The Macroeconomic Effects of Debt on Real GDP Growth: Revisiting the Impact

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Motivation

- The impact of debt on real GDP growth is central to IMF's assessments of countries' capacity to repay their debt and its associated sustainability.
- Covid-19 periods gave us more incentives to understand countries' capacity to repay.
- Are higher debt levels associated with lower subsequent growth?
- How does the impact on real GDP growth change based on debt levels, trajectory, income level, debt relief initiative (HIPC), or various other specifications?
- We revisit the relationship between public debt and real GDP growth.

Our Findings

- Baseline for all countries
  - 1% unanticipated increase in public debt to GDP ratio leads to significant -0.01% reduction in real GDP level at 3 year horizon
- Subsample results

  An unanticipated increase in debt:
  - Hurts growth when initial **debt level** is high
  - Hurts growth for countries with a positive debt **trajectory** over preceding five years
  - Boosts growth for lower **income level** countries.
  - Boosts growth for countries after the **HIPC Initiative**

Literature

- High level of debt and upward trajectory bring additional uncertainty to the growth of the economy (BIS, 2010).
- Pescatori et al found that the trajectory of previous periods' debt to GDP ratio is an indicator of subsequent economic growth (IMF, 2014).
- Existing literature on how debt impacts (as opposed to the correlation) growth is still relatively limited.
- Our contribution is a new way to construct exogenous debt shocks to identify the causal impact of debt on real GDP growth, and how the impact varies across different subsamples.

Literature

- "Faster the income grows, the less debt burden the country holds" (Domar 1944).
- Public debt has a generally negative effect on long run growth based on endogenous growth models (Barro, 1990; Saint-Paul, 1992)
- Existing debt prevents the country from smoothly issuing additional debt because of fear of default (Myers 1977; Woo and Kumar 2015)
- Existing literature on how debt impacts (as opposed to the correlation) growth is still relatively limited

Literature

- High level of debt and upward trajectory bring additional uncertainty to the growth of the economy (BIS, 2010).
- Pescatori et al found that the trajectory of previous periods' debt to GDP ratio is an indicator of subsequent economic growth (IMF, 2014).
- Debt accumulation is negatively related to output growth (Lim, 2019)
- Our contribution is a new way to construct exogenous debt to GDP shocks to identify the causal impact of debt to GDP shock on growth, and how the impact varies across different subsamples.

Methodology

- Data: WEO dataset of Public Debt covering 178 countries, spanning the time period from 1995 to 2020; Public External Debt covering 142 countries from 1990 to 2020.

- Exogeneity: Identified exogenous shocks to the debt level by using the gap between the October WEO projected debt level for the current year and its materialized outcome.

- Econometrics model: Local projection to trace out the short- and medium-run responses of GDP growth to debt shocks. Various sub sample analysis including debt level, trajectory, income level, and HIPC Initiative.

Exogenous Shock Setup

Why do we need exogenous shocks?

