



ASIA AND PACIFIC DEPARTMENT

Worse Than You Think: Public Debt Forecast Errors in Advanced and Developing Economies¹

Julia Estefania Flores

Davide Furceri

Siddharth Kothari

Jonathan D. Ostry

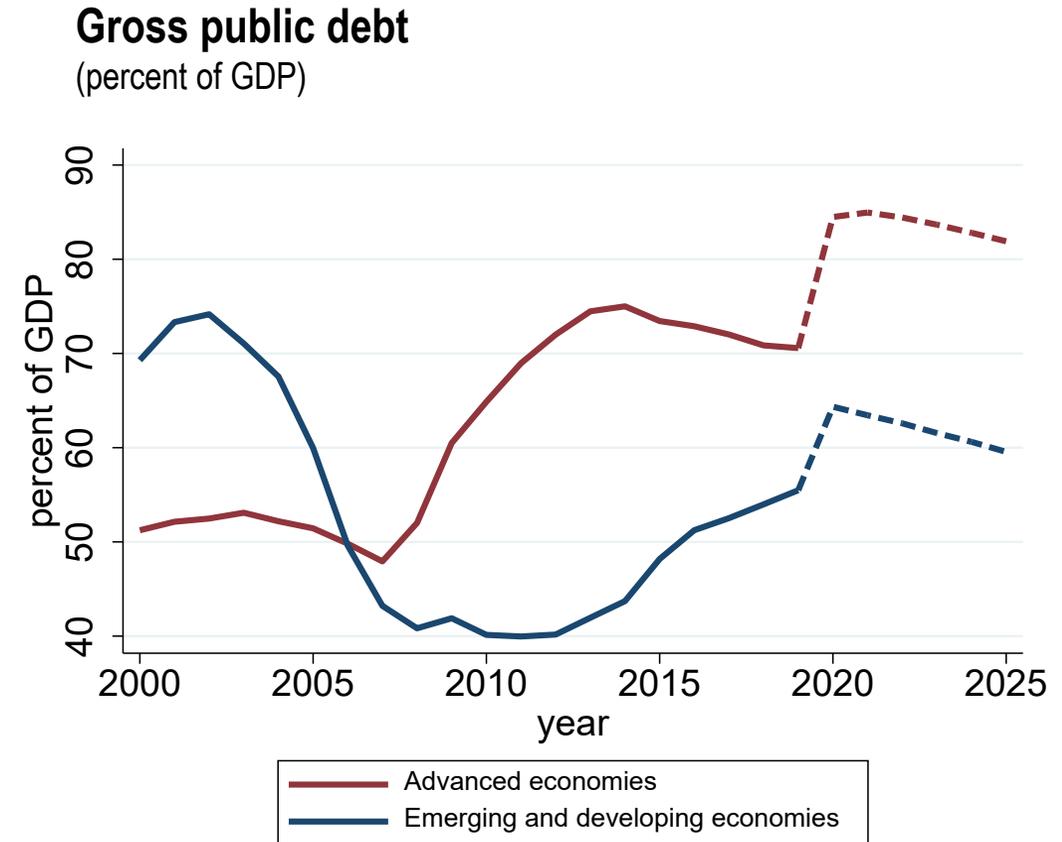
IEO Webinar Series

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¹ This presentation is based on joint work with Julia Estefania Flores, Davide Furceri, and Siddharth Kothari. The views expressed are those of the presenter and should not be attributed to the IMF.

Motivation

- Public debt ratios have increased since the GFC, both in advanced and developing economies
- Sharp rise in debt ratios expected after the COVID shock from already elevated levels, raising concerns about debt vulnerabilities
- Latest projections envisage a quick stabilization and subsequent decline in debt ratios
 - If forecasts are realized, then vulnerabilities will likely stay contained
 - However, if debt ratios instead increase further, it may expose vulnerabilities and undermine market confidence



Source: IMF World Economic Outlook Database

How accurate are public debt forecasts?

Key questions:

- On average, are medium-term debt forecast errors unbiased?
- Which countries have larger forecast errors on average?
- Are positive forecast errors associated with unanticipated recessions, or is there a systematic forecast error irrespective of recessions?
- What can past forecast errors tell us about possible debt paths in the aftermath of the COVID-19 shock?

Large positive forecast errors in public debt forecasts

- At the five-year horizon, realized debt ratios are close to 10 percent of GDP higher than forecast
- Magnitude of the forecast error similar in advanced (AEs) and developing economies (EMDEs):
 - However, positive forecast errors in AEs driven by a recession falling in the forecast horizon
 - In EMDEs, forecast errors are systematically positive, irrespective of recessions
- Forecast errors significantly larger when the projection is for debt ratios to decline than when they are for an increase in debt
- Forecast errors in growth projections a key driver, but other factors play an equally important role
- Oil-exporters and more volatile countries tend to have larger forecast errors
- If post-GFC forecast errors were to repeat, debt ratios in EMDEs would increase to close to 73 percent of GDP by 2025 instead of declining to 63 percent of GDP as currently forecast

Literature review

- **Accuracy of growth forecast:** Inability to predict recessions and weak institutions correlated with bias in growth projections (Ho and Mauro, 2016; Loungani , 2001; Frankel, 2011)
- **Accuracy of fiscal forecasts:** Forecasts underestimate deficits due to overestimating growth and due to political-economy factors
 - **Europe:** Literature focused on official forecasts under the Stability and Growth Pact— Hallerberg et. al. (2004); Bruck and Stephan (2006); Jonung and Larch (2006); Beetsma, Giuliadori, and Wiertz (2009); Marinheiro (2010); Beetsma and others (2010, 2011, 2013)
 - **EMDEs:** Hadzi-Vaskov et. al. (2021), Vasconcelos de Deus and Ferreira de Mendonça (2016) focused on some Latin American countries
- **IMF evaluation of debt forecasts:** Attempt to identify and combat optimism bias in the context of IMF surveillance and lending (IMF 2011, 2013, 2017a,b, and 2021)

Data on forecasts

- Compile comprehensive dataset of medium-term (five-year ahead) debt forecasts made by the IMF and the Economist Intelligence Unit (EIU)
- **IMF Debt-to-GDP Ratio Forecasts**
 - Bi-annual forecasts (April and October WEO) of gross public debt and GDP starting in 1995
 - Unbalanced panel of 174 countries, with country coverage improving gradually over time
- **EIU Debt-to-GDP Ratio Forecasts**
 - Monthly forecasts of gross public debt and GDP available starting in 2007—use April and October forecasts for maximum comparability with IMF data
 - Unbalanced panel of 109 countries

Constructing forecast errors

- **Baseline measure of forecast error:** Realized debt-to-GDP ratio minus forecast debt-to-GDP ratio

$$FE_{c,h}^v = R_{c,v_{y+h}}^{v_{y+h+1}} - F_{c,v_{y+h}}^v$$

where $FE_{c,h}^v$ is the forecast error for country c , in vintage v , at horizon h ($h=0,1\dots5$)

