 (0.008)						
Interactions with Treatment (t) ×							
Treatment (t-1)		4.194 (2.506)	3.372 (3.513)	4.763 (4.293)	3.969 (4.944)	1.851 (5.286)	-3.180 (5.736)
Treatment (t-2)		0.982 (2.508)	-3.177 (3.516)	-5.537 (4.297)	-9.184 (4.949)	-6.892 (5.291)	-3.577 (5.741)
GDP growth (t-1)		0.321 (0.253)	-0.090 (0.355)	-0.009 (0.434)	0.119 (0.499)	-0.043 (0.534)	0.354 (0.579)
GDP growth (t-2)		0.268 (0.209)	-0.172 (0.293)	-0.197 (0.358)	-0.170 (0.412)	0.013 (0.441)	-0.025 (0.478)
Change in Debt/GDP (t-1)		-0.009 (0.075)	-0.208 (0.105)	-0.148 (0.129)	-0.208 (0.148)	-0.351 (0.159)	-0.383 (0.172)
Change in Debt/GDP (t-2)		0.197 (0.072)	0.203 (0.101)	0.175 (0.124)	0.253 (0.143)	0.415 (0.152)	0.493 (0.165)
Change in FX rate (t-1)		0.052 (0.037)	0.083 (0.053)	0.071 (0.064)	0.102 (0.074)	0.098 (0.079)	0.065 (0.086)
Inflation (t-1)		-0.074 (0.093)	-0.069 (0.130)	-0.088 (0.159)	-0.053 (0.183)	-0.069 (0.195)	-0.057 (0.212)
Global Output Gap (t-1)		-0.883 (0.482)	-1.521 (0.676)	-1.195 (0.827)	-1.649 (0.952)	-1.962 (1.018)	-2.043 (1.104)
Observations	1233	1069	1069	1069	1069	1069	1069
Pseudo R-Squared	0.295	0.258	0.364	0.413	0.477	0.529	0.551
AUROC	0.85						

Notes: First stage regression includes country fixed effects, as well as an interaction between the level of debt-to-GDP and the country fixed effect. The second stage specification includes country and year fixed effects. Standard errors are shown in parenthesis.

TABLE 2—RESTRUCTURING WITH POSITIVE CYCLICALLY ADJUSTED PRIMARY BALANCE

Horizon	1 st stage		2 nd stage				
		0	1	2	3	4	5
Treatment (t)		-4.446 (2.843)	-0.286 (3.780)	-5.656 (4.574)	-8.280 (5.116)	-8.928 (5.201)	-14.633 (5.522)
Treatment (t-1)	-0.424 (0.235)	-2.533 (1.650)	-4.623 (2.194)	-7.162 (2.655)	-9.297 (2.969)	-12.658 (3.018)	-13.751 (3.205)
Treatment (t-2)	-0.493 (0.245)	-3.195 (1.617)	-4.048 (2.150)	-6.217 (2.603)	-5.411 (2.911)	-8.325 (2.959)	-7.845 (3.142)
GDP growth (t-1)	-0.046 (0.025)	-0.075 (0.164)	0.097 (0.218)	0.094 (0.264)	-0.150 (0.295)	0.068 (0.300)	0.199 (0.318)
GDP growth (t-2)	-0.004 (0.024)	0.108 (0.157)	0.424 (0.208)	0.233 (0.252)	0.295 (0.282)	0.487 (0.287)	0.848 (0.304)
Change in Debt/GDP (t-1)	-0.024 (0.009)	-0.015 (0.060)	0.134 (0.080)	0.077 (0.097)	-0.055 (0.109)	-0.087 (0.111)	-0.096 (0.118)
Change in Debt/GDP (t-2)	-0.026 (0.008)	-0.127 (0.053)	-0.199 (0.071)	-0.352 (0.085)	-0.298 (0.095)	-0.377 (0.097)	-0.399 (0.103)
Change in FX rate (t-1)	0.004 (0.005)	-0.091 (0.049)	-0.260 (0.066)	-0.373 (0.079)	-0.408 (0.089)	-0.362 (0.090)	-0.363 (0.096)
Inflation (t-1)	0.008 (0.014)	-0.233 (0.094)	-0.184 (0.126)	0.021 (0.152)	0.011 (0.170)	-0.171 (0.173)	-0.370 (0.183)
Global Output Gap (t-1)	-0.020 (0.086)	8.385 (12.760)	53.712 (16.966)	69.849 (20.533)	102.444 (22.965)	98.850 (23.346)	86.158 (24.785)
US Short Rate (t-1)	-0.009 (0.099)						
US Long Rate (t-1)	0.075 (0.112)						
Effective Interest Rate (t-1)	-0.089 (0.198)						
Primary Balance/GDP (t-1)	0.183 (2.320)						
Current Account/GDP (t-1)	-0.023 (0.015)						
Interactions with Treatment (t) ×							
Treatment (t-1)		4.788 (3.543)	6.254 (4.710)	7.976 (5.701)	8.638 (6.376)	12.884 (6.482)	6.655 (6.881)
Treatment (t-2)		-2.309 (3.418)	-6.853 (4.545)	-4.388 (5.500)	-11.330 (6.152)	-8.717 (6.254)	-1.675 (6.639)
GDP growth (t-1)		0.258 (0.364)	-0.185 (0.484)	0.336 (0.585)	0.453 (0.655)	-0.322 (0.665)	0.694 (0.706)
GDP growth (t-2)		-0.336 (0.363)	-1.115 (0.483)	-0.676 (0.585)	-0.641 (0.654)	-0.437 (0.665)	-1.003 (0.706)
Change in Debt/GDP (t-1)		-0.081 (0.107)	-0.484 (0.142)	-0.431 (0.172)	-0.344 (0.193)	-0.380 (0.196)	-0.357 (0.208)
Change in Debt/GDP (t-2)		0.202 (0.105)	0.279 (0.139)	0.474 (0.168)	0.382 (0.188)	0.535 (0.191)	0.739 (0.203)
Change in FX rate (t-1)		0.094 (0.059)	0.236 (0.078)	0.321 (0.095)	0.397 (0.106)	0.350 (0.108)	0.308 (0.114)
Inflation (t-1)		-0.072 (0.162)	-0.337 (0.216)	-0.568 (0.261)	-0.588 (0.292)	-0.609 (0.297)	-0.264 (0.315)
Global Output Gap (t-1)		-0.247 (0.717)	-1.082 (0.954)	-1.410 (1.154)	-2.063 (1.291)	-2.727 (1.312)	-3.622 (1.393)
Observations	583	456	456	456	456	456	456
Pseudo R-Squared	0.399	0.198	0.401	0.466	0.539	0.618	0.648
AUROC	0.91						