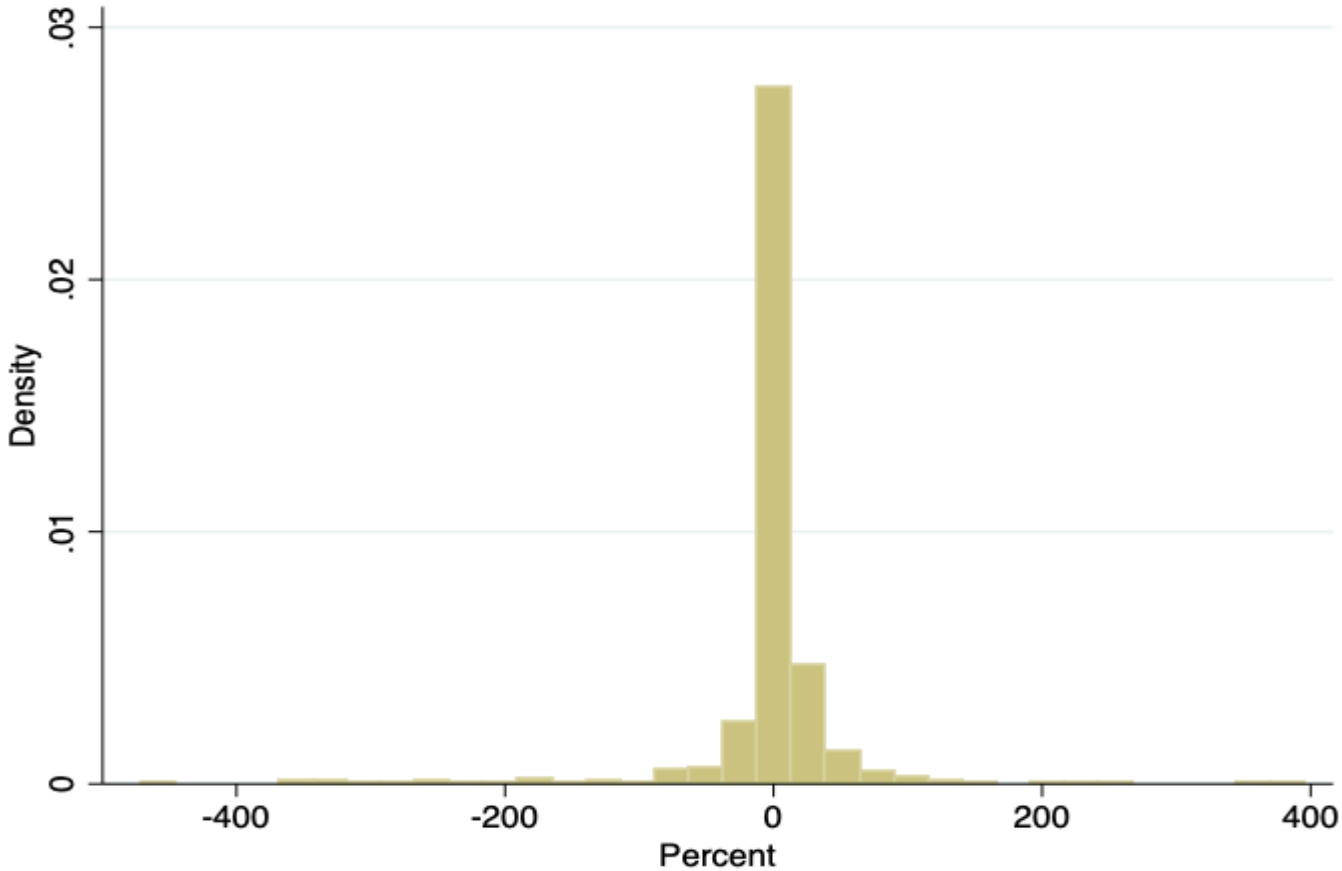
- Identifying the exogenous shocks of macro variables is one of the most common difficulties in macro research
- To measure the **causal impact** of debt to GDP growth

How do we construct exogenous shocks?