$F_{c,v_{y+h}}^v$ is the forecasted debt ratio at horizon h

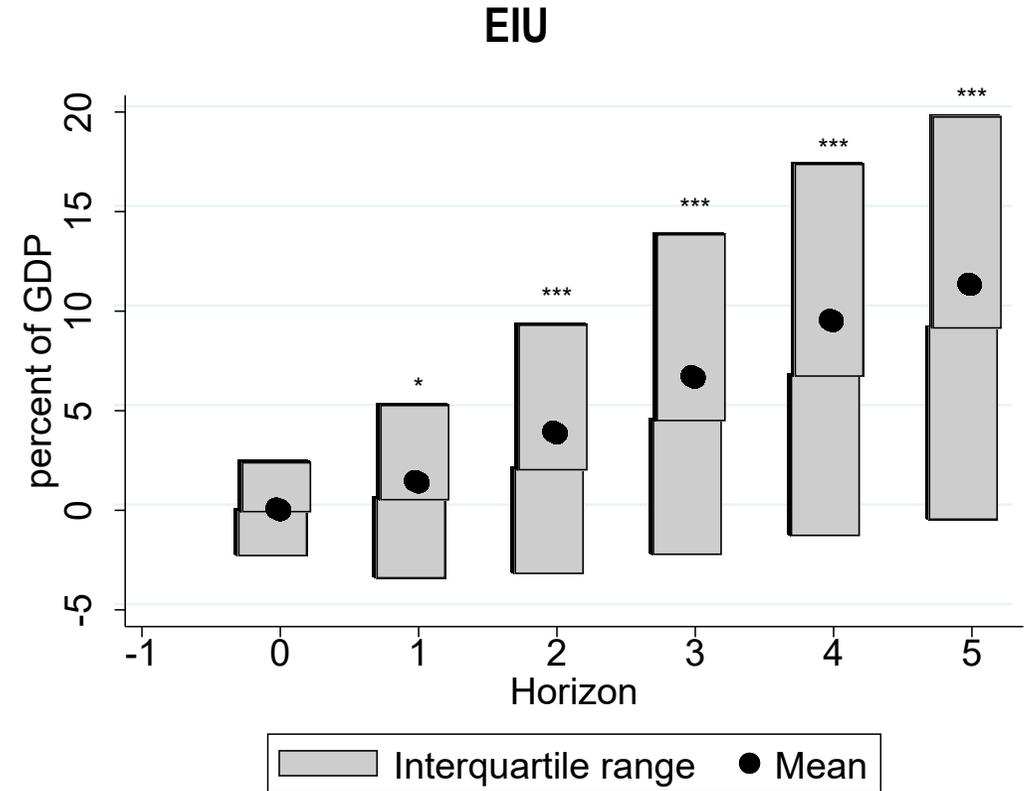
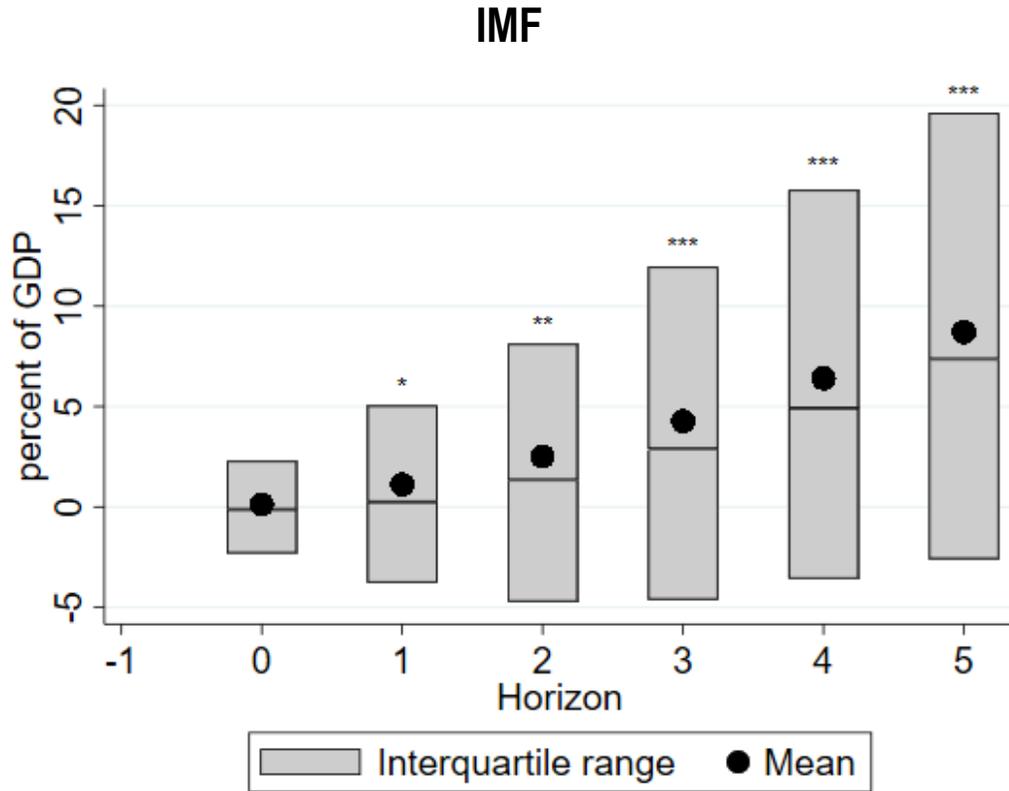
$R_{c,v_{y+h}}^v$ is the realized debt ratio reported in the October vintage of the year after the horizon

- Positive forecast error implies debt ratio outturn was higher than forecast
- Caveat: rebasing of GDP can impact forecast error estimates
- **Alternative measure:** Uses changes in realized and forecast debt ratios (attenuates rebasing bias)

$$FE_{change}^v_{c,h} = \left(R_{c,v_{y+h}}^{v_{y+h+1}} - R_{c,v_{y-1}}^{v_{y+h+1}} \right) - \left(F_{c,v_{y+h}}^v - F_{c,v_{y-1}}^v \right)$$

Realized debt ratios are significantly higher than forecasts

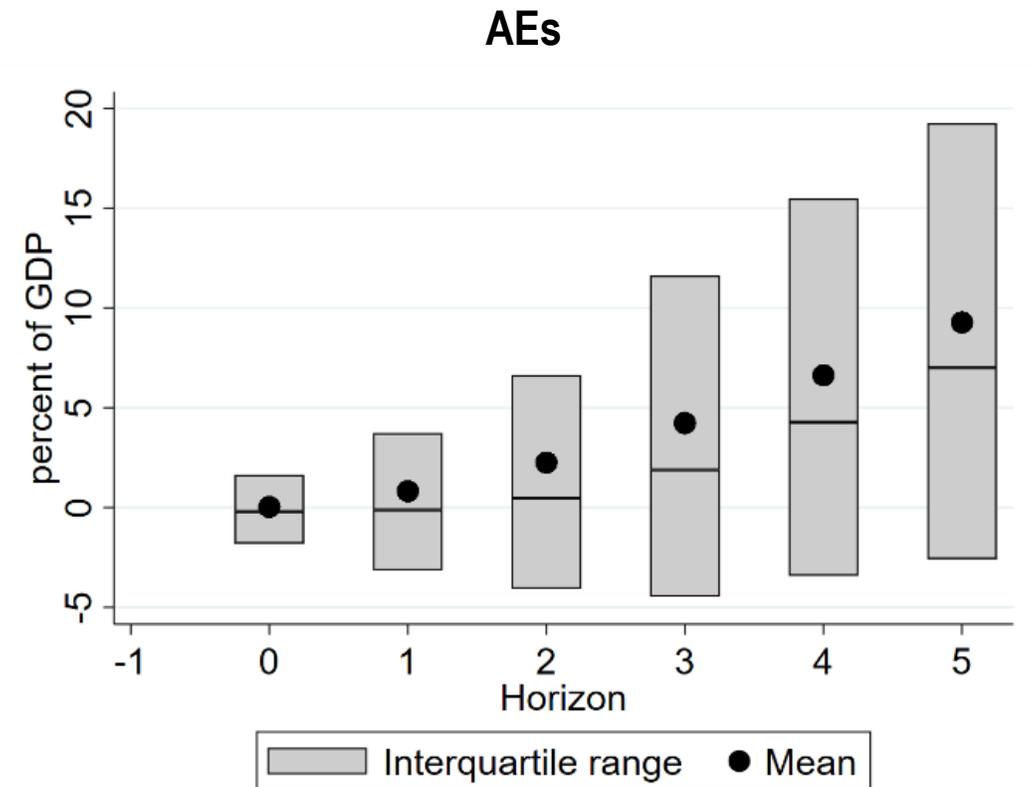
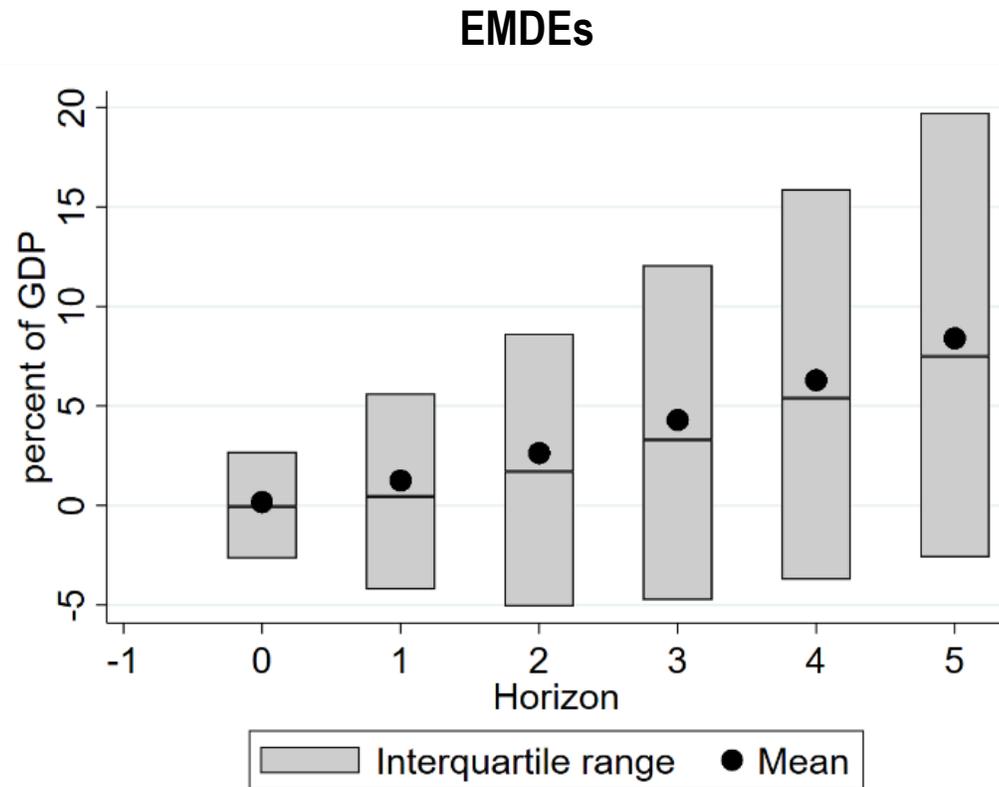
Debt-to-GDP Ratio Forecast Errors For Different Horizons
(percent of GDP)



Notes: Charts show the interquartile range (shaded gray region), mean (black dot), and median (black line in the shaded box) for debt-to-GDP forecast errors for different time horizons. Left figure uses the full IMF sample while the right figure uses the full EIU sample. Forecast errors are computed as the difference between realized and forecasted debt-to-GDP ratios, where realized ratios are taken from the second vintage of the year right after the forecast year. Stars on top of the shaded regions indicates whether the mean is significantly different from zero based on standard errors that are clustered two-way at the country and vintage level. *, **, and *** indicate significance at the 10, 5 and 1 percent level respectively.

