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Public Debt and Real GDP: Revisiting the Impact

Constance de Soyres, Reina Kawai, and Mengxue Wang

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Prepared by Constance de Soyres, Reina Kawai, and Mengxue Wang*

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ABSTRACT: This paper provides new empirical evidence of the impact of an unanticipated change in public debt on real GDP. Using public debt forecast errors, we identify exogenous changes in public debt to assess the impact of a change in the debt to GDP ratio on real GDP. By analyzing data on gross public debt for 178 countries over 1995-2020, we find that the impact of an unanticipated increase in public debt on the real GDP level is generally negative and varies depending on other fundamental characteristics. Specifically, an unanticipated increase in the public debt to GDP ratio hurts real GDP level for countries that have (i) a high initial debt level or (ii) a rising debt trajectory over the five preceding years. On the contrary, an unanticipated increase in public debt boosts real GDP for countries that have (iii) a low-income level or (iv) completed the HIPC debt relief initiative.

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Author's E-Mail Address:	Cdesoyres@imf.org, rkawai7@uw.edu, MWang3@imf.org

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WORKING PAPERS

Public Debt and Real GDP: Revisiting the Impact

Prepared by Constance de Soyres, Reina Kawai, and Mengxue Wang[1]

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Contents

FIGURES

TABLES

Introduction

Understanding the effects of debt on macroeconomic variables (i.e., growth, consumption, etc.) is a key policy question with a long history (see for example Domar, 1944; Barro, 1980; Bernheim, 1987).[1] An increase in debt can stem from a rise in government expenditures, an increase in public investment, a reduction in tax revenues or other fiscal changes. While understanding the impact of the resulting increase in debt on real GDP is essential to public debt sustainability assessments, there is little consensus on its direction and magnitude.

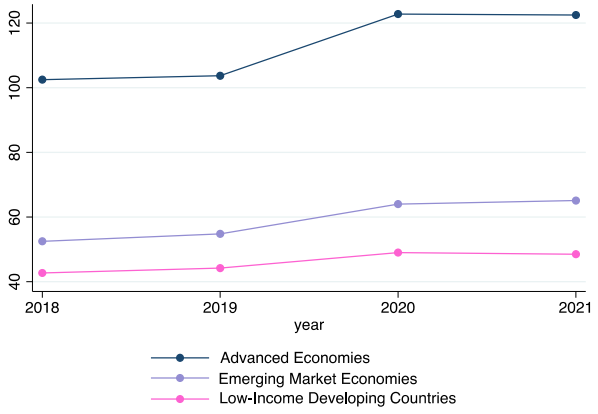
Public debt sustainability analyses are considered a key element in the IMF's work on member countries. They play an essential role in the IMF lending decisions – and help assess critical questions, such as whether the primary balance needed to stabilize debt under both the baseline and realistic shock scenarios is economically and politically feasible. They also provide input into the design of Fund programs, in particular by helping to determine the timing and size of financing, policy choices, as well as the member's capacity to repay the Fund. For those forward-looking assessments, it is crucial to understand how changes in public debt are likely to impact real GDP over the short- to medium-term.[2]

This paper revisits the relationship between public debt and GDP. Understanding the impact of increases in public debt on output has gained renewed interest in the context of the COVID-19 pandemic. The pandemic led to a significant contraction in the world economy (Aizenman and Ito, 2020). Policy responses, including expansionary fiscal policies, have resulted in sharp increases in public debt levels across the globe. The average public debt to GDP ratio across all countries is projected to reach 98.8 percent in 2021 compared to 83.7 percent in 2019, before the pandemic. Advanced Economies (AEs) average public debt to GDP ratio is projected to increase from 103.7 to 122.5 over the same period, while smaller increases are projected for Emerging Markets (EMs) and Low-Income Developing Economies (LIDCs), from 54.8 to 65.1 and from 44.2 to 48.5 percentage points, respectively (Figure 1). While policy responses that increase public debt may be effective in the short run and help boost growth, increased debt to GDP ratios may either partly (or fully) negate the effects of the fiscal stimulus in the medium-term, which could slow down the recovery from the pandemic.

[1] Domar (1944) studies debt and the issue of deficit financing and demonstrates that debt burden is primarily a problem of achieving a growing national income. The faster the income grows; the less debt burden the country holds. Barro (1980) studies the effect of public debt shocks at the federal level in relation to taxation movements and finds that deficits can be considered economically efficient. Bernheim (1987) criticizes the Ricardian equivalence claiming that deficits merely postpone taxes as rational agents should be indifferent between either paying US$1 today or paying US$1 plus interest rate tomorrow. In particular, he finds that government deficits cause people to consume more.

[2] Public debt consists of all liabilities that require payment or payments of interest and/or principal by the debtor to the creditor at a date or dates in the future. This includes debt liabilities in the form of SDR allocations, currency and deposits, debt securities, loans, insurance, pensions and standardized guarantee schemes, and other accounts payable. Debt can be valued at current market, nominal, or face values.

Figure 1: Public Debt to GDP Ratio, 2018-21



Source: World Economic Outlook, July 2021.

This topic is mainly related to the significant strand of literature that theoretically and empirically assesses the impact of an unanticipated increase in public debt on real GDP. Theoretical work demonstrates that if a country already has a high level of debt, a debt overhang prevents the country from smoothly issuing additional debt because of fear of default with a negative effect on subsequent growth (Myers 1977; Woo and Kumar 2015). Overlapping generations models (Blanchard 1985; Diamond 1965; Modigliani 1961) also illustrate that high debt levels negatively impact growth, change expectations, or bring uncertainty (Cochrane, 2011), and change sovereign yield spreads (Codogno et al., 2003) and real interest rate to affect lower private investment (Laubach, 2009). A surge in public debt uses a portion of national savings meant for future generations. The resulting reduction in savings pushes up the interest rate, which reduces incentives to invest—lower investment results in lower capital accumulation, which drags down economic growth. As a result, public debt has a generally negative effect on long-run growth based on endogenous growth models (Barro, 1990; Saint-Paul, 1992).

On the empirical side, Barro (1980) demonstrates that public debt shocks may impact output and unemployment, but the magnitude of the effect is milder than monetary policy shocks. Lo and Rogoff (2015) show that governments react to a rising public debt by increasing the primary surplus or running smaller deficits. The seminal paper of Reinhart and Rogoff (2010) claims that public debt can drag down economic growth at high debt levels, roughly above 90 percent. Pattillo et al. (2011) use GMM to find a non-linear relationship between external debt and growth. Using 93 developing countries, they find that doubling the external debt to GDP ratio reduces growth by a third to a half percentage point. Liaqat (2019) analyzes domestic debt and output growth of 39 high-income countries using Panel VAR and finds a negative relationship based on 1980-2017 data. Pescatori et al. (2014) focus on the long-term relationship by looking at the impact of the debt level on future real GDP growth to get around the reverse causality and conclude that there is no simple threshold for debt to GDP ratios above which medium-term growth prospects are severely undermined. Cecchetti, Mohanty, and Zampolli (2011) use a similar growth model approach to conclude that public debt will drag down real GDP growth beyond a certain level. Eberhardt and Presbitero (2015) find a negative long-run relationship between public debt and growth based on linear and nonlinear approaches. Panizza and Presbitero (2013) use an IV approach to identify public debt shocks and conclude that there is a

negative correlation between public debt and real GDP growth for OECD countries, but that the link disappears when correcting for endogeneity.

Several other papers also zoom into different factors that may affect the impact of public debt on real GDP. Pescatori et al. (2014) categorize the debt trajectory based on the last period growth and previous 15 years of growth and find a slight negative impact on growth for the subsample with rising debt trajectories. Henri (2019) considers that there is little or no positive impact in the short- or medium-term growth of the HIPC Initiative using World Bank data for 1990-2015 and suggests that other factors such as improvement in governance or educational quality and trade agreements matter more. However, Marcelino and Hakobyan (2014) find a significantly positive response of real GDP level following the HIPC Initiative, similar to Hussain and Gunter (2005) and Pattillo et al. (2011). Clements et al. (2003) also find that reducing external debt may be associated with positive growth following the HIPC Initiative using system GMM.

Although the literature on the relationship between debt and GDP is ample, there is still significant uncertainty regarding the magnitude of the impact. One of the key reasons for this uncertainty is the difficulty in identifying exogenous debt shocks, i.e., shocks that would be uncorrelated with contemporaneous macroeconomic shocks (see, for example, Nakamura and Steinsson (2018)).

This paper studies the relationship between public debt and GDP, with two main contributions to the literature. The first contribution is the construction of debt shocks using forecast errors on public debt to identify the causal impact of public debt shocks on real GDP, following a similar approach as in existing literature (Auerbach and Gorodnichenko, 2012, 2013; Abiad et al., 2016; Furceri and Li, 2017; and Furceri et al., 2018). The argument of potential reverse causality concerns in this setup was addressed by Blanchard and Perotti (2002). Since October forecasts already pertain to all available information of public debt and the state of the economy, reverse causality is unlikely. Once public debt shocks are identified, we use the local projections approach of Jordà (2005) to trace out the short- and medium-run output responses for a panel of 178 countries over the period 1995-2020. The second contribution is the comprehensive subsample analysis, studying how the impact of public debt on GDP level varies in different subsets of the data. The identified exogenous movements in debt enable us to examine the role of several characteristics such as the initial level of debt, debt trajectory, income level, and participation in HIPC Initiative that can potentially shape this impact.

Public debt forecast errors can arise due to different reasons, which are beyond the scope of this paper. We outline some explanations, including an unexpected change in government policy in response to macroeconomic shocks that requires more public investment, unexpectedly low/high tax revenue that need to be compensated by public debt, imperfect information provided by policymakers about the state of the economy or public debt at the time of forecast. But the thrust of using projection errors as unexpected movements lies in the fact that we believe that all public information available at the time of projection by IMF economists is incorporated in the forecasts. Whatever information not used, either necessary or unnecessary, is common information for any public sector or market participants. The aforementioned reasons for forecast errors could further serve as potential explanations on the transmission channels from debt to GDP growth, which points directions for future research.

The paper's main results can be summarized as follows: an unanticipated increase in public debt significantly reduces real GDP level at the 3-year horizon. This aggregate effect masks differences across countries. Based on subsample analysis, we find that the negative impulse response to an unanticipated increase in public debt is larger when the initial debt level is high and for countries with a rising debt trajectory over the five preceding

years. However, the effect becomes positive for low-income countries and countries having received debt relief from the Highly Indebted Poor Countries (HIPC) Initiative.