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

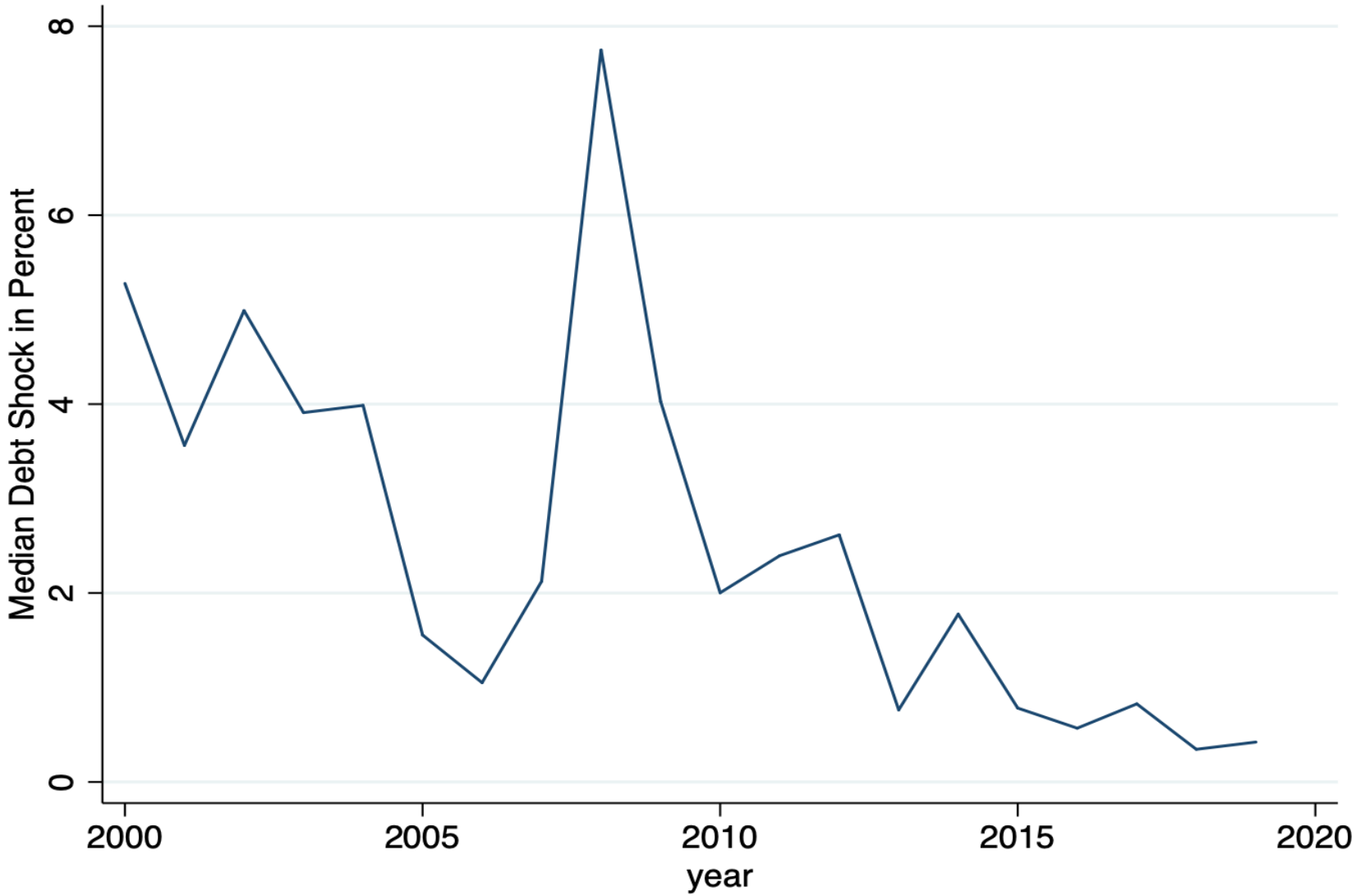
- Forecast errors of WEO October
- Reverse causality of growth to debt shocks is still possible but highly unlikely $\rightarrow$ Valid exogenous shock, Auerbach et al (2012b, 2013)

Public Debt Shock, Distribution



median: 1.22824, 91.17% of shock data $\in \{-50\%, 50\%\}$ range, 63.56% of data $\in \{-10\%, 10\%\}$ range

Exogenous Debt Shock Over Time, Median



What is Local Projection?

$$y_{i,t+k} - y_{i,t-1} = c_i + d_t + \beta^k debt^{Shock}_{i,t}{}_{i,t} + \theta^k Z_{i,t} + \epsilon_{i,t}$$

- For time series analysis, two main estimation methods can be used:
  - Multiple equation: Structural VARs (SVARs)
  - Single equation: direct multistep regressions. Term "local projections" dates to Jorda (2005)

- Technical advantage of the local projection approach: Result robust to misspecification

- Interpretation advantage: Provide simple and analytic inference for impulse response coefficients.