Similar forecast errors in AEs and EMDEs...

Debt-to-GDP Ratio Forecast Errors For Different Horizons, IMF Data
(percent of GDP)

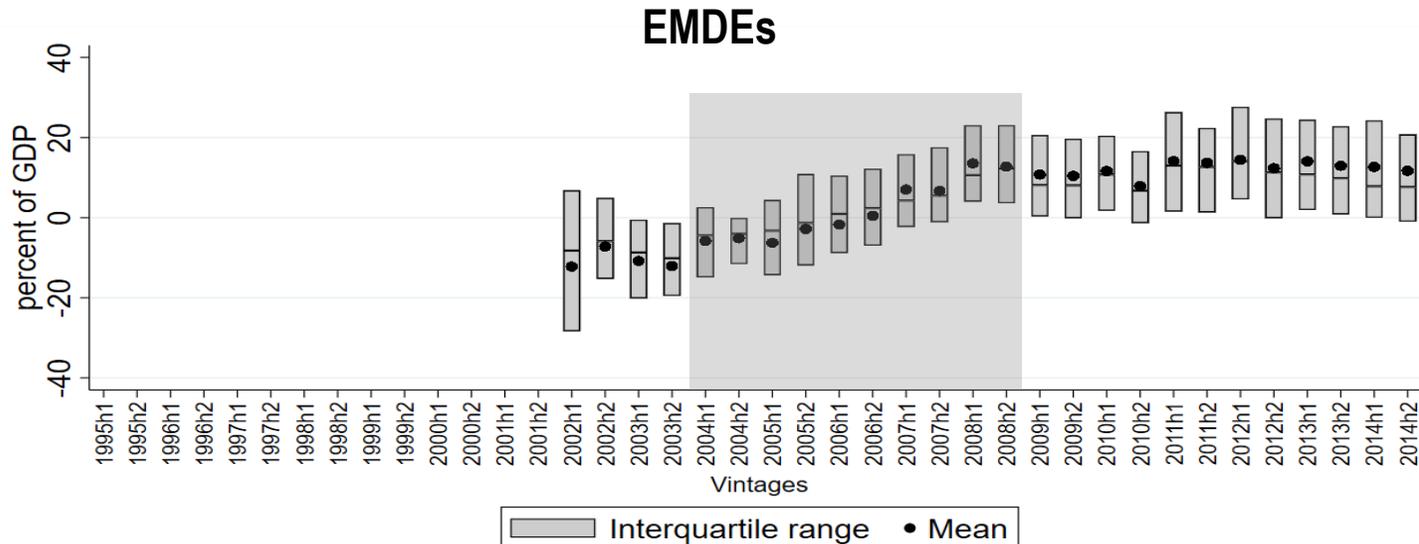
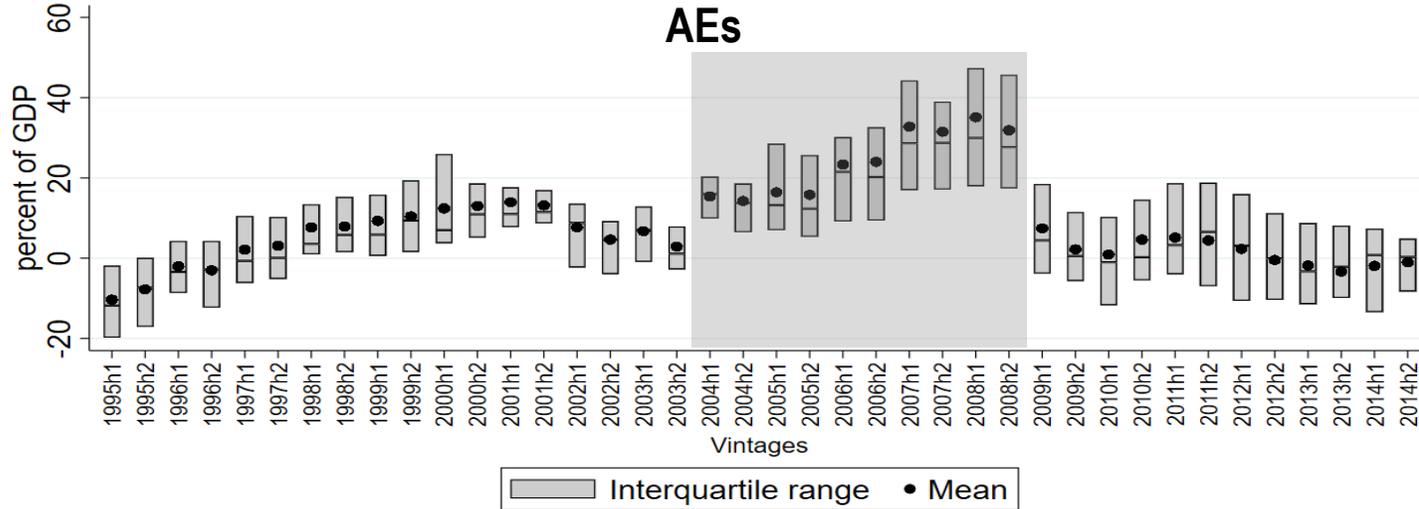


Notes: Charts show the interquartile range (shaded gray region), mean (black dot), and median (black line in the shaded box) for debt-to-GDP forecast errors for different time horizons. Both figures use IMF data. Results are similar when using EIU forecasts. Left figure is for the sample of emerging and developing countries (EMDEs), while the right figure is for the sample of advanced economies (AEs). Forecast errors are computed as the difference between realized and forecasted debt-to-GDP ratios, where realized ratios are taken from the second vintage of the year right after the forecast year.

...mostly in runup to GFC for AEs, consistently for EMDEs

Debt-to-GDP Ratio Forecast Errors Across Vintages, Five-Year Horizon

(percent of GDP)

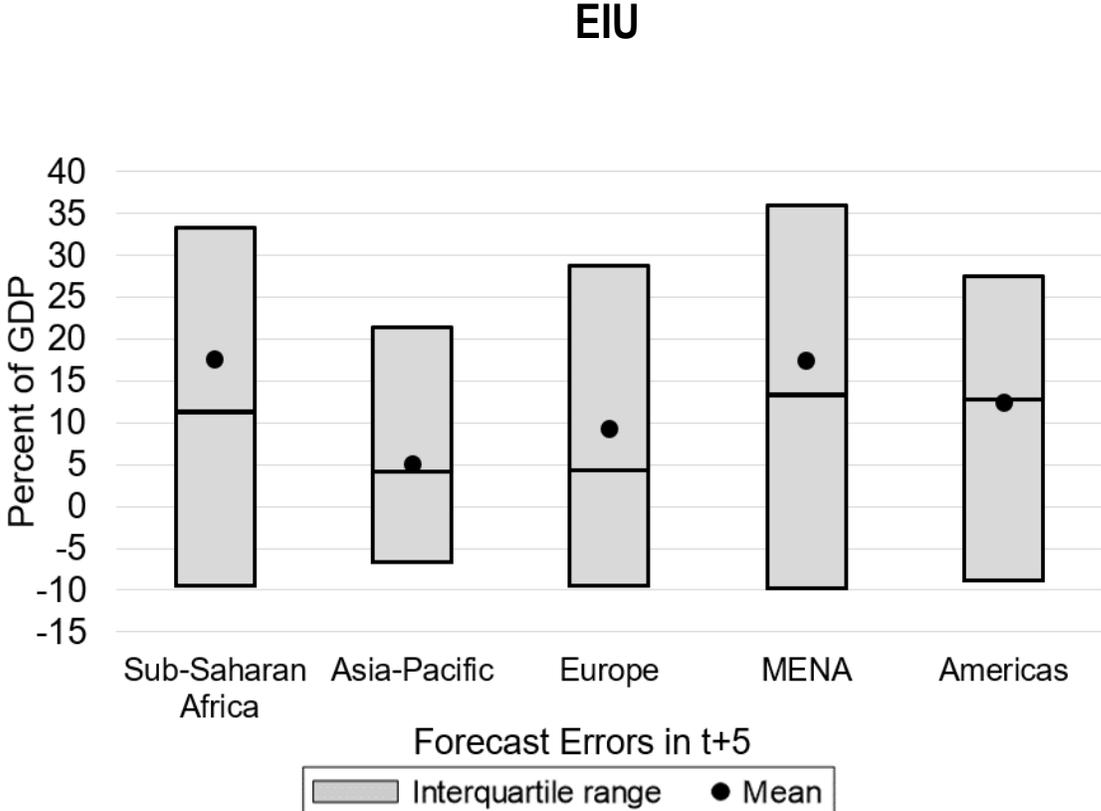
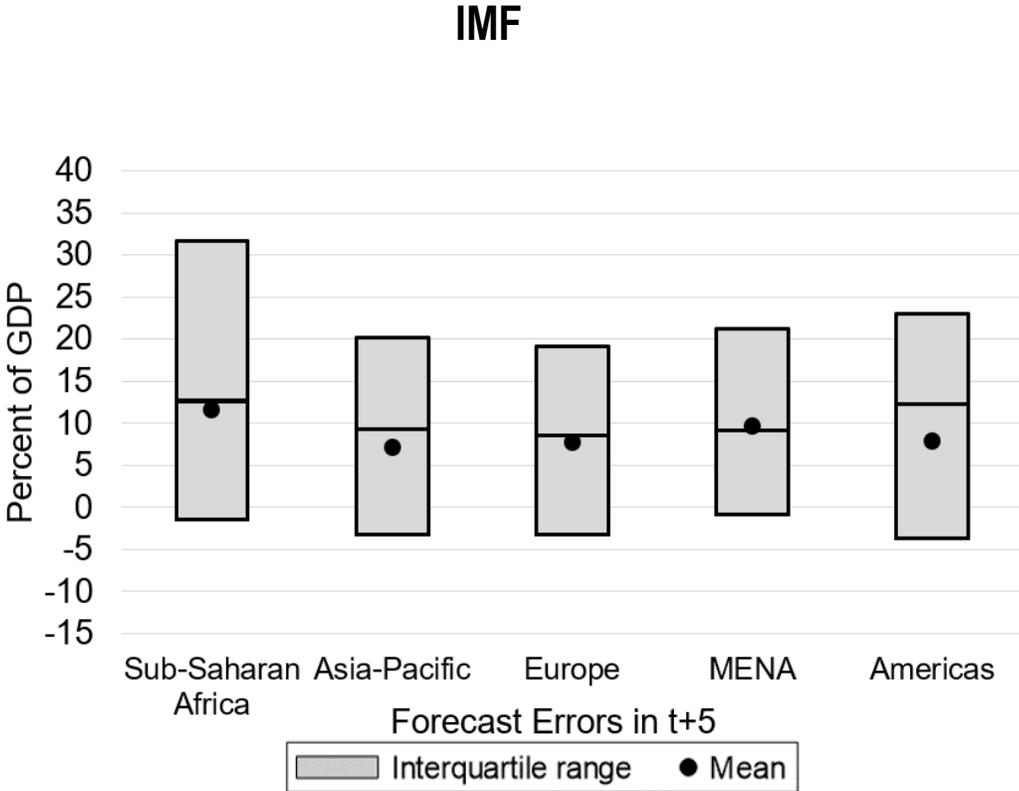