The rest of the paper is organized as follows. The next Section presents the data and methodology. It is followed by a Section that discusses the main results. The following Section presents some robustness analyses of our results. The final Section concludes by summarizing the main findings and policy implications. More details on the dataset and additional results are presented in the Annexes.

Data and Empirical Methodology

Data

The analysis mainly uses the World Economic Outlook (WEO) dataset[3], covering all countries from 1995 to the present.[4] There are two WEO vintages published every year (in April and in October). Each WEO vintage contains actual data available at the time of the publication and projections over a 5-year horizon. While baseline results are based on all countries from the dataset, the additional specifications focus on various subsets of countries, depending on the initial level of debt, the debt trajectory over preceding years, the income level, and participation in the HIPC Initiative. We use the common World Bank Low-Income Country (LIC) demarcation for income classification, a time-varying measure based on the World Bank's yearly data of GNI per capita.[5]

Methodology

To estimate the causal effect of public debt on real GDP, we identify exogenous shocks in public debt by using the forecast errors from various vintages of the IMF WEO publications. Debt shocks are computed in debt to GDP terms, with the shock applied only to public debt and not to GDP, to isolate the impact from the debt variable only. More precisely, they are defined as the difference between the growth rate of the actual debt to GDP ratio ($\Delta lndebt_{i,t}^{actual}$) and the growth rate of the forecasted debt to actual GDP ratio forecasted by IMF analysts in October of the same year ($\Delta lndebt_{i,t}^{forecast}$):

$$debt_{i,t}^{Shock} = \left(ln \frac{Debt_{i,t}^{actual}}{NGDP_{i,t}^{actual}} - ln \frac{Debt_{i,t-1}^{actual}}{NGDP_{i,t-1}^{actual}} \right) - \left(ln \frac{Debt_{i,t}^{forecast}}{NGDP_{i,t}^{actual}} - ln \frac{Debt_{i,t-1}^{actual}}{NGDP_{i,t-1}^{actual}} \right) \quad (1)$$

$$= \Delta \ln debt_{i,t}^{actual} - \Delta \ln debt_{i,t}^{forecast}$$

Constructing shocks using forecast errors solves the endogeneity problem between public debt and other macroeconomic variables, including real GDP. The most common difficulties encountered in the strand of literature attempting to assess the impact of an increase in debt on the level of output is that the debt level, a country's macroeconomic environment, and its policies are jointly determined. There could be both reverse

[3] We follow the standardized methodology in a large strand of literature of using IMF projections, as in Auerbach and Gorodnichenko, 2012, 2013; Abiad et al., 2016; Furceri and Li, 2017; and Furceri et al., 2018, Thus systematic bias is of minimal concern.

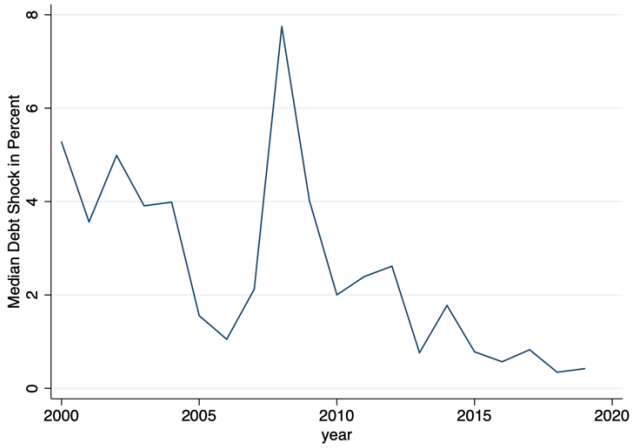
[4] See Annexes for more details.

[5] See World Bank website.

causality and omitted variable bias issues in the regression of real GDP on public debt. In line with the literature (e.g., Blanchard and Perotti, 2002; Auerbach and Gorodnichenko, 2012, 2013; Abiad et al., 2016; Furceri and Li, 2017; and Furceri et al., 2018), the forecast errors constructed as described above can be considered as exogenous changes, absent any unanticipated policy changes, especially over short-term forecast horizons. The projected debt level from the October WEO for the same year is assumed to have absorbed all the information up to the time of projection. The change between the projected debt level and the materialized debt level is thus identified as an exogenous shock to debt. There could be reverse causality of growth to these shocks. But, for this to be a concern, the adjustment of public debt needs to happen within the same quarter as the news about the state of the economy (from October to December). Since all the requisite information about public debt and economic performance until October are incorporated in the October forecasts, this is viewed as highly unlikely in the literature that uses this approach.

The time series of exogenous debt shocks is illustrated in Figure 2.[6] It shows the median of public debt to GDP shocks across economies by year using the full dataset, starting from 2000.[7] The median forecast error in terms of debt to GDP ratio deviation is 1.23 percent and the largest one is 8 percent in 2008 during the GFC period.[8]

Figure 2: Evolution of Public Debt Forecast Error, Median, 2000-2019



Source: World Economic Outlook.

Note: Time series plot of median debt to GDP ratio for all countries are given above. Data points are extremely limited prior to 2000 among Emerging and Developing Countries (EMDCs).

Once public debt shocks are identified, the local projections approach of Jordà (2005) can be used to trace out the short- and medium-run output responses. Specifically, the baseline regression is:

$$y_{i,t+k} - y_{i,t-1} = c_i^k + d_t^k + \beta^k \, debt_{i,t}^{Shock} + \theta^k \, Z_{i,t} + \epsilon_{it} \quad (2)$$

[6] See also Annexes for more details.

[7] Data before 2000 is scarce.

[8] Given that 2020 data are not actual data yet, our dataset of debt shocks runs through 2019 and there is no debt shock under COVID-19 yet. Larger shocks tend to respond bigger than smaller shocks. We verified that elimination of the year 2008 will bring identical results in our paper. Results without the year of 2008 are available upon request.

The left-hand side component $y_{i,t+k} - y_{i,t-1}$ is the k-period ahead change of output level. In our analysis, k goes from zero to five to assess the short- and medium-term impulse responses to the exogenous public debt shock. $debt_{i,t}^{Shock}$ is the exogenous shock on the debt to GDP ratio defined as the realized debt to GDP growth rate minus the forecasted debt to actual GDP growth rate. c_i^k and d_t^k are the country and time fixed effects, respectively. We cluster the standard error at the country level since debt responses are country-specific (Reinhart et al., 2003). $Z_{i,t}$ refers to the control variables, including two lags of real GDP growth and two lags of debt shocks.[9]

Based on the regression model, impulse responses are obtained from direct multistep regressions of empirical data where each response is estimated by a single Ordinary Least Squares (OLS) regression without relying on a theoretical model, thereby preventing potential misspecification errors, as explained by Montiel Olea and Plagborg-Møller (2021). The robustness to misspecification errors also stems from the large number of observations to compute the impulse responses at each horizon, which helps to improve the precision and stability of the result.

This empirical model is first applied to all countries in the dataset, which serves as the baseline. We conduct further analysis by separating our sample based on other characteristics such as the initial level of debt, the debt trajectory over the preceding five years, the income level, and pre vs. post participation in the HIPC debt relief initiative.[10] Lastly, we perform robustness checks by (i) controlling for the initial level of debt, (ii) checking for a potential Nickell-bias, [11] and (iii) using actual data from $t + 2$ and $t + 3$ WEO vintage.

Results

Baseline result

Our empirical results indicate that on average, real GDP level responds negatively to an unexpected increase in public debt. Figure 3 and Table 1 suggest that a 1 percent unanticipated increase in the debt to GDP ratio leads to a significant -0.01 percent decrease in the real GDP level 3 years after the shock. In the short run, the impact on real GDP is negative but not statistically significant, suggesting that the impact of shocks on public debt takes time to materialize. As an example, applying the median shock under the Global Financial Crisis (GFC) to the median country in the sample, an unanticipated 3.69 percentage points increase in the public debt to GDP ratio reduces the level of output by about -0.08 percent in 3 years after the shock.[12] The impact is a reduction in the real GDP level in the short- and medium-term. This means that countries experiencing such unanticipated debt shocks will have a negative impact on real GDP level after the shock. While the change in GDP level is small in magnitude, it can be considered as prominent given that it is a persistent reduction in the

[9] Although WEO forecast errors are often thought of as surprise shocks; one can demonstrate the potential correlation or explanatory power with the lag of several macro variables (i.e., Auerbach and Gorodnichenko, 2013). Regressing forecast error with a period lagged GDP growth suggests that there is -0.02 correlation between the lag of real GDP growth and public debt forecast error. This subtle correlation indicates little explanatory power of lagged real GDP on public debt forecast error.

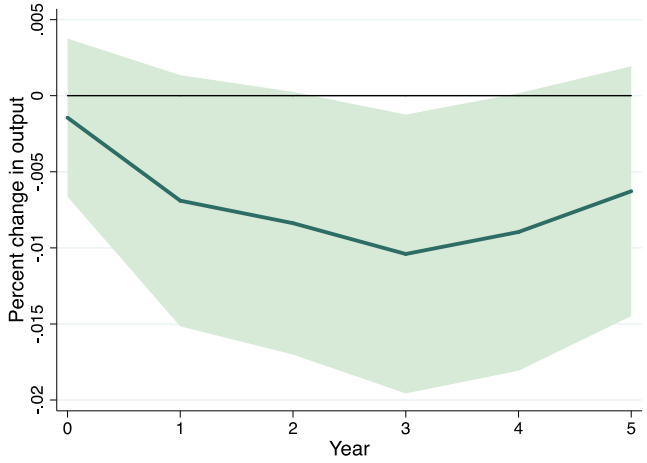
[10] We define rising (declining) debt trajectories when countries had a positive (negative) growth in debt to GDP ratio over the preceding five years.

[11] To test the potential concerns of Nickell Bias, we drop two lags of dependent variables, and find identical results. We also conduct various other robustness checks (see Annexes for details).

[12] The median shock during the GFC is 8 percent (Figure 2), and the median public debt to GDP ratio of our sample is 46.12 percent. In this example, the median shock of an 8 percent increase under GFC is equivalent to an increase in the median debt to GDP ratio by 3.69 percentage points.

level of real GDP and that real GDP would not experience any growth in the following years, everything else is constant. Our empirical result is broadly in line with other results from the literature, such as Reinhart and Rogoff (2010) and Woo and Kumar (2015). Impulse responses also vary depending on other fundamental characteristics that we study in the following sections, with broadly larger impacts in magnitude on the real GDP level.