Notes: First stage regression includes country fixed effects, as well as an interaction between the level of debt-to-GDP and the country fixed effect. The second stage specification includes country and year fixed effects. Standard errors are shown in parenthesis.

TABLE 3—RESTRUCTURING WITH POSITIVE CHANGE IN CYCLICALLY ADJUSTED PRIMARY BALANCE

Horizon	1 st stage		2 nd stage				
		0	1	2	3	4	5
Treatment (t)		-9.281 (2.646)	-5.169 (3.855)	-7.072 (4.817)	-9.675 (5.546)	-8.809 (5.920)	-10.657 (6.472)
Treatment (t-1)	-0.359 (0.223)	0.898 (1.482)	0.942 (2.159)	1.730 (2.698)	2.594 (3.107)	1.424 (3.316)	2.119 (3.625)
Treatment (t-2)	-0.504 (0.232)	-1.494 (1.459)	-0.086 (2.125)	1.085 (2.655)	1.022 (3.057)	-0.081 (3.263)	1.659 (3.568)
GDP growth (t-1)	-0.015 (0.021)	0.215 (0.124)	0.392 (0.180)	0.448 (0.225)	0.481 (0.259)	0.512 (0.277)	0.556 (0.303)
GDP growth (t-2)	-0.010 (0.019)	-0.135 (0.116)	0.077 (0.169)	-0.057 (0.211)	-0.161 (0.243)	-0.211 (0.260)	-0.103 (0.284)
Change in Debt/GDP (t-1)	-0.029 (0.008)	0.093 (0.053)	0.212 (0.077)	0.256 (0.096)	0.295 (0.111)	0.307 (0.118)	0.378 (0.129)
Change in Debt/GDP (t-2)	-0.011 (0.007)	-0.025 (0.048)	-0.062 (0.070)	-0.075 (0.088)	-0.042 (0.101)	-0.022 (0.108)	-0.033 (0.118)
Change in FX rate (t-1)	-0.000 (0.005)	-0.024 (0.029)	-0.076 (0.042)	-0.160 (0.052)	-0.160 (0.060)	-0.133 (0.064)	-0.093 (0.070)
Inflation (t-1)	0.014 (0.010)	-0.176 (0.074)	-0.176 (0.108)	-0.010 (0.135)	-0.054 (0.156)	-0.197 (0.166)	-0.351 (0.182)
Global Output Gap (t-1)	-0.067 (0.067)	1.729 (2.040)	2.499 (2.972)	3.481 (3.714)	8.772 (4.276)	9.301 (4.565)	3.669 (4.990)
US Short Rate (t-1)	-0.087 (0.073)						
US Long Rate (t-1)	0.009 (0.095)						
Effective Interest Rate (t-1)	-0.069 (0.167)						
Primary Balance/GDP (t-1)	-0.705 (2.144)						
Current Account/GDP (t-1)	0.004 (0.012)						
Interactions with Treatment (t) ×							
Treatment (t-1)		6.166 (3.348)	4.297 (4.876)	3.359 (6.093)	3.585 (7.016)	-0.410 (7.489)	-7.428 (8.187)
Treatment (t-2)		3.084 (3.513)	-2.062 (5.118)	-5.487 (6.395)	-10.325 (7.363)	-12.129 (7.860)	-10.014 (8.592)
GDP growth (t-1)		0.112 (0.319)	-0.466 (0.465)	-0.278 (0.581)	-0.389 (0.669)	-0.955 (0.714)	-0.614 (0.781)
GDP growth (t-2)		-0.030 (0.359)	-0.759 (0.524)	-0.504 (0.654)	0.186 (0.753)	0.688 (0.804)	0.595 (0.879)
Change in Debt/GDP (t-1)		0.062 (0.108)	-0.143 (0.157)	-0.231 (0.196)	-0.239 (0.226)	-0.355 (0.241)	-0.466 (0.264)
Change in Debt/GDP (t-2)		0.071 (0.105)	0.110 (0.154)	0.190 (0.192)	0.196 (0.221)	0.282 (0.236)	0.391 (0.258)
Change in FX rate (t-1)		-0.022 (0.067)	-0.053 (0.098)	0.012 (0.122)	-0.022 (0.141)	-0.087 (0.150)	-0.182 (0.164)
Inflation (t-1)		0.116 (0.140)	0.231 (0.204)	0.074 (0.254)	0.178 (0.293)	0.291 (0.313)	0.425 (0.342)
Global Output Gap (t-1)		-0.278 (0.653)	-0.717 (0.951)	-0.710 (1.188)	-0.953 (1.368)	-1.986 (1.460)	-2.078 (1.596)
Observations	777	614	614	614	614	614	614
Pseudo R-Squared	0.382	0.252	0.333	0.359	0.423	0.474	0.500
AUROC	0.90						