- AEs: vintages leading up to the global financial crisis (GFC) had large forecast errors, as the recession and the corresponding fiscal stimulus was unanticipated. Post GFC forecast errors close to 0

- EMDEs: forecast errors are more systematic and have been consistently positive after the GFC

Positive forecast errors in all regions

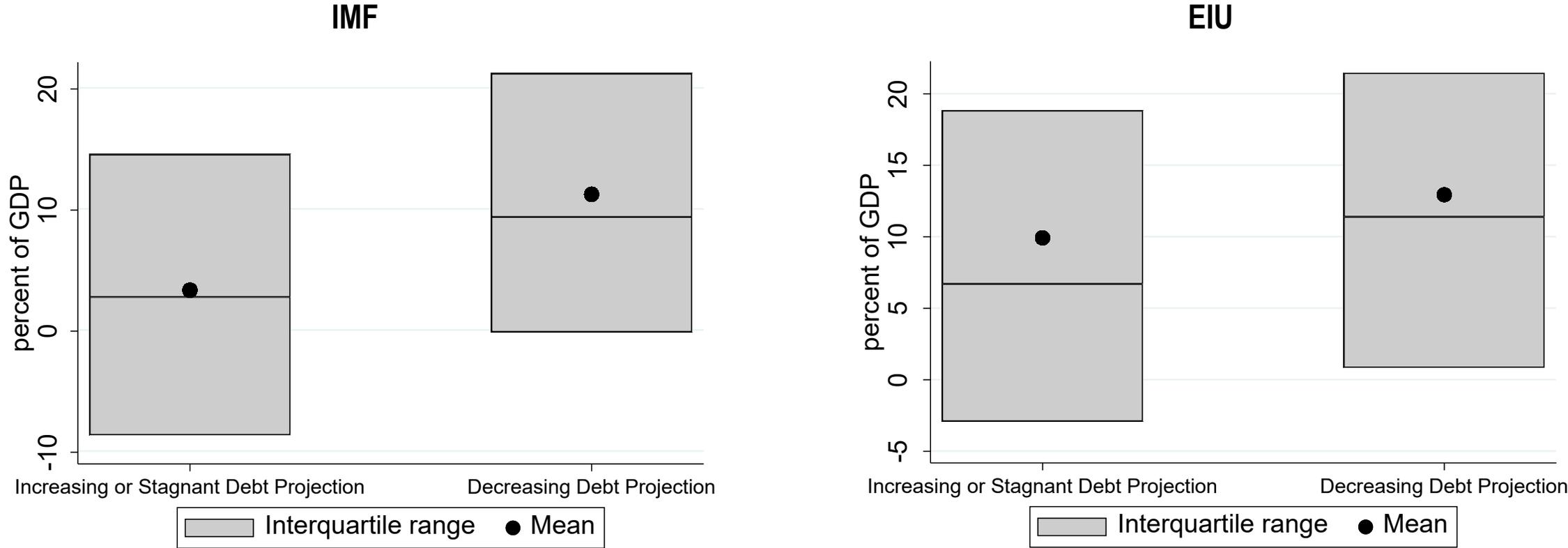
Debt-to-GDP Ratio Forecast Errors Across Regions, Five-Year Horizon
(percent of GDP)



Notes: Charts show the interquartile range (shaded gray region), mean (black dot), and median (black line in the shaded box) for debt-to-GDP forecast errors at the five-year horizon for different regions. Left figure uses the IMF sample while the right figure uses the full sample. Forecast errors are computed as the difference between realized and forecasted debt-to-GDP ratios, where realized ratios are taken from the second vintage of the year right after the forecast year. The difference in forecast errors across regions is not statistically different from zero. MENA=Middle-East and North Africa.

Larger errors when projection is for debt ratios to decrease

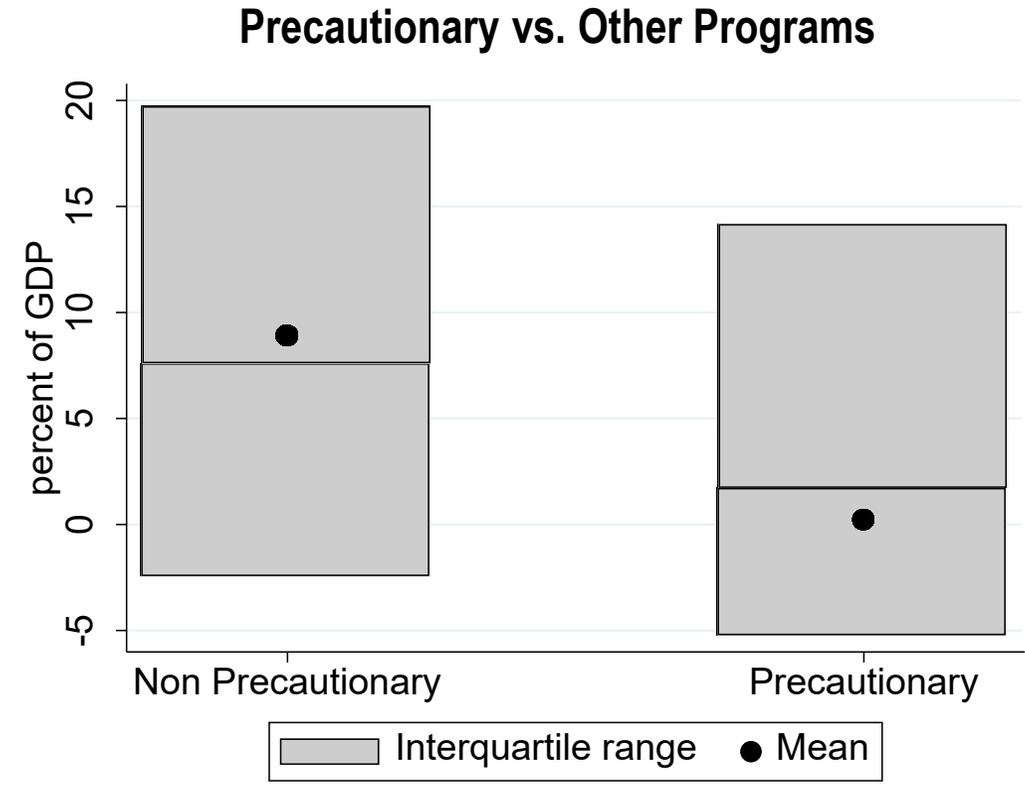
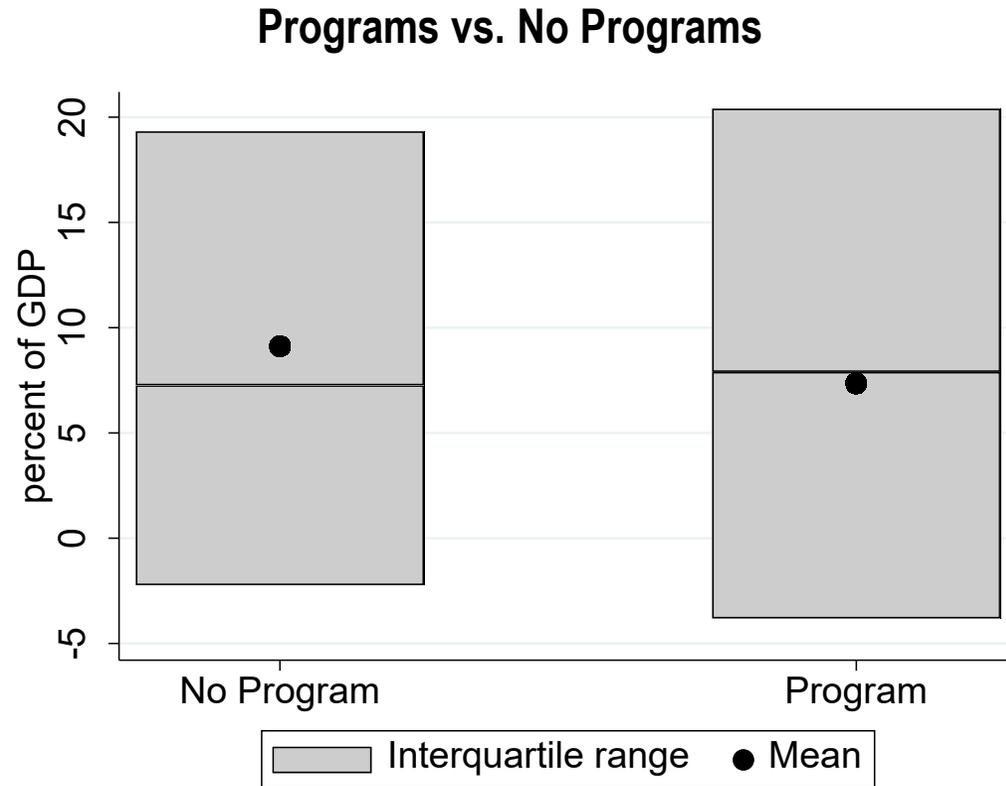
Forecasts Errors Conditional on Forecasted Debt Trajectory, Five-Year Horizon
(percent of GDP)