Our Baseline Equation

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

- k-period ahead change of output level, where $k \in \{0, 5\}$
- Shock variable: $debt_{i,t}^{Shock}$
- Country and time fixed effect: c_i^k, d_t^k
- Clustered standard error at country level
- Control variables $Z_{i,t}$:2 lags of dependent and 2 lags of shocks

Our Main Results

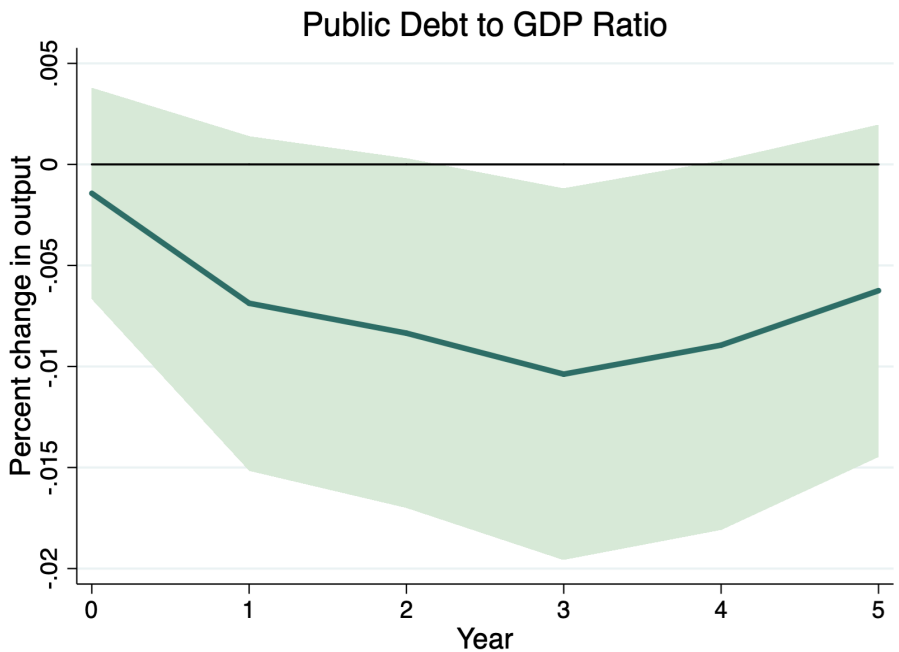
We study the impact of **Public debt** on **Real GDP growth** in the following cases:

- (i) Baseline for all countries, with an additional focus on public external debt
- (ii) Following subsamples:
  - **Initial Debt Level**
  - **Debt Trajectory Over Preceding Five Years**
  - **Income Level**
  - **Pre vs Post HIPC Initiative focusing on public external debt**

Baseline Public Debt Response

- 1% unanticipated increase in public debt to GDP ratio leads to significant -0.01% reduction in real GDP level in 3 years
- Example using a typical shock during the GFC: An unanticipated 3.69 percentage points increase in public debt to GDP ratio reduces the output by -.08 percent 3 years after the shock for the median country.