Figure 3: Response of Real GDP to Public Debt Shocks, Baseline



Sources: World Economic Outlook and IMF staff calculation.

Note: t=0 is the year of shock. Green shaded area represents the 90 percent confidence bands. The solid green line denotes the output response to an unanticipated increase in public debt to GDP ratio. Median public debt to GDP ratio is 46.12 percent. Estimates based on equation (2).

Table 1: Regression Results, Baseline

	K=0	K=1	K=2	K=3	K=4	K=5
PUBLIC DEBT SHOCK(T)	-.00144	-.00690	-.00838	-.01040*	-.00896	-.00628
	.00316	.00502	.00525	.00557	.00554	.00499
GROWTH(T-1)	.08324	-.02294	-.14854	-.30954***	-.42897***	-.56866***
	.08498	.08936	.10453	.09615	.09703	.09292
GROWTH(T-2)	-.16842***	-.17521***	-.15640*	-.09328	-.06861	-.01170
	.07937	.07552	.09199	.09179	.10193	.09662
PUBLIC DEBT SHOCK(T-1)	-.00389	-.00276	-.00437	-.00257	-.00136	-.00049
	.00286	.00389	.00412	.00363	.00408	.00339
PUBLIC DEBT SHOCK(T-2)	.00127	.00078	.00089	-.00140	-.00596	-.01066***
	.00288	.00309	.00356	.00414	.00435	.00449
NUMBER OF COUNTRIES	179	178	176	173	168	163
N	2229	2052	1876	1701	1530	1366
R^2	0.4033	0.3962	0.4185	0.4615	0.5060	0.5459

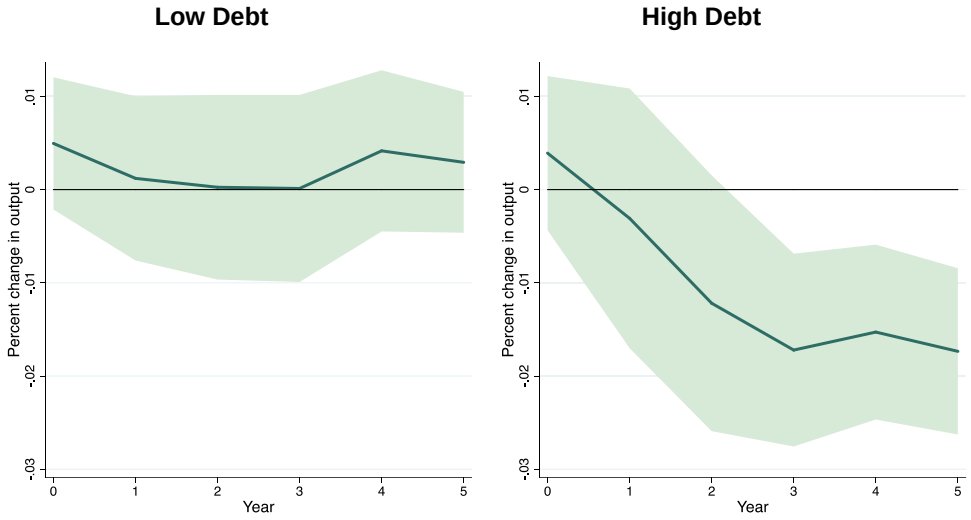
Note: Observations are at the country-vintage level. Dependent variable is the change in real GDP between t+k and t-1for up to five-year horizon(k). k=0 is the year of shock. Country and time fixed effects were incorporated. Standard errors are clustered at the country level. *, **, and *** indicate significance at the 10, 5, and 1 percent level, respectively.

Initial Level of Public Debt

To analyze how the initial level of debt affects the response of real GDP to an unanticipated increase in public debt, we separate our sample into two groups: high and low initial level of public debt, using as a threshold the median of our sample (46.12 percent). The main result is that an unanticipated increase in public debt hurts growth for countries with a high initial level of debt (Figure 4 and Table 2). In the high initial debt level subsample, we find that a 1 percent unanticipated increase in the debt to GDP ratio leads to a significant -0.02 percent decrease in real GDP 3-5 years after the shock. As an illustration, the median shock during the GFC was 8 percent, in terms of debt to GDP ratio deviation from the projection (Figure 2). Starting from the median public debt to GDP ratio in the high initial level of debt subsample of 73.98 percent, the median shock is equivalent to an increase in the median debt to GDP ratio by 5.92 percentage points. In this context, such an unanticipated increase in debt to GDP ratio causes a -0.16 percent reduction in real GDP for countries with a high initial level of debt. The decline is persistent in the medium-term. On the contrary, responses in the low initial debt level subsample are not statistically significant.

There are various papers investigating whether there exists a debt to GDP ratio threshold beyond which macroeconomic outcomes would be negatively affected.[13] Our result is broadly in line with the literature, which finds that high initial debt to GDP ratios tend to be associated with lower subsequent growth.

Figure 4: Response of Real GDP to Public Debt Shocks, by Initial Debt Level Classification



Sources: World Economic Outlook and IMF staff calculation.

Note: t=0 is the year of shock. Green shaded area represents the 90 percent, confidence bands. The solid green line represents the output response to an unanticipated increase in public debt to GDP ratio. Median public debt to GDP ratio is 30.92 and 73.98 percent in the low and high public debt level subsamples, respectively. Estimates based on equation (2).

[13] Reinhart and Rogoff (2010) state that a debt to GDP ratio at 90 percent is optimal, while beyond 90 percent, the debt to GDP ratio may have a negative impact on real GDP. Others claim that no such rule exists (Pescatori et al., 2014; Rahman et al., 2019) or that the threshold should be revised (Herndon, Ash, and Pollin, 2013).

Table 2: Regression Results, by Initial Debt Level Classification

LOW DEBT	K=0	K=1	K=2	K=3	K=4	K=5
PUBLIC DEBT SHOCK(T)	0.0049	0.0012	0.0002	0.0001	0.0041	0.0029
	0.0043	0.0054	0.0060	0.0061	0.0052	0.0046
NUMBER OF COUNTRIES	122	118	112	102	94	88
NUMBER OF OBSERVATIONS	1038	915	799	692	597	506
R^2	0.4119	0.4460	0.5050	0.5367	0.5777	0.6240

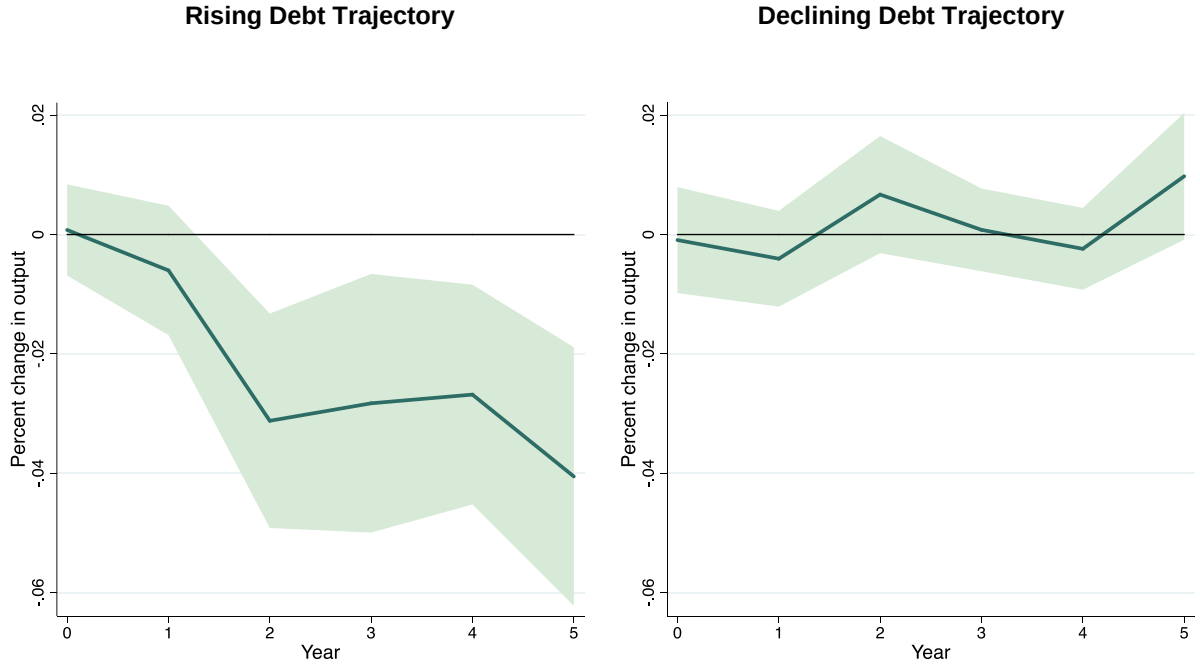
HIGH DEBT	K=0	K=1	K=2	K=3	K=4	K=5
PUBLIC DEBT SHOCK(T)	0.0039	-0.0031	-0.0121	-0.0172***	-0.0152***	-0.0173***
	0.0050	0.0084	0.0083	0.0062	0.0057	0.0054
NUMBER OF COUNTRIES	109	99	94	80	70	62
NUMBER OF OBSERVATIONS	956	837	735	640	561	494
R^2	0.4815	0.4672	0.4507	0.4861	0.5218	0.5513

Note: Observations are at the country-vintage level. Dependent variable is change in real GDP between t+k and t-1 for up to five-year horizon(k). k=0 is the year of shock. Country and time fixed effects were incorporated. Control variables are included but not shown here. Standard errors are clustered at the country level. *, **, and *** indicate significance at the 10, 5 and 1 percent level respectively.

Public Debt Trajectory

To analyze how the public debt trajectory in previous years affects the response of real GDP to an unanticipated increase in public debt, we separate our sample into two groups based on the following definition: a debt trajectory is rising (declining) when countries had a positive (negative) growth in their debt to GDP ratio over the preceding five years. In Figure 5 and Table 3, the analysis of the subsample with rising public debt trajectories reveals that a 1 percent unanticipated increase in the debt to GDP ratio leads to a significant -0.03 percent decrease in real GDP starting 2 years after the shock, and the effect went further down to -0.04 percent 5 years into the shock without dying out. This result is four times larger in magnitude over the medium-term than the baseline result, meaning that countries who are accumulating debt are more vulnerable to debt shocks. On the contrary, results are not significant in the declining public debt trajectory subsample.
Our result can be related to Pescatori, Sandri and Simon (2014) who find that the debt trajectory can be an essential determinant in understanding future growth prospects.