Notes: Charts show the interquartile range (shaded gray region), mean (black dot), and median (black line in the shaded box) for IMF (left chart) and EIU (right chart) debt-to-GDP forecast errors for the five-year time horizon. The charts show average forecast errors conditional on whether the forecast was for debt ratios to increase or decrease over the forecast horizon. Forecast errors are computed as the difference between realized and forecasted debt-to-GDP ratios, where realized ratios are taken from the second vintage of the year right after the forecast year.

Errors similar across IMF program & non-program cases

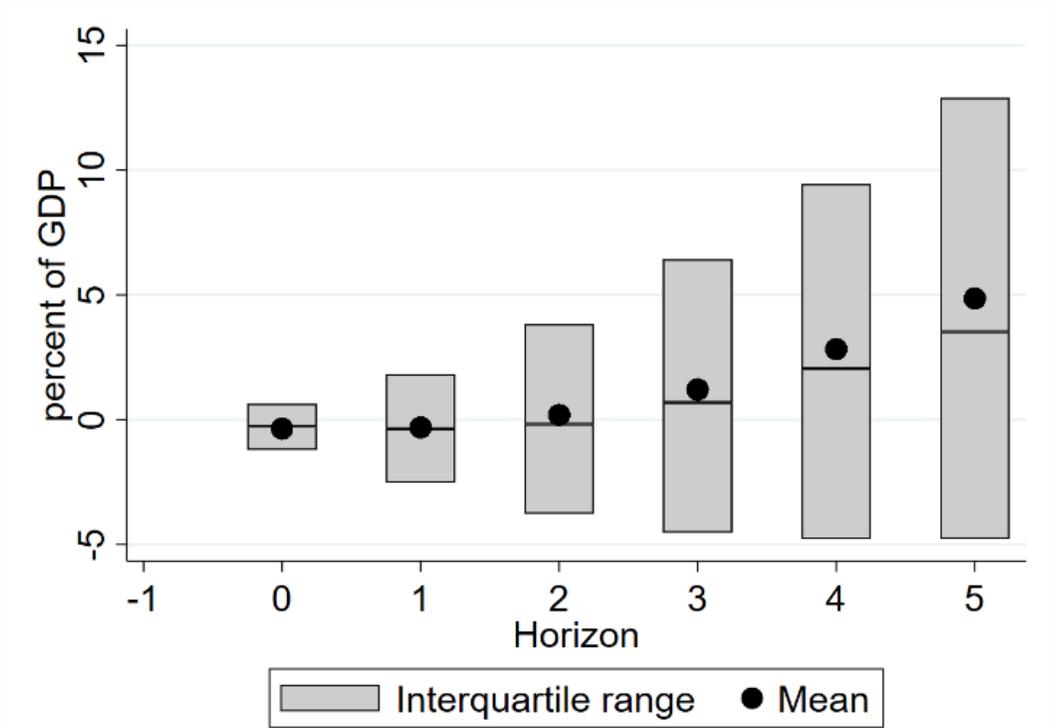
IMF Debt-to-GDP Ratio Forecast Errors in Programs, Five-Year Horizon (percent of GDP)



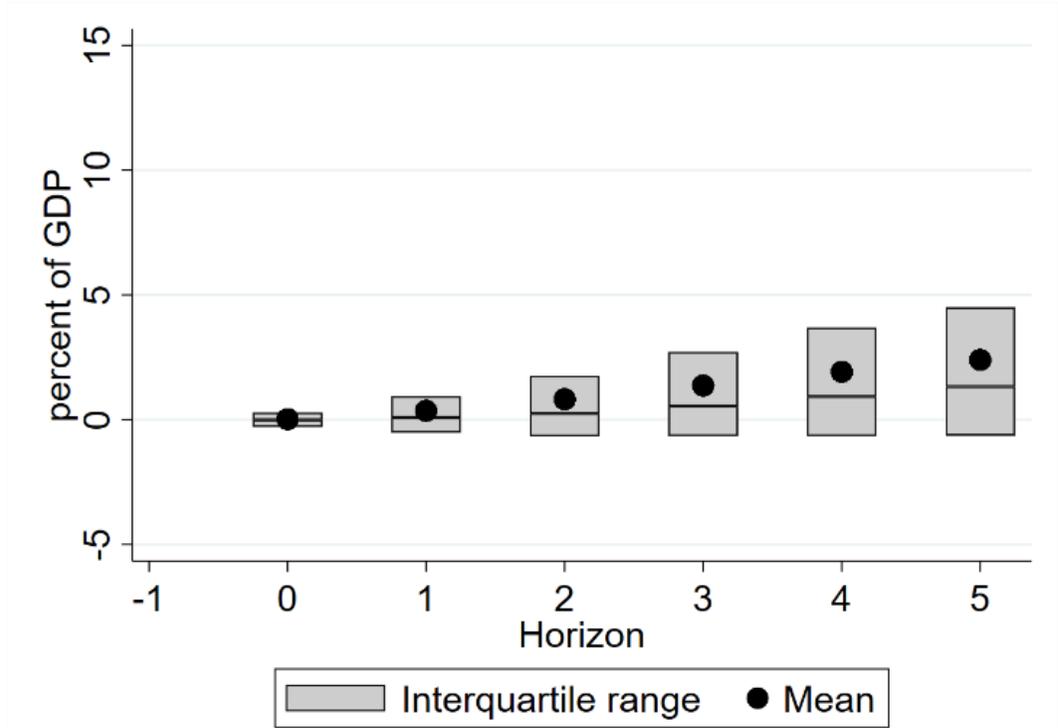
Notes: Charts show the interquartile range (shaded gray region), mean (black dot), and median (black line in the shaded box) for debt-to-GDP forecast using IMF data for the five-year horizon. Left chart distinguishes between forecast errors during programs and non-programs, where a country-vintages is classified as a program if the country had an IMF program ongoing in the year of the vintage. The right chart shows forecast errors in precautionary versus non-precautionary programs. Forecast errors are computed as the difference between realized and forecasted debt-to-GDP ratios, where realized ratios are taken from the second vintage of the year right after the forecast year.

Growth & fiscal projection misses behind debt forecast errors

Fiscal Misses Contribution, Accounting Approximation
(percent of GDP)



Growth Misses Contribution, Accounting Approximation
(percent of GDP)



Notes: Charts show the interquartile range (shaded gray region), mean (black dot), and median (black line in the shaded box) for the contribution of fiscal deficit (left chart) and growth (right chart) forecast errors in explaining the forecast error in debt projections. The contribution of fiscal deficit is simply calculated as the sum of realized fiscal deficits (as a percent of GDP) over the forecast horizon minus the sum of fiscal deficits that were forecasted. As we use fiscal deficits instead of primary deficits in this calculation (due to data constraints), real interest rate shocks, which interact with the level of debt itself, are included in the contribution of fiscal deficits. For the contribution of growth, we use the standard debt decomposition equation which identifies the contribution of growth to changes in debt ratios as $\frac{g_t}{1+g_t} * d_{t-1}$ where 'g' is the growth rate of real GDP and 'd' is the debt-to-GDP ratio. As with fiscal deficit, the contribution to forecast error is computed as the contribution of growth to the accumulation of debt in realized data minus the contribution in the forecast data.