Median Debt to GDP Ratio: 46.12%



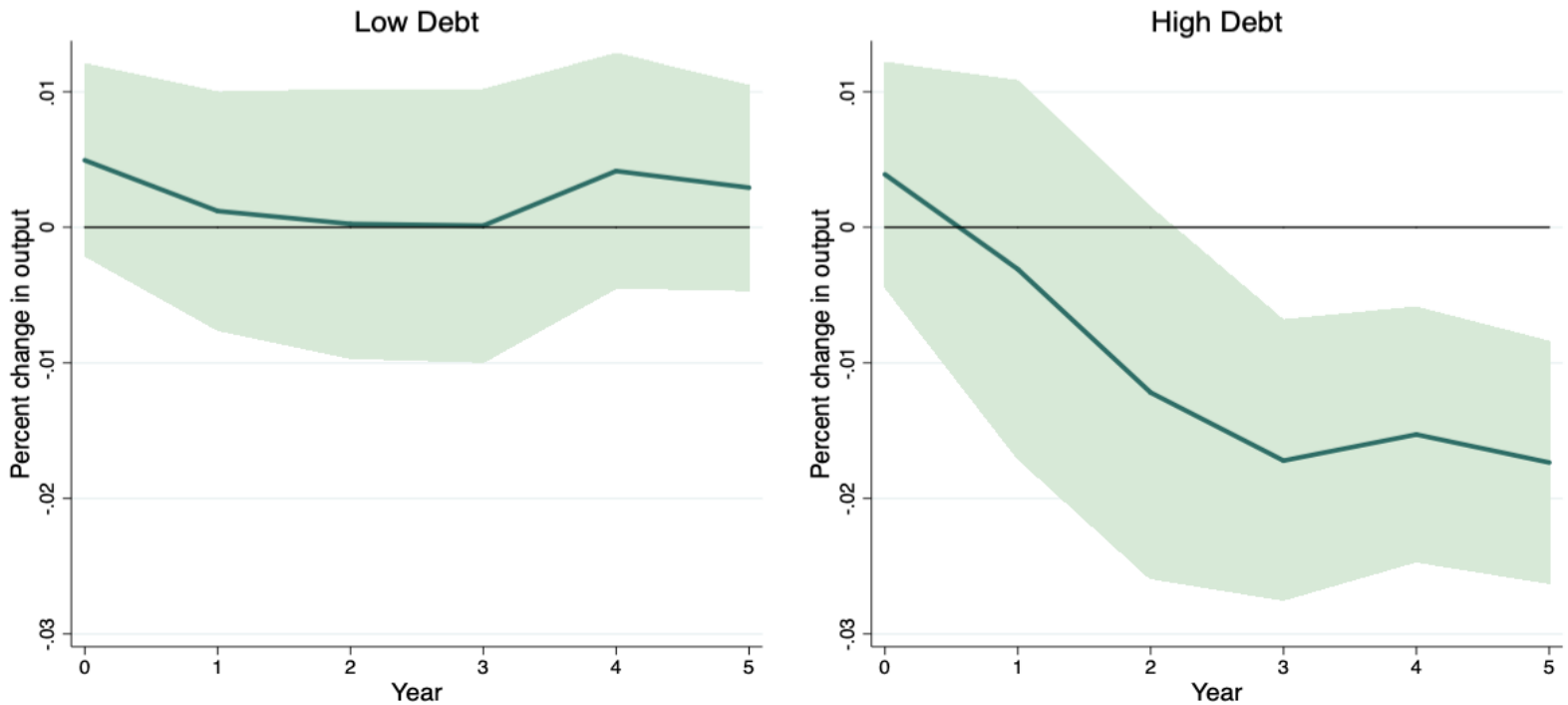
Shock at year = 0

detail 1

Subsample by Initial Debt Level

- We divide into two subsamples (low vs. high debt) using the median as threshold
- **Debt overhang**: For countries with a high initial debt to GDP ratio, an unanticipated increase in debt hurts growth more

Median Debt to GDP Ratio: 30.92% in Low Debt; 73.98% in High Debt; 46.12% in full