Notes: First stage regression includes country fixed effects, as well as an interaction between the level of debt-to-GDP and the country fixed effect. The second stage specification includes country and year fixed effects. Standard errors are shown in parenthesis.

TABLE 4—RESTRUCTURING WITH FACE VALUE REDUCTION

Horizon	1 st stage	2 nd stage					
		0	1	2	3	4	5
Treatment (t)		-5.898 (3.510)	-3.168 (5.126)	-5.195 (6.219)	-8.918 (7.212)	-8.420 (7.597)	-7.914 (8.240)
Treatment (t-1)	-0.784 (0.316)	0.452 (1.945)	0.530 (2.840)	0.027 (3.445)	-0.160 (3.996)	3.318 (4.209)	3.834 (4.565)
Treatment (t-2)	-0.474 (0.294)	-0.713 (1.820)	-2.091 (2.658)	-1.695 (3.224)	0.073 (3.739)	1.137 (3.938)	2.352 (4.272)
GDP growth (t-1)	-0.019 (0.029)	-0.025 (0.140)	0.220 (0.204)	0.337 (0.248)	0.510 (0.288)	0.579 (0.303)	0.631 (0.328)
GDP growth (t-2)	-0.001 (0.025)	-0.158 (0.128)	-0.008 (0.187)	-0.040 (0.227)	-0.030 (0.263)	-0.050 (0.277)	0.078 (0.300)
Change in Debt/GDP (t-1)	-0.037 (0.011)	-0.053 (0.064)	0.080 (0.094)	0.031 (0.114)	0.073 (0.132)	0.135 (0.139)	-0.049 (0.151)
Change in Debt/GDP (t-2)	-0.002 (0.010)	-0.000 (0.058)	-0.031 (0.084)	-0.056 (0.102)	0.040 (0.118)	-0.068 (0.125)	-0.060 (0.135)
Change in FX rate (t-1)	-0.008 (0.010)	-0.030 (0.053)	-0.229 (0.077)	-0.282 (0.093)	-0.275 (0.108)	-0.249 (0.114)	-0.233 (0.123)
Inflation (t-1)	-0.002 (0.017)	-0.139 (0.115)	0.099 (0.168)	0.356 (0.204)	0.337 (0.236)	0.238 (0.249)	0.173 (0.270)
Global Output Gap (t-1)	0.007 (0.088)	4.174 (4.240)	8.780 (6.193)	11.916 (7.512)	15.681 (8.712)	17.471 (9.177)	20.258 (9.953)
US Short Rate (t-1)	-0.088 (0.113)						
US Long Rate (t-1)	-0.234 (0.146)						
Effective Interest Rate (t-1)	0.405 (0.279)						
Primary Balance/GDP (t-1)	3.526 (3.817)						
Current Account/GDP (t-1)	0.017 (0.020)						
Interactions with Treatment (t) ×							
Treatment (t-1)		-0.627 (4.652)	4.514 (6.794)	5.938 (8.242)	4.019 (9.559)	-3.091 (10.069)	-3.182 (10.921)
Treatment (t-2)		0.213 (4.803)	5.548 (7.015)	1.181 (8.510)	5.217 (9.870)	2.000 (10.396)	4.132 (11.275)
GDP growth (t-1)		-0.102 (0.413)	-0.300 (0.604)	0.063 (0.732)	0.405 (0.849)	0.019 (0.895)	0.149 (0.970)
GDP growth (t-2)		0.100 (0.397)	-0.206 (0.580)	0.360 (0.704)	0.502 (0.816)	1.203 (0.860)	1.114 (0.932)
Change in Debt/GDP (t-1)		-0.086 (0.130)	-0.377 (0.190)	-0.156 (0.230)	-0.316 (0.267)	-0.396 (0.281)	-0.307 (0.305)
Change in Debt/GDP (t-2)		0.269 (0.155)	0.487 (0.227)	0.535 (0.275)	0.774 (0.319)	0.896 (0.336)	0.948 (0.364)
Change in FX rate (t-1)		0.021 (0.122)	0.260 (0.178)	0.209 (0.216)	0.246 (0.251)	0.233 (0.264)	0.101 (0.287)
Inflation (t-1)		-0.619 (0.218)	-1.038 (0.318)	-1.056 (0.386)	-1.039 (0.447)	-1.082 (0.471)	-0.891 (0.511)
Global Output Gap (t-1)		-0.889 (0.872)	-0.204 (1.274)	0.897 (1.545)	1.153 (1.792)	0.142 (1.888)	0.047 (2.048)
Observations	493	399	399	399	399	399	399
Pseudo R-Squared	0.397	0.311	0.397	0.437	0.482	0.540	0.564
AUROC	0.91						