Drivers of forecast error: growth and fiscal deficits

	(1)	(2)	(3)	(4)
	All Countries			
Growth FE, t=0		-0.161 (0.274)		-0.166 (0.331)
Growth FE, t=1		-0.766*** (0.134)		-0.531*** (0.134)
Growth FE, t=2		-0.695*** (0.0983)		-0.616*** (0.116)
Growth FE, t=3		-0.838*** (0.0926)		-0.557*** (0.120)
Growth FE, t=4		-1.001*** (0.146)		-0.666*** (0.170)
Growth FE, t=5		-1.240*** (0.201)		-1.067*** (0.206)
Fiscal deficit FE, t=0			0.100 (0.207)	0.223 (0.203)
Fiscal deficit FE, t=1			0.133* (0.0738)	0.0792 (0.0901)
Fiscal deficit FE, t=2			0.582*** (0.199)	0.427** (0.181)
Fiscal deficit FE, t=3			0.420 (0.259)	0.163 (0.258)
Fiscal deficit FE, t=4			1.015*** (0.278)	0.933*** (0.298)
Fiscal deficit FE, t=5			0.131 (0.214)	-0.0125 (0.203)
Constant	8.707*** (1.255)	4.065*** (1.124)	6.527*** (1.064)	3.771*** (0.996)
Observations	3,383	3,378	3,360	3,356
R-squared	0.000	0.218	0.226	0.335

- Reduced form regressions of five-year debt forecast errors on growth and fiscal deficit forecast errors
- Coefficients on forecast errors as expected—debt forecast errors are larger when realized growth (deficits) is lower (higher) than what was forecast
- Forecast errors in growth projections are a significant driver of debt forecast errors, though other factors play an equally important role—constant in column 2 is about half in magnitude compared to column 1
- Fiscal deficit projections play only limited role in the positive average forecast error in debt ratio once we control for growth forecast errors (column 4)

Note: Dependent variable in each regression is the five-year ahead forecast error of country c in vintage v . Independent variables are growth and fiscal deficit forecast errors at different horizons. Standard errors clustered two-way at country and vintage level. *, **, and *** indicate significance at the 10, 5 and 1 percent level respectively.

Larger average errors in oil exporters, volatile countries

$$\overline{FE}_c = \alpha + \beta X_c + \epsilon_c$$

\overline{FE}_c : average five-year forecast error for country c

X_c : vector of country characteristics

VARIABLES	(1)	(2)	(3)
Per-capita GDP PPP (ln)	-3.673*** (1.094)	-3.300*** (1.107)	-3.538*** (1.060)
Oil Exporter = 1	19.31*** (4.220)	14.25*** (4.447)	19.74*** (3.720)
Volatility of GDP Growth		1.146** (0.456)	
Average Debt Level			0.123*** (0.0452)
Constant	40.68*** (10.03)	32.14*** (10.84)	32.25*** (10.09)
Observations	173	173	172
R-squared	0.170	0.209	0.208

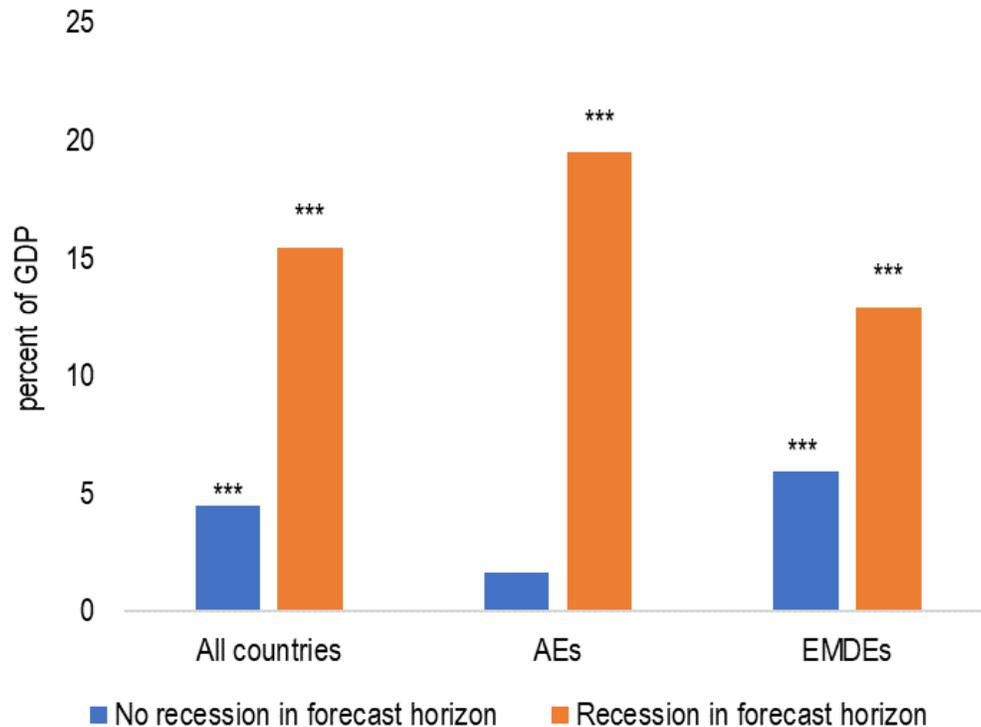
Note: Dependent variable in each regression is the average five-year ahead forecast error of each country across all vintages after 2008. Independent variables are also averaged across all years in the sample. Sample consists of 174 countries. Robust standard errors reported in parenthesis. *, **, and *** indicate significance at the 10, 5 and 1 percent level respectively.

- Simple cross-sectional regression of average country-level forecast errors on country characteristics—restrict to post-GFC vintages
- Richer countries have smaller forecast errors
- Oil exporters and countries with more volatile GDP have larger average forecast errors—indicates asymmetric response to shocks and/or larger negative shocks
- Countries with higher average debt ratios have large forecast errors—debt a magnifier
- Fiscal rules, other measures of volatility seem insignificant

Recessions drive forecast errors in AEs, systematic errors in EMDEs

Five-Year Forecast Errors Conditional on Recession Falling in Forecast Horizon, IMF Data

(percent of GDP)



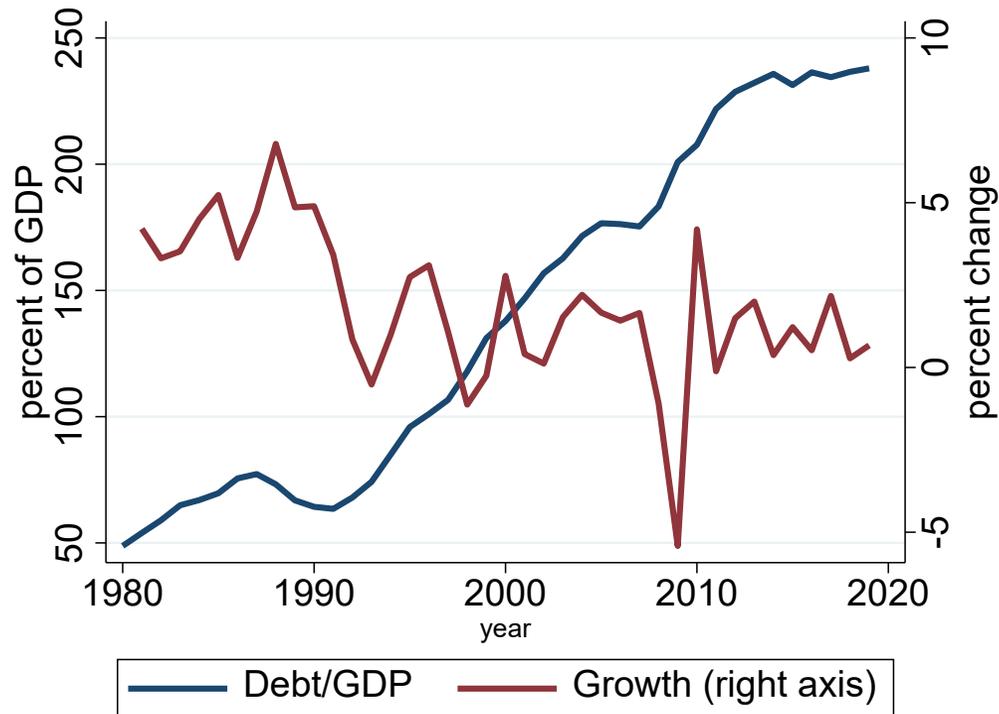
Note: Based on a pooled regression with observations at country-vintage level. Dependent variable in each regression is forecast error of country 'c' in vintage 'v'. Independent variable is a dummy which takes value 1 if the start of a recession occurs in country 'c' in the five-year forecast horizon. Any country-year with negative GDP growth is classified as a recession. Standard errors are clustered two-way at country and vintage level. *, **, and *** indicate significance at the 10, 5 and 1 percent level respectively.