Figure 5: Response of Real GDP to Public Debt Shocks, by Public Debt Trajectory



Sources: World Economic Outlook and IMF staff calculation.

Note: t=0 is the year of shock. Green shaded area represents the 90 percent, confidence bands. The solid green line represents the output response to an unanticipated increase in public debt to GDP ratio. Median public debt to GDP ratio is 48.7 and 41.49 percent in the rising and declining public debt trajectory subsamples, respectively. Estimates based on equation (2).

Table 3: Regression Results, by Public Debt Trajectory

RISING DEBT TRAJECTORY	K=0	K=1	K=2	K=3	K=4	K=5
PUBLIC DEBT SHOCK(T)	0.0008	-0.0060	-0.0312***	-0.0283**	-0.0268**	-0.0405***
	0.0046	0.0066	0.0109	0.0132	0.0112	0.0132
NUMBER OF COUNTRIES	160	151	147	131	108	97
NUMBER OF OBSERVATIONS	1023	834	685	547	435	349
R^2	0.5270	0.4822	0.5012	0.5075	0.5285	0.6017

DECLINING DEBT TRAJECTORY	K=0	K=1	K=2	K=3	K=4	K=5
PUBLIC DEBT SHOCK(T)	-0.0009	-0.0041	0.0067	0.0008	-0.0024	0.0098
	0.0054	0.0049	0.0060	0.0042	0.0042	0.0065
NUMBER OF COUNTRIES	122	110	99	83	60	49
NUMBER OF OBSERVATIONS	628	489	378	283	207	157
R^2	0.3484	0.3888	0.4042	0.4845	0.4171	0.4695

Note: Observations are at the country-vintage level. Dependent variable is the change in real GDP between t+k and t-1for up to five-year horizon(k). k=0 is the year of shock. Country and time fixed effects were incorporated. Control variables are included but not shown here. Standard errors are clustered at the country level. *, **, and *** indicate significance at the 10, 5 and 1 percent level respectively.

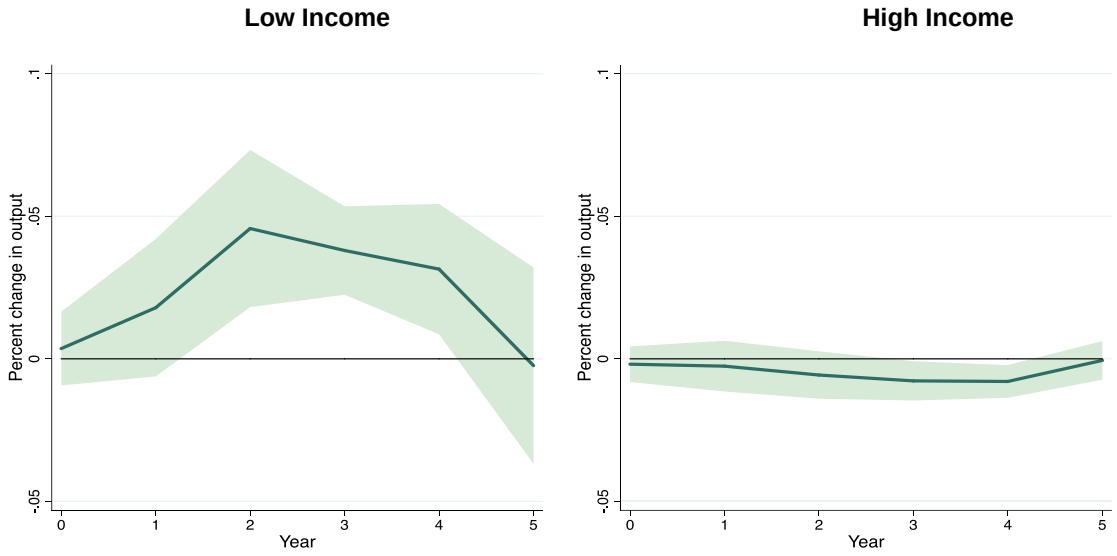
Income Classification

To analyze how the income level affects the response of real GDP to an unanticipated increase in public debt, we divide our sample between high-, middle-, and low-income countries following the World Bank income classification based on GNI per capita. The comparison between high-income countries and low-income countries in Figure 6 and Table 4 indicates that, in low-income countries, a 1 percent unanticipated increase in the debt to GDP ratio leads to a significant 0.05 percent increase in real GDP 2 years after the shock.[14] The response remains significant up to the 4-year horizon. This result is also much larger and of opposite direction compared to the baseline result, meaning that low-income countries could benefit significantly from debt shocks. On the contrary, in high-income countries, the response is negative and smaller in magnitude; a 1 percent unanticipated increase in debt to GDP ratio leads to a significant -0.008 percent reduction in real GDP 4 years after the shock.

This result of high-income countries is in line with Rahman et al. (2019), who emphasize the importance of analyzing the causal implications of public debt shock to real GDP growth further based on the income classification. The literature on low-income countries is limited, because of relatively scarce data.

[14] Results for middle-income countries can be found in the Annexes.

Figure 6: Response of Real GDP to Public Debt Shocks, by Income Classification



Sources: World Economic Outlook and IMF staff calculation.

Note: t=0 is the year of shock. Green shaded area represents the 90 percent confidence bands. The solid green line denotes the response to an unanticipated increase in public debt to GDP ratio. Median public debt to GDP ratio is 50.03 and 53.65 percent in the low- and high-income countries subsamples, respectively. Estimates based on equation (2).

Table 4: Regression Results, by Income Classification

LOW-INCOME COUNTRIES	K=0	K=1	K=2	K=3	K=4	K=5
PUBLIC DEBT SHOCK(T)	0.0036	0.0179	0.0457***	0.0380***	0.0315**	-0.0024
	0.0079	0.0146	0.0167	0.0094	0.0139	0.0209
NUMBER OF COUNTRIES	38	37	32	30	27	27
NUMBER OF OBSERVATIONS	273	233	196	165	137	112
R^2	0.2798	0.5149	0.5989	0.6872	0.7008	0.7165

HIGH-INCOME COUNTRIE	K=0	K=1	K=2	K=3	K=4	K=5
PUBLIC DEBT SHOCK(T)	-0.0019	-.0026	-0.0057	-0.0077*	-0.0079**	-0.0006
	0.0038	0.0054	0.0051	0.0042	0.0035	0.0041
NUMBER OF COUNTRIES	55	53	52	50	50	49
NUMBER OF OBSERVATIONS	778	721	668	618	570	521
R^2	0.5002	0.5140	0.5414	0.5715	0.5949	0.6270

Note: Observations are at the country-vintage level. Dependent variable is change in real GDP between t+k and t-1 for up to five-year horizon(k). k=0 is the year of shock. Country and time fixed effects were incorporated. Control variables are included but not shown here. Standard errors are clustered at the country level. *, **, and *** indicate significance at the 10, 5 and 1 percent level respectively.

HIPC Initiative

The HIPC Initiative was introduced in 1996 by the IMF and the World Bank to help reduce unmanageable debt burdens in poor countries. It has provided US$76 billion in debt relief so far. The debt relief was completed for 36 countries.[15] To analyze how the HIPC debt relief initiative may have affected the response of real GDP to an unanticipated increase in public external debt, we divide our sample between data points before and after the completion of the HIPC debt relief.[16] In the HIPC process, there are two important milestones: (i) the decision point is the date when the country is assessed to qualify for the HIPC debt relief, which involves among other requirements, establishing a credible track record of policy performance, attempting to clear the amount of arrears to the IMF and World Bank, preparing of Poverty Reduction Strategy Paper (PRSP), and (ii) the completion point when the country has successfully completed the key structural reforms agreed at the

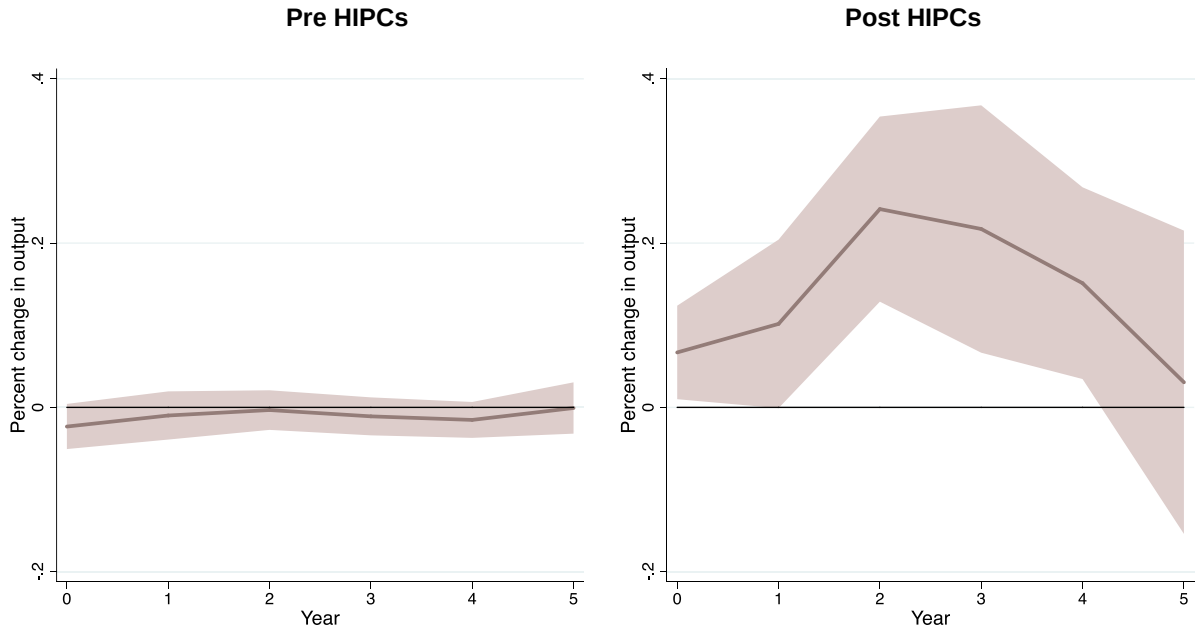
[15] Three countries (Eritrea, Somalia and Sudan) remain eligible to benefit from the Initiative.