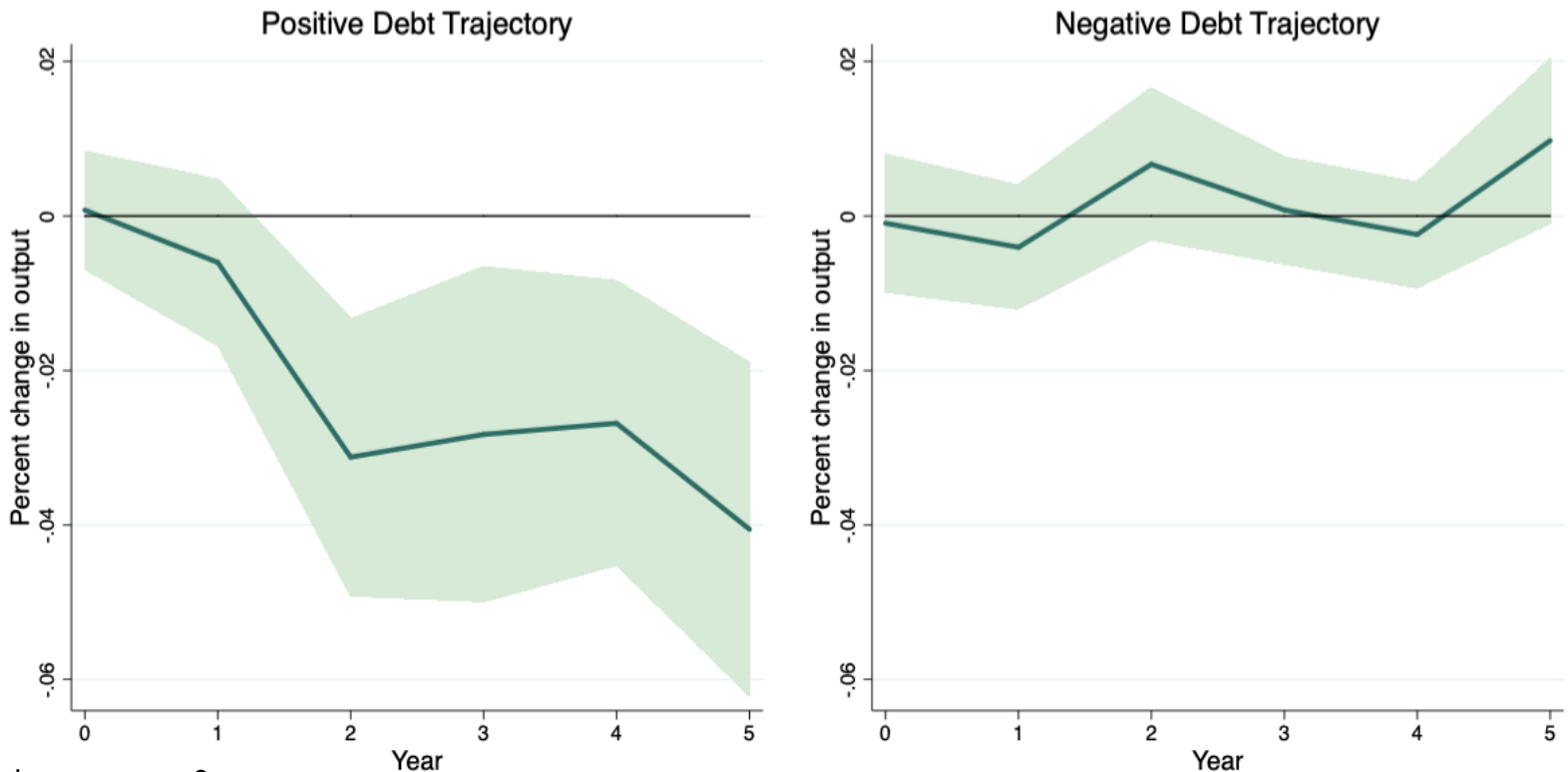


Shock at year = 0

Subsample by Trajectory

- Positive (negative) Trajectory: positive (negative) debt to GDP ratio growth over preceding five years
- For countries with a positive debt trajectory, an unanticipated increase in debt hurts growth

Median Debt to GDP Ratio: 48.7% in Positive Trajectory; 41.49% in Negative Trajectory