Notes: First stage regression includes country fixed effects, as well as an interaction between the level of debt-to-GDP and the country fixed effect. The second stage specification includes country and year fixed effects. Standard errors are shown in parenthesis.

TABLE 5—RESTRUCTURING WITH FACE VALUE REDUCTION AFTER EXCLUDING OUTLIERS

Horizon	1 st stage		2 nd stage				
		0	1	2	3	4	5
Treatment (t)		-7.607 (3.519)	-5.278 (5.471)	-9.130 (6.681)	-11.929 (7.663)	-9.047 (7.930)	-5.626 (8.506)
Treatment (t-1)	-1.438 (0.498)	-1.223 (2.231)	-0.600 (3.469)	0.780 (4.236)	2.172 (4.858)	6.014 (5.028)	6.409 (5.393)
Treatment (t-2)	-0.216 (0.368)	-0.480 (2.045)	-0.015 (3.180)	2.869 (3.884)	8.030 (4.454)	9.803 (4.609)	11.737 (4.945)
GDP growth (t-1)	-0.012 (0.034)	-0.113 (0.142)	0.165 (0.221)	0.361 (0.270)	0.544 (0.309)	0.650 (0.320)	0.837 (0.344)
GDP growth (t-2)	-0.003 (0.029)	-0.020 (0.124)	0.142 (0.192)	0.184 (0.235)	0.297 (0.269)	0.330 (0.279)	0.457 (0.299)
Change in Debt/GDP (t-1)	-0.034 (0.013)	0.025 (0.068)	0.164 (0.106)	0.165 (0.129)	0.190 (0.148)	0.244 (0.153)	0.168 (0.164)
Change in Debt/GDP (t-2)	-0.003 (0.012)	0.055 (0.058)	0.014 (0.091)	0.010 (0.111)	0.179 (0.127)	0.099 (0.131)	0.103 (0.141)
Change in FX rate (t-1)	-0.008 (0.012)	0.004 (0.049)	-0.195 (0.076)	-0.250 (0.093)	-0.250 (0.106)	-0.209 (0.110)	-0.177 (0.118)
Inflation (t-1)	0.002 (0.020)	-0.061 (0.109)	0.190 (0.169)	0.453 (0.206)	0.445 (0.237)	0.304 (0.245)	0.251 (0.263)
Global Output Gap (t-1)	0.034 (0.101)	1.085 (6.551)	4.522 (10.186)	9.928 (12.440)	19.581 (14.267)	23.170 (14.765)	26.508 (15.838)
US Short Rate (t-1)	-0.131 (0.128)						
US Long Rate (t-1)	-0.184 (0.168)						
Effective Interest Rate (t-1)	0.431 (0.314)						
Primary Balance/GDP (t-1)	5.232 (4.792)						
Current Account/GDP (t-1)	0.037 (0.028)						
Interactions with Treatment (t) ×							
Treatment (t-1)		-13.649 (6.844)	-16.210 (10.642)	-8.540 (12.996)	-1.560 (14.906)	-5.315 (15.425)	-4.621 (16.547)
Treatment (t-2)		6.474 (4.982)	13.664 (7.746)	5.656 (9.459)	8.751 (10.849)	6.335 (11.227)	7.801 (12.043)
GDP growth (t-1)		0.162 (0.411)	-0.156 (0.638)	0.343 (0.780)	0.782 (0.894)	0.500 (0.925)	0.596 (0.993)
GDP growth (t-2)		-0.263 (0.404)	-0.387 (0.629)	0.051 (0.768)	0.354 (0.881)	1.075 (0.911)	1.192 (0.978)
Change in Debt/GDP (t-1)		-0.385 (0.144)	-0.640 (0.223)	-0.570 (0.273)	-0.615 (0.313)	-0.597 (0.324)	-0.546 (0.347)
Change in Debt/GDP (t-2)		0.501 (0.179)	0.696 (0.279)	0.852 (0.340)	1.000 (0.390)	1.278 (0.404)	1.540 (0.433)
Change in FX rate (t-1)		0.156 (0.185)	0.356 (0.287)	0.308 (0.351)	0.556 (0.403)	0.599 (0.417)	0.336 (0.447)
Inflation (t-1)		-0.889 (0.233)	-1.327 (0.362)	-1.222 (0.442)	-1.287 (0.507)	-1.342 (0.524)	-1.247 (0.562)
Global Output Gap (t-1)		-0.856 (0.928)	0.304 (1.442)	0.886 (1.761)	0.577 (2.020)	-0.550 (2.091)	-1.104 (2.243)
Observations	460	0	0	0	0	0	0
Pseudo R-Squared	0.450	0	0	0	0	0	0
AUROC	0.91						

Notes: First stage regression includes country fixed effects, as well as an interaction between the level of debt-to-GDP and the country fixed effect. The second stage specification includes country and year fixed effects. Standard errors are shown in parenthesis.