[16] See IMF Policy Paper, Heavily Indebted Poor Country (HIPC) Initiative and Multilateral Debt Relief Initiative (MDRI) – Statistical Update, August 6, 2019.

decision point. We divide the data between pre vs. post HIPC Initiative based on the completion point to assess the difference in impulse responses of real GDP to the unanticipated public debt increase.
Given that the HIPC debt relief was regarding the effect of reduction in the public external debt, the analysis focuses on public external debt.[17] Figure 7 and Table 5 indicate that, in the post-HIPC Initiative subsample, a 1 percent increase in the debt to GDP ratio leads to a significant 0.24 percent increase in real GDP 2 years after the shock. This result is the largest in magnitude among all the analyses conducted in the paper, meaning that countries benefit significantly from extra borrowings after recovering from unmanageable debt burdens.

Our result is in line with the literature, which illustrates the positive impact on growth of participating in the HIPC Initiative (Hussain and Gunter, 2005; Pattillo et al., 2011; Marcelino and Hakobyan, 2014).

Figure 7: Response of Real GDP to Public Debt Shocks, pre- vs. post-HIPC Initiative



Sources: World Economic Outlook and IMF staff calculation.

Note: t=0 is the year of shock. Red shaded area represents the 90 percent confidence bands. The solid red line denotes the response to an unanticipated increase in public debt to GDP ratio. Median public debt to GDP ratio is 65.28 and 23.97 percent in the pre- vs. post-HIPC Initiative subsamples, respectively. Estimates based on equation (2).

[17] The total liabilities of a country with foreign creditors on resident general government and monetary authorities to all foreign (non-resident) sectors. Creditors often determine all the terms of the debt contracts, which are normally subject to the jurisdiction of the foreign creditors or, for multilateral credits, to international law.

Table 5: Regression Results, pre- vs. post- HIPC Initiative

PRE HIPC	K=0	K=1	K=2	K=3	K=4	K=5
PUBLIC DEBT SHOCK(T)	-0.0233	-0.0099	-0.0033	-0.0109	-0.0153	-0.0008
	0.0167	0.0178	0.0146	0.0141	0.0133	0.0190
NUMBER OF COUNTRIES	33	33	33	33	33	33
NUMBER OF OBSERVATIONS	292	292	292	292	292	292
R^2	0.1832	0.2599	0.3533	0.4721	0.6010	0.6157

POST HIPC	K=0	K=1	K=2	K=3	K=4	K=5
PUBLIC DEBT SHOCK(T)	0.0669*	0.1016	0.2414*	0.2171*	0.1512*	0.0306
	0.0346	0.0623	0.0685	0.0915	0.0709	0.1122
NUMBER OF COUNTRIES	36	36	36	36	35	34
NUMBER OF OBSERVATIONS	438	402	366	330	295	261
R^2	0.1866	0.2473	0.3970	0.4707	0.5456	0.5975

Note: Observations are at the country-vintage level. Dependent variable is the change in real GDP between t+k and t-1 for up to five-year horizon(k). k=0 is the year of shock. Country and time fixed effects were incorporated. Control variables are included but not shown here. Standard errors are clustered at the country level. *, **, and *** indicate significance at the 10, 5 and 1 percent level respectively.

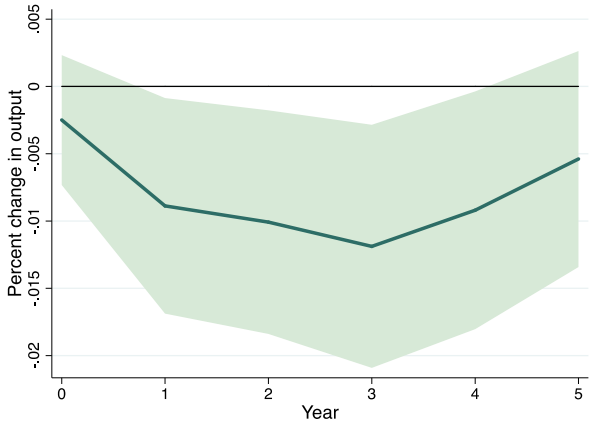
Robustness Analysis

This section assesses several robustness checks to confirm whether our results are robust to different specifications. In our analysis, we add the initial debt levels as control variables, we check for the Nickell-bias, and also use actual data from the $t+2$ and $t+3$ WEO vintages.

Adding Lags of Initial Debt Level as Controls

To check the robustness of our results, we add two lags of the initial debt to GDP Ratio as controls. Potential endogeneity issues could arise despite the approach of shock construction based on forecast errors, defined as the gap between the materialized outcome and October WEO projection of the same year. However, results remain essentially identical (Figure 8 and Table 6).

Figure 8: Response of Real GDP to Public Debt Shocks, Baseline, Adding Lags of Initial Debt Levels



Sources: World Economic Outlook and IMF staff calculation.

Note: t=0 is the year of shock. Green shaded area represents the 90 percent, confidence bands. The solid green line denotes the response to an unanticipated increase in public debt to GDP ratio. Median public debt to GDP ratio is 46.12 percent. Estimates based on equation (2).

Table 6: Regression Results, Baseline, Adding Lags of Initial Debt Levels

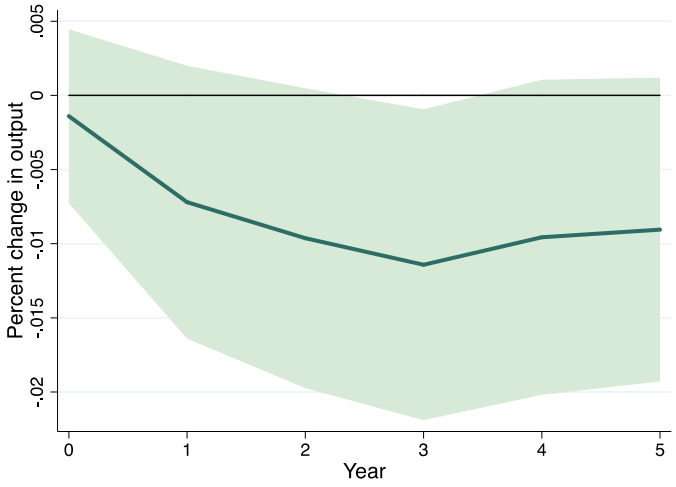
ADDING INITIAL DEBT LEVELS	K=0	K=1	K=2	K=3	K=4	K=5
PUBLIC DEBT SHOCK(T)	-0.00250	-0.00887*	-0.0101***	-0.0119***	-0.00920	-0.00539
	0.00293	0.00487	0.00505	0.00549	0.00537	0.00488
NUMBER OF COUNTRIES	179	178	176	173	168	163
NUMBER OF OBSERVATIONS	2229	2052	1876	1701	1530	1366
R^2	0.4093	0.4046	0.4274	0.4711	0.5145	0.5546

Note: Observations are at the country-vintage level. Dependent variable is the change in real GDP between t+k and t-1 for up to five-year horizon(k). k=0 is the year of shock. Country and time fixed effects were incorporated. Control variables are included but not shown here. Standard errors are clustered at the country level. *, **, and *** indicate significance at the 10, 5 and 1 percent level respectively.

Dropping Two Lags of Dependent Variable

Following the literature on standard local projection, we added two lags of the dependent variable as controls. However, it could potentially cause an endogeneity issue if there is correlation between the lags of the dependent variable and the excluded lags subsumed in the error term, which is called the Nickell-bias. The literature (e.g. Furceri and Li 2017) therefore controls for Nickell-bias by dropping the lags of the dependent variable as a robustness check. Using the same approach, our results remain broadly identical (Figure 9 and Table 7).

Figure 9: Response of Real GDP to Public Debt Shocks, Baseline, Dropping Lags of Dependent Variable



Sources: World Economic Outlook and IMF staff calculation.

Note: t=0 is the year of shock. Green shaded area denotes the 90 percent confidence bands. The solid green line represents the response to an unanticipated increase in public debt to GDP ratio. Median public debt to GDP ratio is 46.12 percent. Estimates based on equation (2).

Table 7: Regression Results, Baseline, Dropping Lags of Dependent Variable

NICKELL-BIAS	K=0	K=1	K=2	K=3	K=4	K=5
PUBLIC DEBT SHOCK(T)	-0.00140	-0.00720	-0.00963	-0.0114*	-0.00957	-0.00905
	0.00357	0.00559	0.00614	0.00637	0.00646	0.00622
NUMBER OF COUNTRIES	179	178	176	173	168	163
NUMBER OF OBSERVATIONS	2229	2052	1876	1701	1530	1366
R^2	0.3563	0.2900	0.2532	0.2362	0.2216	0.2171

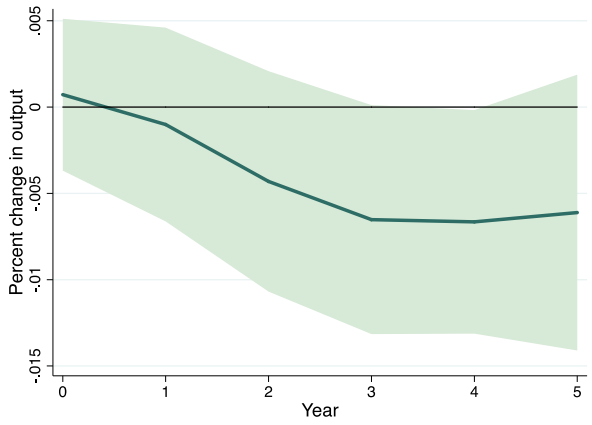
Note: Observations are at the country-vintage level. Dependent variable is the change in real GDP between t+k and t-1 for up to five-year horizon(k). k=0 is the year of shock. Country and time fixed effects were incorporated. Control variables are included but not shown here. Standard errors are clustered at the country level. *, **, and *** indicate significance at the 10, 5 and 1 percent level respectively.

Alternative Constructions of the Forecast Error

Since the beginning of our dataset, WEO data may have encountered some revisions, making our use of actual data from the April 2021 WEO to construct forecast errors potentially less accurate. To tackle this potential concern, we use realized actual data published two and three years after the forecasted October WEO instead

of actual data available in the latest WEO vintage in the calculation of unanticipated shocks. For both alternative constructions, our results remain largely identical (Figure 10, Figure 11, Table 8, and Table 9).