- Long literature on forecasters inability to predict recessions
- Is positive average forecast error simply due to unanticipated recessions leading to a large, unexpected increase in debt ratios?
 - Yes, in AEs: Very large forecast errors when recessions fall in the forecast horizon, not otherwise
 - No, in EMDEs: Even forecasts with no recessions in the forecast horizon have positive forecast errors
- Results robust to various definitions of recessions and to using EIU data

Japan: Sharp rise in debt accompanied by large forecast errors

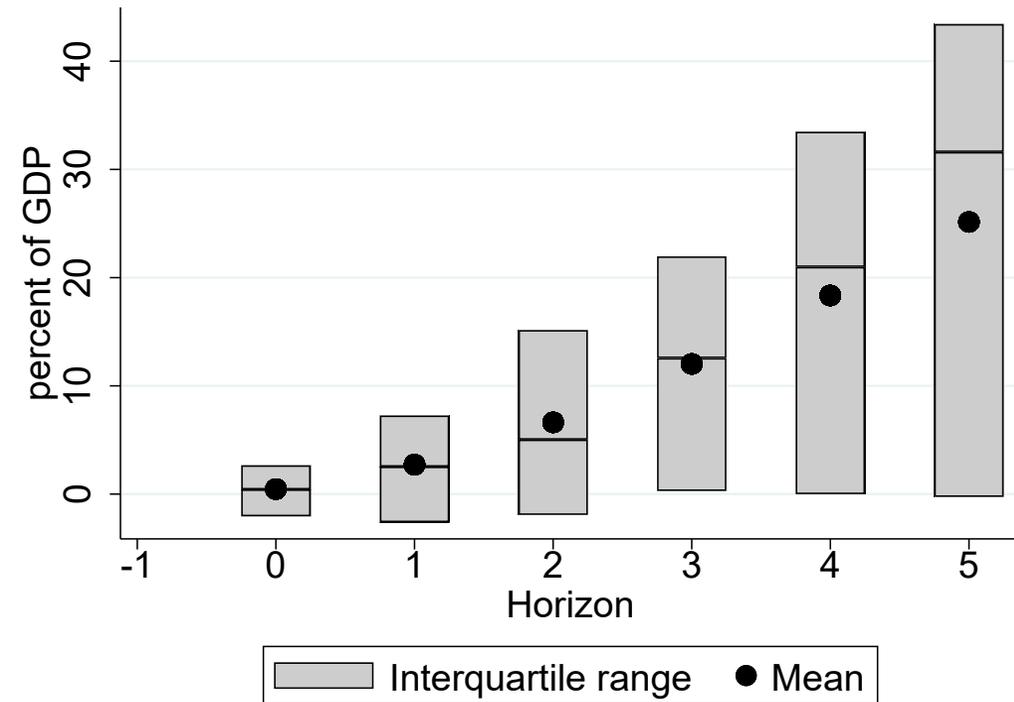
Debt-to-GDP Ratio and GDP Growth, Japan

(percent of GDP, percent change)



Debt-to-GDP Ratio Forecast Errors, Japan

(percent of GDP)

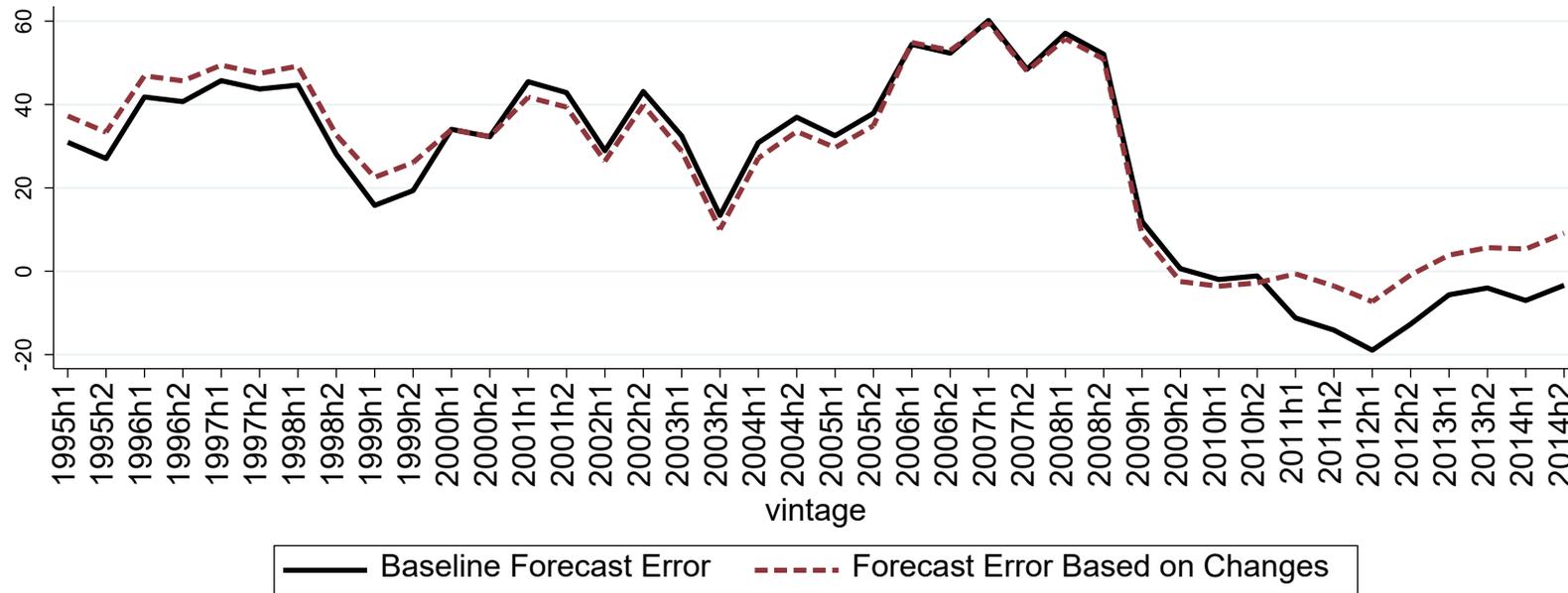


Notes: The blue line shows the evolution of Japan's debt-to-GDP ratio between 1980 and 2019. The red line shows the growth rate of real GDP in Japan from 1980 to 2019.

Notes: Chart shows the interquartile range (shaded gray region), mean (black dot), and median (black line in the shaded box) across different vintages for debt-to-GDP forecast errors for Japan for different time horizons. IMF data is used.

Japan: Large forecast errors for over a decade up to the GFC

Japan: Forecast Error
(percent of GDP)



Notes: Chart shows two measures of forecast errors for Japan. The black line shows our baseline measure of forecast error, which is based on the difference between realized and forecasted debt ratios. The dashed red line shows a measure of forecast error that compares the realized change in debt ratio to the forecasted change. This second measure attenuates bias due to revisions in nominal GDP across vintages.

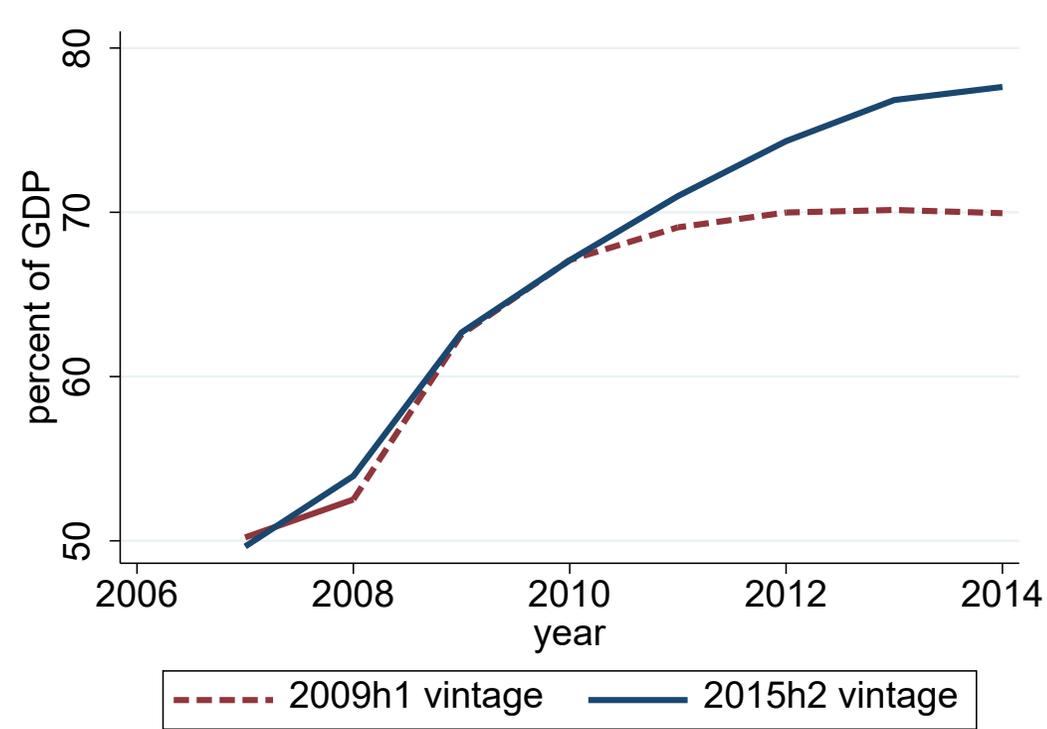
- Throughout the 1990s and leading up to the GFC, forecasts were projecting a plateauing and/or a decrease in debt ratios that did not materialize—forecast errors ranged between 20 to 60 percent of GDP
- Post-GFC forecast errors have been close to 0—also a time when debt ratios stabilized