TABLE 6.1—RESTRUCTURING WITH PREDICTED FACE VALUE REDUCTION

Horizon	1 st stage	2 nd stage					
		0	1	2	3	4	5
Treatment (t)		-4.106 (3.721)	-1.625 (5.527)	-8.282 (6.555)	-10.560 (7.836)	-11.601 (8.369)	-9.126 (9.004)
Treatment (t-1)	-0.680 (0.371)	-0.416 (2.372)	-3.562 (3.524)	0.706 (4.179)	2.294 (4.996)	5.289 (5.335)	6.986 (5.740)
Treatment (t-2)	-0.452 (0.354)	-4.225 (2.143)	-2.199 (3.183)	-0.007 (3.775)	2.400 (4.513)	2.786 (4.820)	2.222 (5.185)
GDP growth (t-1)	-0.045 (0.033)	-0.251 (0.171)	0.133 (0.254)	0.269 (0.301)	0.433 (0.360)	0.504 (0.385)	0.583 (0.414)
GDP growth (t-2)	0.044 (0.041)	-0.082 (0.169)	-0.100 (0.250)	-0.169 (0.297)	-0.336 (0.355)	-0.534 (0.379)	-0.646 (0.408)
Change in Debt/GDP (t-1)	-0.023 (0.013)	-0.053 (0.086)	0.089 (0.127)	0.168 (0.151)	0.196 (0.180)	0.236 (0.192)	0.061 (0.207)
Change in Debt/GDP (t-2)	0.006 (0.013)	-0.138 (0.075)	-0.060 (0.112)	-0.019 (0.133)	0.163 (0.159)	0.029 (0.169)	-0.019 (0.182)
Change in FX rate (t-1)	-0.014 (0.010)	-0.081 (0.068)	-0.312 (0.101)	-0.420 (0.119)	-0.447 (0.143)	-0.431 (0.152)	-0.430 (0.164)
Inflation (t-1)	0.053 (0.022)	-0.385 (0.141)	-0.548 (0.210)	-0.514 (0.249)	-0.568 (0.297)	-0.752 (0.318)	-1.012 (0.342)
Global Output Gap (t-1)	0.069 (0.106)	2.980 (7.327)	3.848 (10.884)	8.626 (12.908)	19.527 (15.431)	21.418 (16.481)	25.703 (17.731)
US Short Rate (t-1)	0.102 (0.137)						
US Long Rate (t-1)	-0.477 (0.182)						
Effective Interest Rate (t-1)	0.960 (0.335)						
Primary Balance/GDP (t-1)	6.798 (4.350)						
Current Account/GDP (t-1)	-0.020 (0.026)						
Interactions with Treatment (t) ×							
Treatment (t-1)		-3.979 (5.126)	0.930 (7.614)	-2.214 (9.030)	-1.481 (10.795)	-5.288 (11.529)	-10.221 (12.404)
Treatment (t-2)		-3.081 (5.522)	-2.070 (8.202)	-5.777 (9.727)	4.046 (11.629)	8.162 (12.419)	13.912 (13.361)
GDP growth (t-1)		-0.551 (0.608)	-1.288 (0.904)	0.208 (1.072)	0.647 (1.281)	0.367 (1.368)	0.341 (1.472)
GDP growth (t-2)		-0.527 (0.491)	-1.109 (0.730)	-0.675 (0.865)	-0.471 (1.035)	0.765 (1.105)	1.156 (1.189)
Change in Debt/GDP (t-1)		-0.161 (0.157)	-0.496 (0.234)	-0.402 (0.277)	-0.557 (0.331)	-0.489 (0.354)	-0.354 (0.381)
Change in Debt/GDP (t-2)		0.142 (0.197)	0.032 (0.293)	0.032 (0.347)	0.190 (0.415)	0.666 (0.443)	1.015 (0.477)
Change in FX rate (t-1)		-0.034 (0.132)	0.199 (0.196)	0.226 (0.232)	0.292 (0.277)	0.200 (0.296)	0.094 (0.319)
Inflation (t-1)		0.064 (0.214)	0.106 (0.318)	0.020 (0.377)	-0.112 (0.451)	-0.055 (0.481)	0.215 (0.518)
Global Output Gap (t-1)		-0.840 (0.980)	-1.722 (1.456)	-0.261 (1.727)	-0.982 (2.065)	-2.491 (2.205)	-2.644 (2.373)
Observations	429	286	286	286	286	286	286
Pseudo R-Squared	0.476	0.258	0.328	0.383	0.412	0.485	0.531
AUROC	0.93						

Notes: First stage regression includes country fixed effects, as well as an interaction between the level of debt-to-GDP and the country fixed effect. The second stage specification includes country and year fixed effects. Standard errors are shown in parenthesis.