Figure 10: Response of Real GDP to Public Debt Shocks, Baseline, Using t+2 WEO Vintage for Actual Data



Source: World Economic Outlook and IMF staff calculation

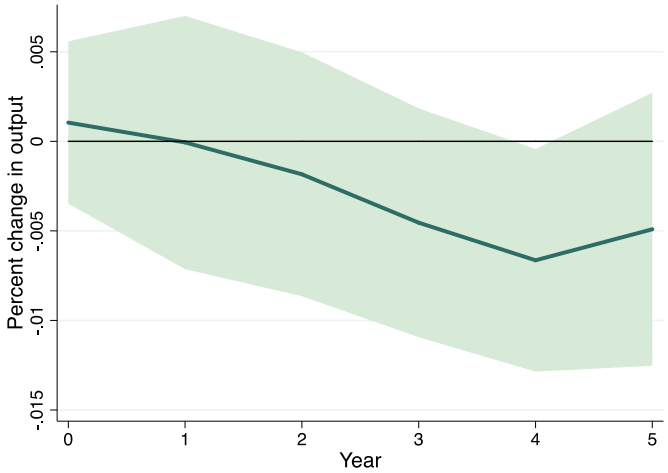
Note: t=0 is the year of shock. Green shaded area denotes the 90 percent confidence bands. The solid green line represents the response to an unanticipated increase in public debt to GDP ratio. Median public debt to GDP ratio is 35.64 percent. Estimates based on equation (2).

Table 8: Regression Results, Baseline, Using t+2 WEO Vintage for Actual Data

USING T+2 ACTUAL DATA	K=0	K=1	K=2	K=3	K=4	K=5
PUBLIC DEBT SHOCK(T)	0.00072	-0.00101	-0.00431	-0.00652	-0.00665*	-0.00611
	0.00267	0.00341	0.00388	0.00403	0.00394	0.00486
NUMBER OF COUNTRIES	177	177	177	174	169	163
NUMBER OF OBSERVATIONS	1890	1890	1890	1715	1544	1380
R^2	0.2504	0.3195	0.4088	0.4521	0.4942	0.4872

Note: Observations are at the country-vintage level. Dependent variable is the change in real GDP between t+k and t-1 for up to five-year horizon(k). k=0 is the year of shock. Country and time fixed effects were incorporated. Control variables are included but not shown here. Standard errors are clustered at the country level. *, **, and *** indicate significance at the 10, 5 and 1 percent level respectively.

Figure 11: Response of Real GDP to Public Debt Shocks, Baseline, Using t+3 WEO Vintage for Actual Data



Sources: World Economic Outlook and IMF staff calculations

Note: t=0 is the year of shock. Green shaded area denotes the 90 percent confidence bands. The solid green line represents the response to an unanticipated increase in public debt to GDP ratio. Median public debt to GDP ratio is 35.10 percent. Estimates based on equation (2).

Table 9: Regression Results, Baseline, Using t+3 WEO Vintage for Actual Data

USING T+3 ACTUAL DATA	K=0	K=1	K=2	K=3	K=4	K=5
PUBLIC DEBT SHOCK(T)	0.00105	-0.00006	-0.00184	-0.00454	-0.00664*	-0.00491
	0.0028	0.0043	0.0041	0.0039	0.0038	0.0046
NUMBER OF COUNTRIES	173	173	173	173	168	162
NUMBER OF OBSERVATIONS	1710	1710	1710	1710	1539	1375
R^2	0.2545	0.3319	0.3728	0.4517	0.4963	0.4909

Note: Observations are at the country-vintage level. Dependent variable is the change in real GDP between t+k and t-1 for up to a five-year horizon(k). k=0 is the year of shock. Country and time fixed effects were incorporated. Control variables are included but not shown here. Standard errors are clustered at the country level. *, **, and *** indicate significance at the 10, 5, and 1 percent level, respectively.

Conclusion

Using a novel way of constructing exogenous shocks in public debt, this paper provides new empirical evidence on the impact of an unanticipated change in the public debt to GDP ratio on real GDP. Overall, real GDP responds negatively to unanticipated debt to GDP ratio increases. The response also varies depending on several fundamental characteristics. We find that an unanticipated increase in the public debt to GDP ratio hurts real GDP level for countries with (i) a high initial debt level and (ii) a rising debt trajectory over the five preceding years. On the contrary, it boosts real GDP for countries (iii) with a low-income level and (iv) that have completed the HIPC debt relief initiative. The magnitude of the impact is much more prominent in subgroup analyses, revealing potential canceling out effects in the aggregate sample analysis. To conclude, country-specific characteristics need to be taken into account to fully assess the impact of increasing public debt on real GDP.

Future research could look into the channels through which the unanticipated increase in public debt impacts real GDP, particularly for each subsample with different macroeconomic characteristics. If the rise in public debt is used for public investment, it is likely to increase subsequent growth (Furceri et al., 2018). However, the increase in public debt may be channeled to other uses, such as tax cuts or other fiscal spending. Those channels can also be impacted by other factors such as governance or corruption. In those cases, the impact of an increase in public debt on real GDP may not be the same. Several papers in the literature have shed light on those impacts. Using a difference-in-differences approach, Kim et al. (2017) finds that corruption hurts the impact of debt on growth in countries with high corruption. Furthermore, future projects can consider microeconomic channels which could be diagnosed further: such as debt stemming from natural disaster, governance instability, debt investors portfolio, or a structural shift in the ability of countries to carry debt in relation to the financial secular development and reduction in interest rates (Grigorian et al., 2016; Dell'Ariccia et al., 2018).

Additionally, interest rates may remain low in advanced economies with independent central banks. On the contrary, emerging economies or economies without significant monetary autonomy may have a different detrimental impact on output (Bakker et al., 2019). Understanding the decomposition of the usage of debt could also be addressed in future work since responses by debt may differ based on specifications (i.e., concessional debt, external debt, or short/long term debt).

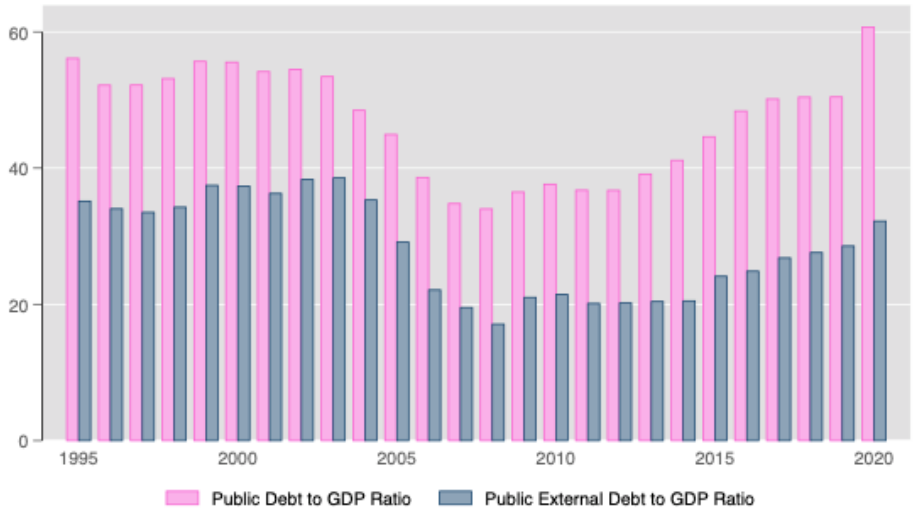
Our results prescribe various policy implications. First, low-income countries can benefit from an increase in debt to GDP ratio. Second, lowering the initial levels of debt or keeping a declining debt trajectory increases countries' potential benefit from additional borrowings. Third, participation in the HIPC Initiative increases countries' potential to gain from extra borrowings, which can be a positive experience to be considered for other debt relief initiatives.

Annex I. Statistics and Debt Shocks

This annex illustrates our dataset and shows the distribution of the constructed debt shocks, both for public debt shocks and public external debt shocks.

Figure 12: Evolution of Debt in the Dataset

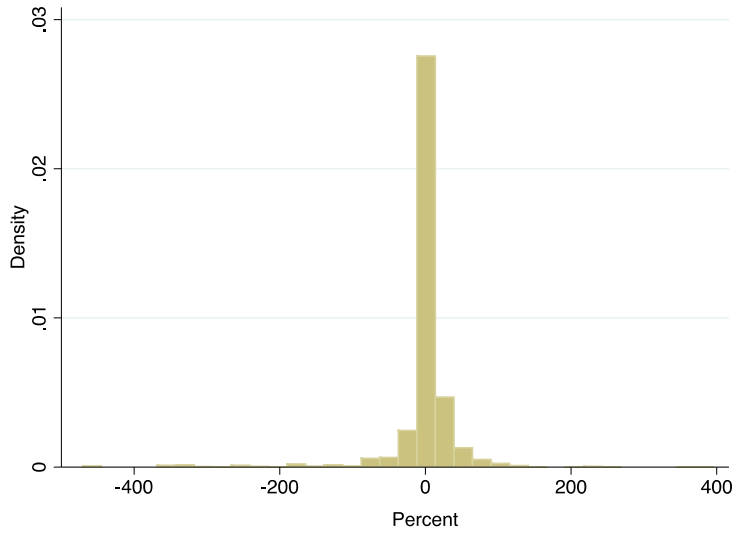
Debt to GDP Ratio, All Countries, Median



Sources: World Economic Outlook and IMF staff calculation.

Figure 13: Public Debt Shocks

Public Debt to GDP Ratio, Deviation from Projection, Percent

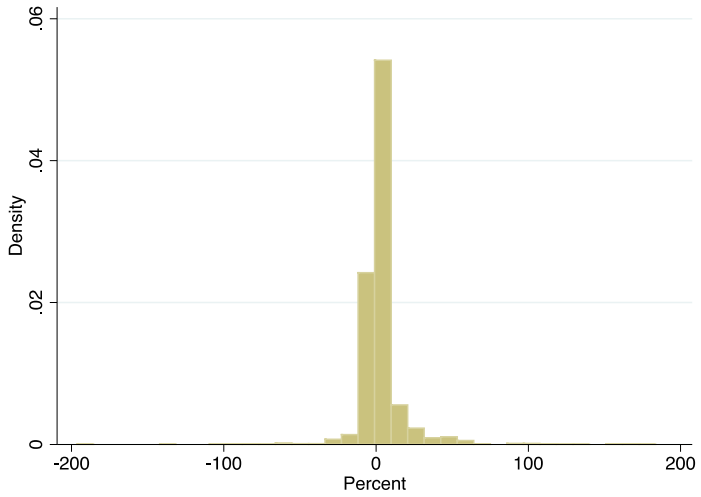


Sources: World Economic Outlook and IMF staff calculation.

Note: The figure reports the shock distribution of public debt shock(percent). Median is 1.23 percent. 91.17 percent of data lies within 50% range of deviation, and 63.56% of data lies within 10% range of deviation.