Large forecast errors in the aftermath of the GFC

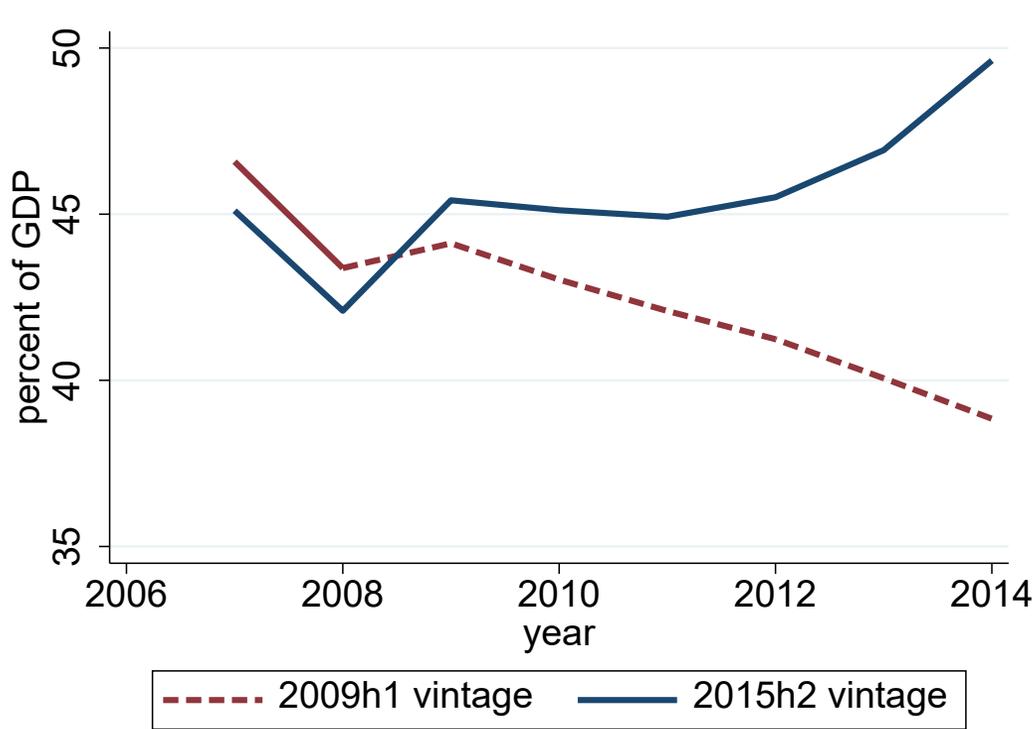
Debt Projections and Outcomes After GFC, By Income Level

(percent of GDP)

AEs



EMDEs



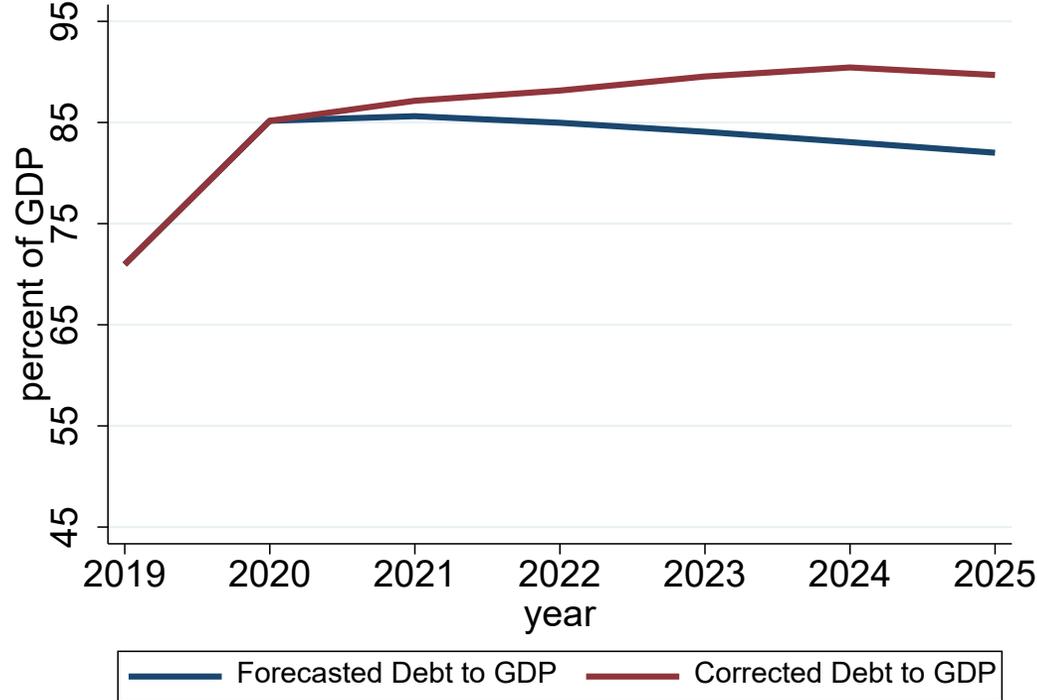
Notes: Charts compare the simple average across countries of the forecasted debt-to-GDP ratio in the 2009H1 vintage (first vintage after the GFC shock) to the outturn as reported in the 2015H2 vintage. Left panel is for advanced economies only, while the right panel is for EMDEs only. Dashed line is for the forecast period. IMF data is used.

Possible implications for post-COVID debt paths?

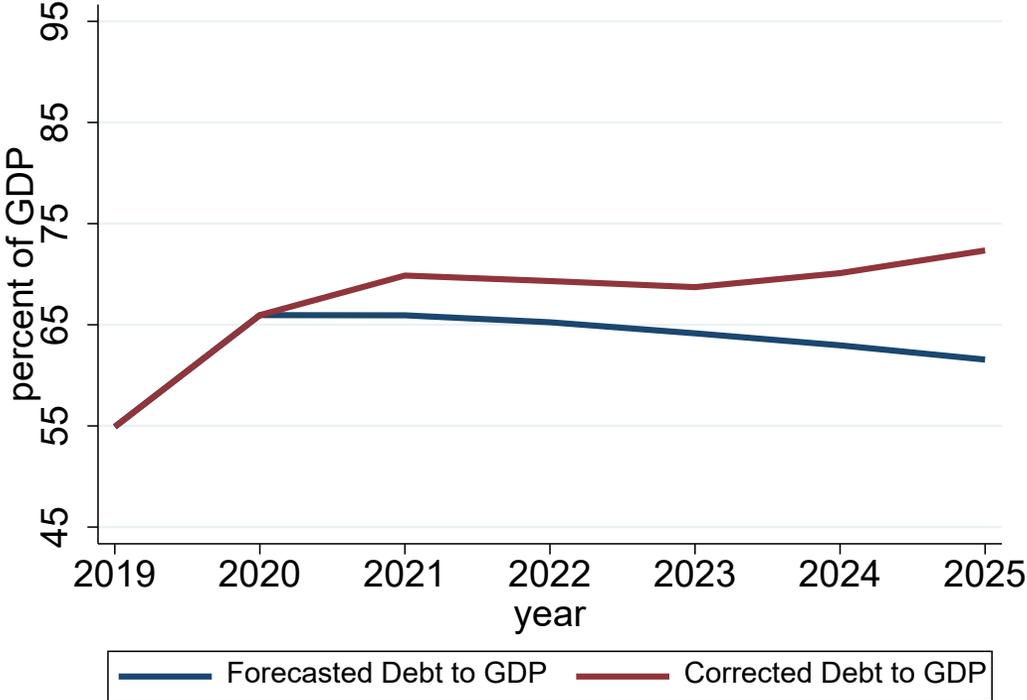
Correcting IMF Projections for GFC Level Forecast Errors, By Income Level

(percent of GDP)

AEs



EMDEs



Notes: Charts compare the forecast for debt-to-GDP as reported in the 2020H2 vintage (i.e. the first vintage after the COVID-19 shock) to a counterfactual path if forecast errors for countries were as large as they were during the 2009H1 vintage (i.e. the first vintage after the GFC shock). Left panel is for the sample of AEs only, while the right panel is for EMDEs only. IMF data is used.

Conclusions and policy implications

- Increased focus on debt vulnerabilities, especially for EMDEs, in the aftermath of the COVID-19 crisis—our results indicate that we may be underestimating debt & so vulnerabilities
- Accuracy of debt forecasts critical input to planning & policy—greater realism essential
- Mitigating and tackling these vulnerabilities will be key
 - Greater concessional and grant financing needed for the foreseeable future for many low-income economies that have been hit hard by the crisis and have little policy space
 - For countries facing sustainability issues, global cooperation via G-20 Common Framework essential to ensure orderly restructuring of debt so that countries can quickly return to growth
 - Growth performance is a key driver of debt projections—puts a premium on policies that deliver strong, resilient growth and mitigate the economic scarring effects of the pandemic
 - Continued efforts to improve the realism of debt projections needed (IMF, 2021)

Thank you