TABLE 6.2—LIKELIHOOD OF RESTRUCTURING WITH FACE VALUE REDUCTION (STARTING IN PERIOD T+1)

	Coefficient
Global Output Gap (t-1)	0.193 (0.104)
Effective Interest Rate (t-1)	-0.22 (-0.619)
US Short Rate (t-1)	-0.619 (0.165)
US Long Rate (t-1)	1.617 (0.313)
Dummy = 1 if already Restructuring at t	0.442 (0.319)
Dummy = 1 if in Restructuring with official creditors at t+1	0.324 (0.408)
Observations	189
Pseudo R-Squared	0.424

Notes: Standard errors are shown in parenthesis. The probit estimation also includes country fixed and HIPC/MDRI dummy interacted with debt-to-GDP ratio at t-1.

TABLE 7—RESTRUCTURING WITHOUT FACE VALUE REDUCTION

Horizon	1 st stage		2 nd stage				
		0	1	2	3	4	5
Treatment (t)		-4.445 (2.298)	-1.558 (3.379)	-3.067 (4.042)	-6.100 (4.667)	-8.106 (4.919)	-11.274 (5.460)
Treatment (t-1)	-0.650 (0.265)	-0.232 (1.368)	-0.640 (2.012)	-3.135 (2.407)	-5.498 (2.779)	-8.718 (2.929)	-9.039 (3.251)
Treatment (t-2)	-0.861 (0.288)	-3.374 (1.401)	-4.080 (2.060)	-6.023 (2.464)	-5.059 (2.845)	-8.591 (2.998)	-6.986 (3.328)
GDP growth (t-1)	-0.041 (0.023)	-0.399 (0.106)	-0.265 (0.156)	-0.567 (0.187)	-0.890 (0.216)	-0.946 (0.227)	-1.015 (0.252)
GDP growth (t-2)	-0.007 (0.018)	0.051 (0.064)	-0.092 (0.094)	-0.059 (0.112)	-0.058 (0.129)	-0.058 (0.136)	0.067 (0.151)
Change in Debt/GDP (t-1)	-0.015 (0.009)	0.048 (0.052)	-0.030 (0.076)	-0.025 (0.091)	-0.091 (0.106)	0.076 (0.111)	0.167 (0.124)
Change in Debt/GDP (t-2)	-0.011 (0.008)	-0.127 (0.048)	-0.124 (0.070)	-0.076 (0.084)	-0.067 (0.097)	-0.072 (0.102)	-0.086 (0.113)
Change in FX rate (t-1)	0.003 (0.004)	-0.067 (0.020)	-0.109 (0.030)	-0.143 (0.036)	-0.155 (0.041)	-0.173 (0.043)	-0.178 (0.048)
Inflation (t-1)	0.004 (0.007)	-0.124 (0.040)	-0.206 (0.059)	-0.234 (0.071)	-0.286 (0.082)	-0.268 (0.086)	-0.269 (0.096)
Global Output Gap (t-1)	-0.090 (0.071)	-2.150 (3.852)	-10.330 (5.663)	-0.451 (6.774)	-0.118 (7.822)	8.680 (8.244)	0.679 (9.151)
US Short Rate (t-1)	-0.034 (0.084)						
US Long Rate (t-1)	0.124 (0.103)						
Effective Interest Rate (t-1)	-0.231 (0.171)						
Primary Balance/GDP (t-1)	-0.274 (0.391)						
Current Account/GDP (t-1)	-0.014 (0.012)						
Interactions with Treatment (t) ×							
Treatment (t-1)		8.578 (3.712)	1.875 (5.457)	4.641 (6.527)	2.784 (7.538)	7.204 (7.944)	-4.203 (8.817)
Treatment (t-2)		3.434 (4.042)	-4.543 (5.942)	-3.749 (7.108)	-17.119 (8.207)	-9.970 (8.650)	-3.366 (9.601)
GDP growth (t-1)		0.272 (0.372)	-0.340 (0.547)	0.228 (0.654)	-0.243 (0.755)	-0.670 (0.796)	-0.226 (0.884)
GDP growth (t-2)		0.409 (0.254)	-0.116 (0.374)	-0.628 (0.447)	-0.191 (0.516)	-0.147 (0.544)	-0.126 (0.604)
Change in Debt/GDP (t-1)		0.142 (0.130)	0.185 (0.192)	-0.010 (0.229)	0.081 (0.265)	-0.177 (0.279)	-0.261 (0.310)
Change in Debt/GDP (t-2)		0.088 (0.125)	0.072 (0.183)	-0.107 (0.219)	0.109 (0.253)	0.262 (0.267)	0.589 (0.296)
Change in FX rate (t-1)		0.010 (0.067)	-0.081 (0.098)	0.005 (0.117)	-0.023 (0.135)	-0.076 (0.143)	-0.092 (0.158)
Inflation (t-1)		0.262 (0.124)	0.546 (0.182)	0.344 (0.218)	0.629 (0.251)	0.718 (0.265)	0.768 (0.294)
Global Output Gap (t-1)		0.738 (0.673)	0.155 (0.989)	0.239 (1.183)	0.438 (1.366)	1.168 (1.440)	0.756 (1.598)
Observations	727	554	554	554	554	554	554
Pseudo R-Squared	0.374	0.311	0.353	0.418	0.482	0.554	0.565
AUROC	0.89						