Figure 14: Public External Debt Shocks

Public External Debt to GDP Ratio, Deviation from Projection, Percent



Sources: World Economic Outlook and IMF staff calculation.

Note: The figure reports the shock distribution of public debt shock(percent). Median is 0.12 percent. 98.05 percent of data lies within 50% range of deviation, and 84.24% of data lies within 10% range of deviation.

Annex II. Other Results

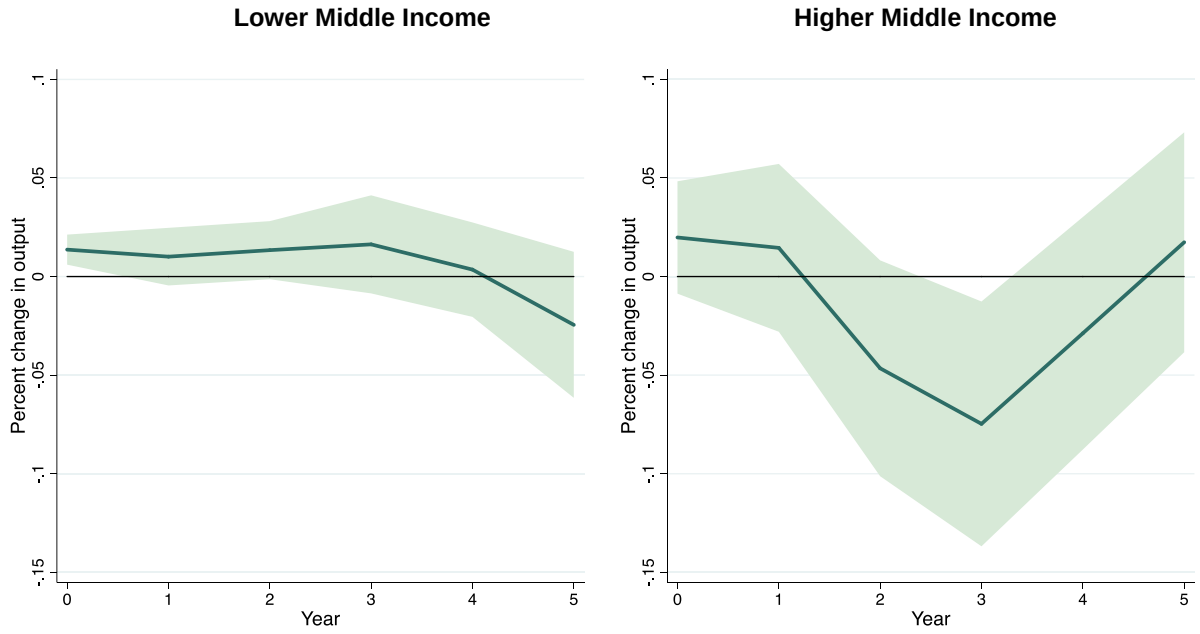
This annex provides results for two other income classifications and public external debt.

Additional Results for Income Classification

As mentioned previously, we provide the results for the other two income classifications that are not .shown The results suggest a small positive impact of exogenous debt shocks for lower middle income countries, while a small and negative impact for higher middle income countries.

Figure 15: Response of Real GDP to Public Debt Shocks

Middle-Income Countries



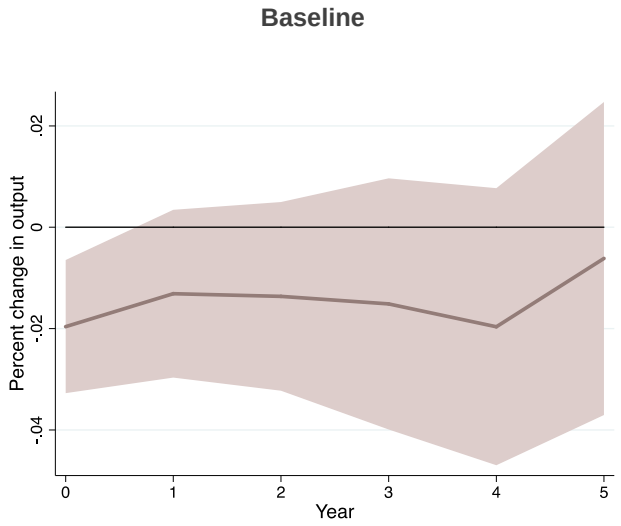
Sources: World Economic Outlook and IMF staff calculation.

Note: t=0 is the year of shock. Green shaded area denotes the 90 percent, confidence bands. The solid green line represents the response to an unanticipated increase in public debt to GDP ratio. The median public debt to GDP ratio is 40.36 and 42.18 percent in the lower and upper middle-income countries subsamples, respectively. Estimates based on equation (2).

Public External Debt

We perform additional analysis on public external debt shocks, and the baseline results are shown in Figure 16. The results suggest that real GDP overall responds negatively to public external debt shocks, and the response is contemporaneous.

Figure 16: Response of Real GDP to Public External Debt Shocks



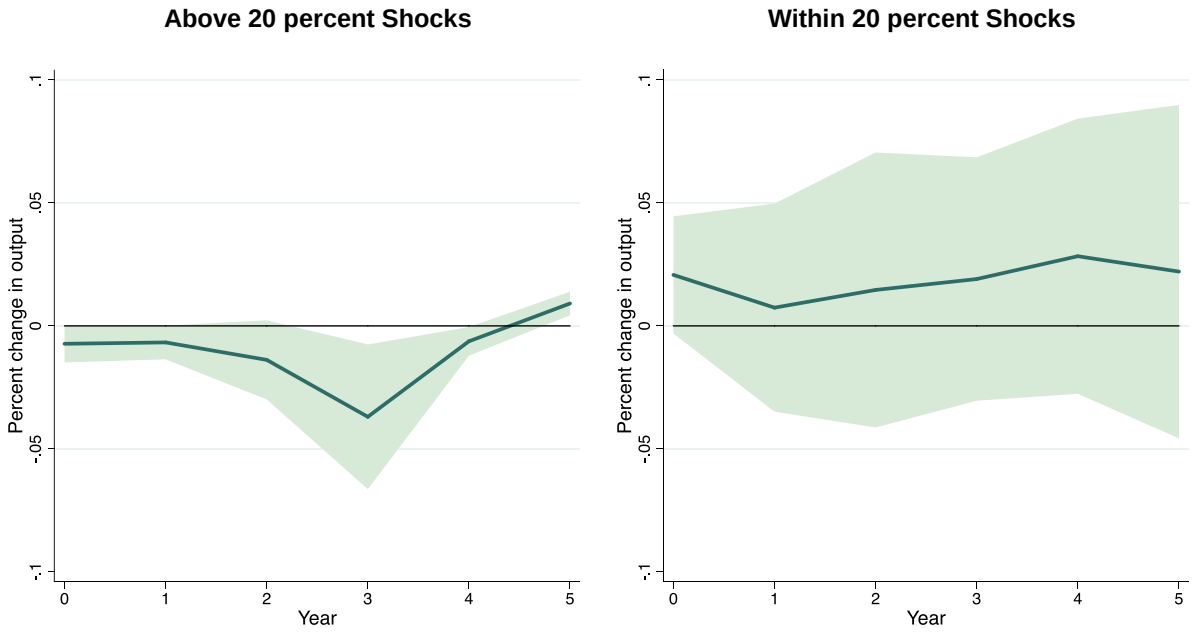
Sources: World Economic Outlook and IMF staff calculation.

Note: t=0 is the year of shock. Red shaded area denotes the 90 percent, confidence bands. The solid red line represents the response to an unanticipated increase in public debt to GDP ratio. Median public external debt to GDP ratio is 27.5 percent. Estimates based on equation (2).

Size of debt shocks

One may reasonably expect that the larger forecast errors are more likely to have economic significance than smaller forecast errors, especially for low-income countries, and are unlikely to reflect a meaningful surprise. The result reveals that 20 percent or above debt shocks will lead to a significantly negative output response, and the magnitude is larger than the previous results, while we do not see a remarkable difference for smaller (within 20 percent) shocks.

Figure 17: Response of Real GDP to Public Debt Shocks: Larger vs. Smaller Shocks



Sources: World Economic Outlook and IMF staff calculation.

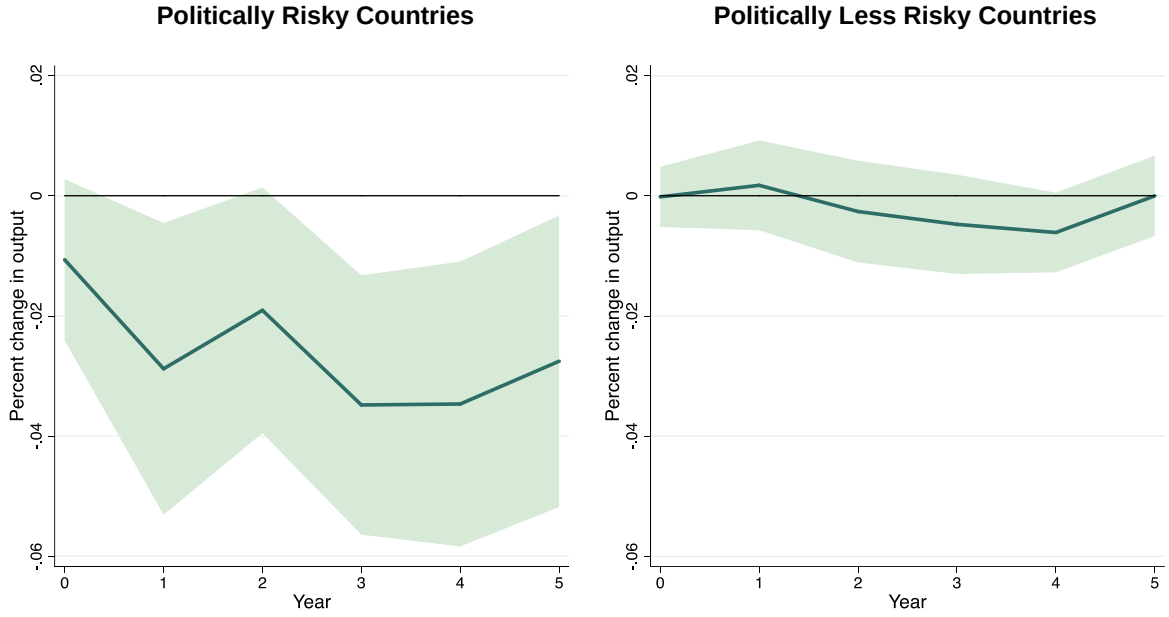
Note: t=0 is the year of shock. Green shaded area denotes the 90 percent, confidence bands. The solid green line represents the response to an unanticipated increase in public debt to GDP ratio. The median public debt to GDP ratio is 45.27 and 48.52 percent in the above 20 percent shocks and within 20 percent shocks, respectively. Estimates based on equation (2).