Notes: First stage regression includes country fixed effects, as well as an interaction between the level of debt-to-GDP and the country fixed effect. The second stage specification includes country and year fixed effects. Standard errors are shown in parenthesis.

TABLE 8—RESTRUCTURING IN HIPC OR MDRI COUNTRIES

Horizon	1 st stage	2 nd stage					
		0	1	2	3	4	5
Treatment (t)		-9.589 (3.072)	-9.277 (4.226)	-13.911 (5.084)	-15.337 (5.847)	-18.401 (6.284)	-17.173 (6.826)
Treatment (t-1)	-0.673 (0.224)	-2.723 (1.589)	-2.583 (2.186)	-2.905 (2.630)	-1.768 (3.024)	0.199 (3.250)	1.783 (3.530)
Treatment (t-2)	-0.471 (0.215)	-0.915 (1.531)	0.094 (2.106)	0.528 (2.534)	1.837 (2.914)	2.511 (3.132)	3.197 (3.402)
GDP growth (t-1)	-0.005 (0.021)	-0.015 (0.131)	0.210 (0.180)	0.333 (0.217)	0.268 (0.249)	0.206 (0.268)	0.273 (0.291)
GDP growth (t-2)	0.007 (0.020)	-0.158 (0.122)	0.074 (0.168)	-0.081 (0.202)	-0.104 (0.232)	-0.176 (0.249)	-0.144 (0.271)
Change in Debt/GDP (t-1)	-0.023 (0.008)	0.002 (0.056)	0.122 (0.077)	0.144 (0.093)	0.175 (0.106)	0.188 (0.114)	0.166 (0.124)
Change in Debt/GDP (t-2)	-0.008 (0.007)	-0.018 (0.049)	0.046 (0.067)	0.037 (0.081)	0.086 (0.093)	0.012 (0.100)	0.008 (0.109)
Change in FX rate (t-1)	-0.004 (0.007)	-0.067 (0.046)	-0.152 (0.063)	-0.230 (0.076)	-0.250 (0.088)	-0.215 (0.094)	-0.224 (0.102)
Inflation (t-1)	0.019 (0.013)	-0.321 (0.104)	-0.408 (0.143)	-0.411 (0.172)	-0.452 (0.198)	-0.602 (0.213)	-0.653 (0.231)
Global Output Gap (t-1)	0.053 (0.070)	4.547 (4.623)	7.112 (6.358)	10.238 (7.650)	14.645 (8.798)	15.670 (9.455)	17.677 (10.270)
US Short Rate (t-1)	-0.110 (0.100)						
US Long Rate (t-1)	-0.090 (0.107)						
Effective Interest Rate (t-1)	0.041 (0.209)						
Primary Balance/GDP (t-1)	2.219 (2.241)						
Current Account/GDP (t-1)	-0.001 (0.011)						
Interactions with Treatment (t) ×							
Treatment (t-1)		4.156 (3.664)	5.827 (5.039)	7.540 (6.063)	5.678 (6.973)	2.530 (7.494)	-2.287 (8.140)
Treatment (t-2)		-1.268 (3.886)	-2.495 (5.344)	-4.674 (6.430)	-3.657 (7.395)	-3.392 (7.947)	-1.949 (8.632)
GDP growth (t-1)		0.169 (0.368)	-0.120 (0.507)	-0.013 (0.610)	0.131 (0.701)	0.046 (0.753)	-0.176 (0.818)
GDP growth (t-2)		0.607 (0.379)	0.237 (0.521)	0.793 (0.626)	0.639 (0.720)	1.042 (0.774)	1.065 (0.841)
Change in Debt/GDP (t-1)		-0.095 (0.111)	-0.340 (0.152)	-0.305 (0.183)	-0.326 (0.211)	-0.362 (0.227)	-0.427 (0.246)
Change in Debt/GDP (t-2)		0.260 (0.114)	0.220 (0.157)	0.298 (0.189)	0.365 (0.217)	0.530 (0.233)	0.581 (0.253)
Change in FX rate (t-1)		0.114 (0.109)	0.191 (0.151)	0.160 (0.181)	0.136 (0.208)	0.044 (0.224)	-0.011 (0.243)
Inflation (t-1)		-0.173 (0.165)	-0.117 (0.227)	-0.037 (0.273)	0.143 (0.314)	0.405 (0.338)	0.498 (0.367)
Global Output Gap (t-1)		-0.788 (0.710)	-1.059 (0.976)	-0.842 (1.175)	-1.732 (1.351)	-2.241 (1.452)	-2.590 (1.577)
Observations	599	549	549	549	549	549	549
Pseudo R-Squared	0.284	0.289	0.418	0.474	0.536	0.585	0.609
AUROC	0.85						

Notes: First stage regression includes country fixed effects, as well as an interaction between the level of debt-to-GDP and the country fixed effect. The second stage specification includes country and year fixed effects. Standard errors are shown in parenthesis.