Political/Governance Stability

The importance of incorporation of political or governance stability is emphasized (Kim et al., 2017). In line with the literature, we confirmed that politically risky countries tend to have a negative output response to an unanticipated increase in debt.[18]

[18] The political risk data was obtained from the International Country Risk Guide (ICRG) database. “Political Risk Rating” measures the political stability of a country on a comparable basis with other countries by assessing risk points for each of the component factors of government stability, socioeconomic conditions, investment profile, internal conflict, external conflict, corruption, military in politics, religious tensions, law and order, ethnic tensions, democratic accountability, and bureaucracy quality.

Figure 18: Response of Real GDP to Public Debt Shocks: Political Stability



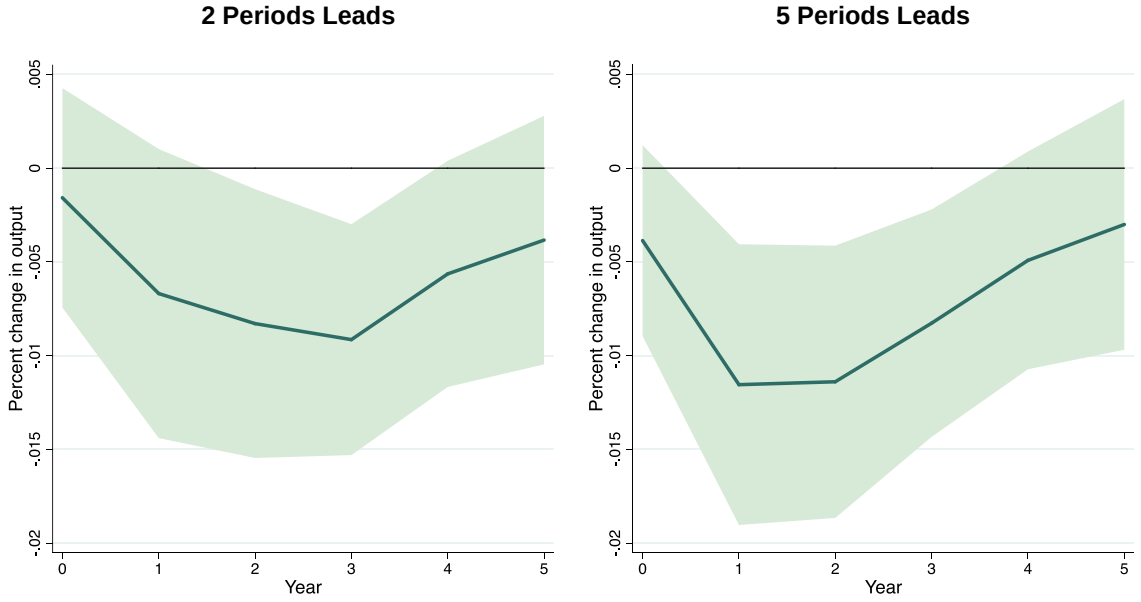
Sources: World Economic Outlook, ICRG and IMF staff calculation.

Note: t=0 is the year of shock. Green shaded area denotes the 90 percent, confidence bands. The solid green line represents the response to an unanticipated increase in public debt to GDP ratio. The median public debt to GDP ratio is 45.14 and 45.79 percent in the politically risky countries and politically less risky countries subsamples, respectively. Estimates based on equation (2).

Additional Robustness Check

Teulings and Zubanov (2014) illustrate the potential local projection bias using a cumulative empirical approach that may arise, especially when analyzing more long-time horizons. They proposed that this potential bias could be alleviated by incorporating the lead variables of the shocks into regressors. We assessed by adding two-period and five-period leads of shocks to the regressors and confirmed that the results remain robust.

Figure 19: Response of Real GDP to Public Debt Shocks: Different Lead Periods



Sources: World Economic Outlook and IMF staff calculation.

Note: t=0 is the year of shock. Green shaded area denotes the 90 percent, confidence bands. The solid green line represents the response to an unanticipated increase in public debt to GDP ratio. The median public debt to GDP ratio is 46.57 for both 2 periods lead, and 5 periods leads. Estimates based on equation (2).

Annex III. Data Cleaning

This annex explains how we cleaned our data to prevent possible data errors from influencing the results. The data cleaning process that we used closely follows the methodology of the paper "Worse Than You Think: Public Debt Forecast Errors in Advanced and Developing Economies" (Flores et al., 2020). Looking at each country individually rescale, convert, or eliminate data points when substantial forecast errors. We use their strategy when applicable to our context. In addition, to prevent potential additional data errors from affecting the result, we also eliminated data points that had a debt shock larger than 5; in other words, we have considered a forecast error greater than 5 times the debt to GDP ratio to be an outlier. Following this truncation method, we have eliminated 74 data points in total.

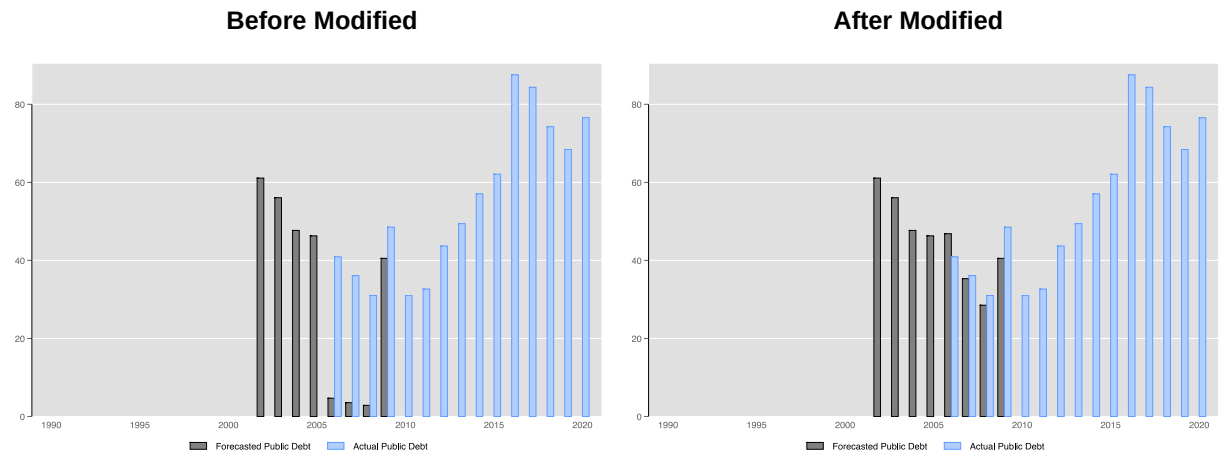
Rescaling

Following Flores et al. (2020), we rescaled the time series with an essential shift in the public debt forecast time series.

Table 10: Data Cleaning, Rescaling

Country Name	Correction
Mongolia	Gross debt series multiplied by 10 for vintages 2005-2008

Figure 20 : Evolution of Public Debt to GDP in Mongolia, Forecast and Actual Data



Sources: World Economic Outlook and IMF staff calculation.

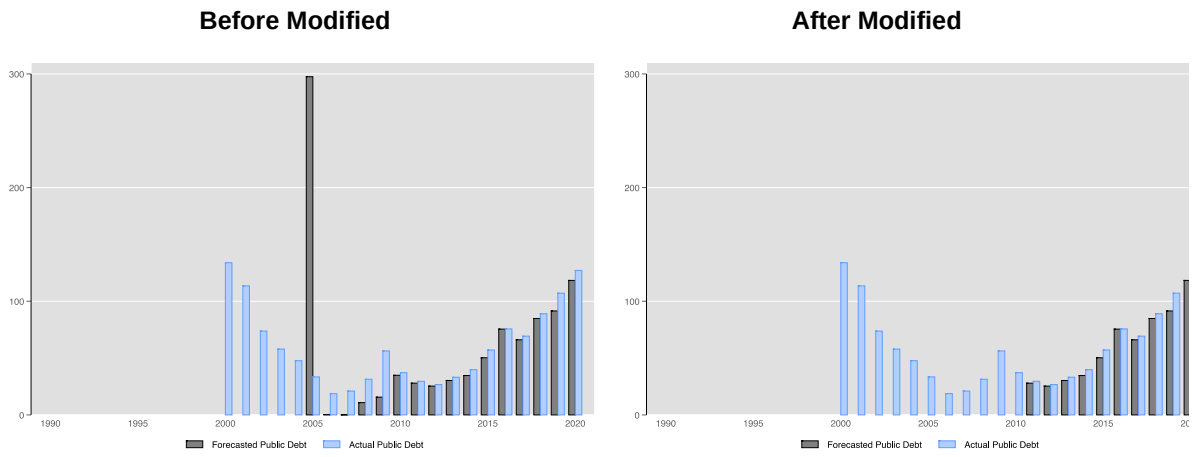
Excluding Data Points

Following Flores et al. (2020), we converted data points to missing data when there was an essential shift in the public debt forecast time series and rescaling was not feasible. Table 11 lists which data points were converted to missing, and Figure 21 illustrates how the adjustment changed the time series before and after the conversion to missing data in the case of Angola.

Table 11: Data Cleaning, Conversion to Missing Data

Country Name	Correction
Angola	Debt series excluded prior to 2010 vintage
Albania	Debt series excluded when data points are equal to 1.000e-13, for all vintages in 1990-1994
Hong Kong	Debt series excluded for all vintages in 2011-14
Kazakhstan	Debt series excluded in 2005
Kyrgyz Republic	Debt series excluded in 2014
Niger	Debt series excluded for all vintages before 2014
Nicaragua	Debt series excluded for all vintages before 2013
Pakistan	Debt series excluded for all vintages before 2003
Sweden	Debt series excluded for all vintages before 2006
Seychelles	Debt series excluded for all vintages in 2005-20
Guinea-Bissau	Debt series excluded
Mauritania	Debt series excluded
Uruguay	Debt series excluded

Figure 21: Evolution of Public Debt to GDP in Angola, Forecast and Actual Data



Sources: World Economic Outlook and IMF staff calculation.

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