TABLE 9—AVERAGE TREATMENT EFFECT UNDER DIFFERENT SPECIFICATIONS

Specification	Horizon	ATE	Standard Error	95 CI up	95 CI low
All Restructuring Events	0	-3.100	1.119	-0.907	-5.293
	1	-3.838	1.289	-1.313	-6.364
	2	-5.137	1.537	-2.125	-8.149
	3	-6.248	1.803	-2.715	-9.782
	4	-6.715	1.884	-3.024	-10.407
Restructuring with Positive Cyclically Adjusted Primary Balance	0	-3.431	1.279	-0.924	-5.937
	1	-4.697	1.597	-1.568	-7.826
	2	-6.301	1.876	-2.625	-9.977
	3	-8.367	2.078	-4.293	-12.440
	4	-10.303	2.122	-6.143	-14.463
Restructuring with Positive Change in Cyclically Adjusted Primary Balance	0	-5.220	1.414	-2.448	-7.992
	1	-5.172	1.729	-1.783	-8.561
	2	-7.725	1.992	-3.822	-11.628
	3	-6.678	2.452	-1.872	-11.483
	4	-6.003	2.347	-1.403	-10.603
Restructuring with Face Value Reduction	0	-10.626	1.365	-7.950	-13.302
	1	-8.905	2.077	-4.835	-12.975
	2	-9.727	2.745	-4.347	-15.107
	3	-8.149	3.214	-1.850	-14.447
	4	-7.306	3.267	-0.903	-13.709
Restructuring with Face Value Reduction after Excluding Outliers	0	-15.101	1.203	-12.744	-17.459
	1	-14.358	2.041	-10.357	-18.358
	2	-15.526	2.730	-10.175	-20.877
	3	-12.899	2.953	-7.111	-18.686
	4	-11.321	2.876	-5.684	-16.958
Restructuring with Predicted Face Value Reduction	0	-8.187	2.573	-3.144	-13.230
	1	-6.816	2.835	-1.259	-12.372
	2	-8.363	2.630	-3.207	-13.518
	3	-6.479	2.686	-1.215	-11.744
	4	-5.279	2.763	0.136	-10.694
Restructuring without Face Value Reduction	0	3.642	1.155	5.906	1.377
	1	1.630	1.362	4.299	-1.040
	2	0.087	1.744	3.505	-3.331
	3	-2.108	2.318	2.436	-6.651
	4	-3.769	2.406	0.947	-8.485
Restructuring in HIPC or MRDI Countries	0	-5.671	1.513	-2.707	-8.636
	1	-5.353	1.787	-1.850	-8.856
	2	-7.681	1.839	-4.077	-11.285
	3	-7.435	2.134	-3.253	-11.617
	4	-7.303	2.461	-2.479	-12.127
	5	-6.403	2.868	-0.782	-12.024

Notes: 95CI up and low are the upper and lower bound of 95 percent confidence interval.

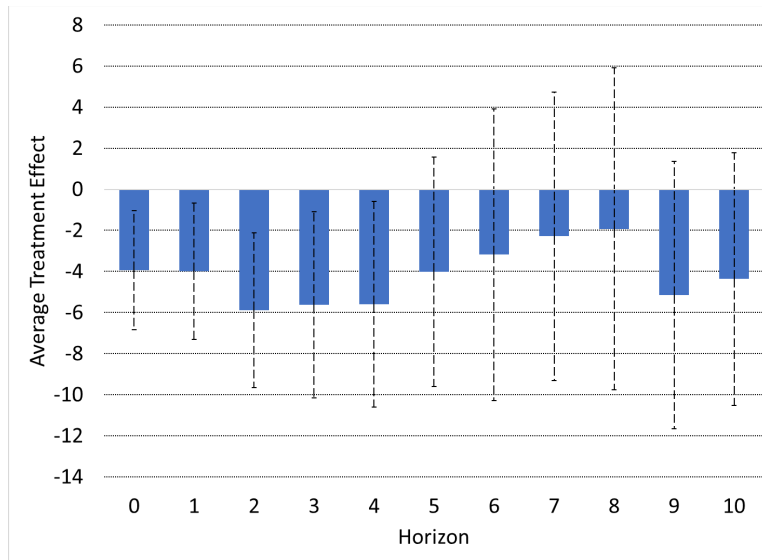


FIGURE 1. IMPACT OF RESTRUCTURING ON DEBT-TO-GDP RATIO OVER 10 YEARS

Notes: The lines denote 95 percent confidence interval. To ensure that the ATE is estimated based on the same data for all 10 years, the sample is restricted to those that had restructuring events by 2012. Thus, the estimates of ATE could be different from the 5-year version of Figure 1 in the main text that restricts the sample to those that had restructuring events by 2017.