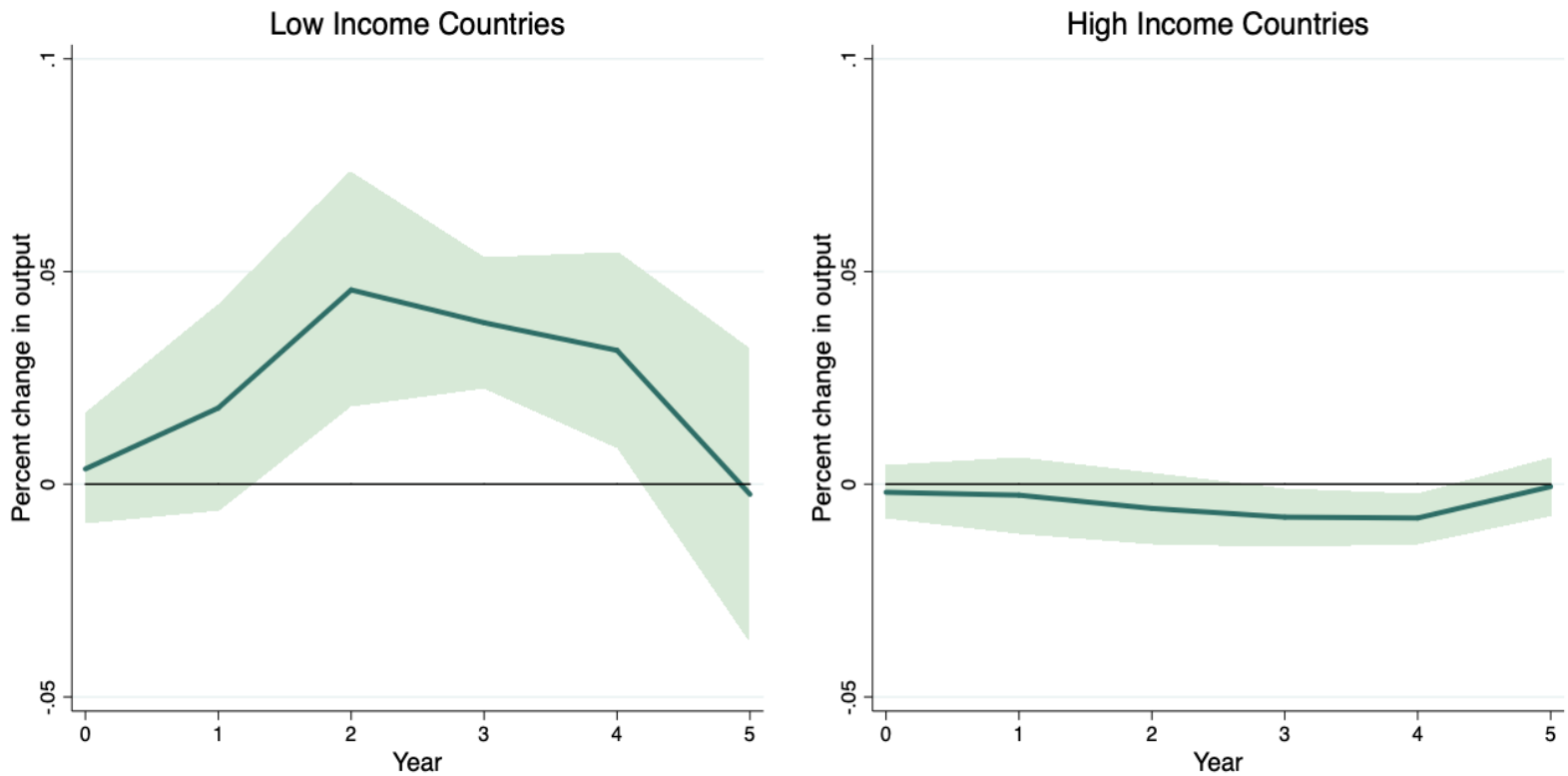


Shock at year = 0

Subsample by Income Level

- In low income countries, GDP responds positively to unanticipated increase in government debt, and vice versa

Median Debt to GDP Ratio: 50.03% in Low Income Countries; 53.65% in High Income Countries

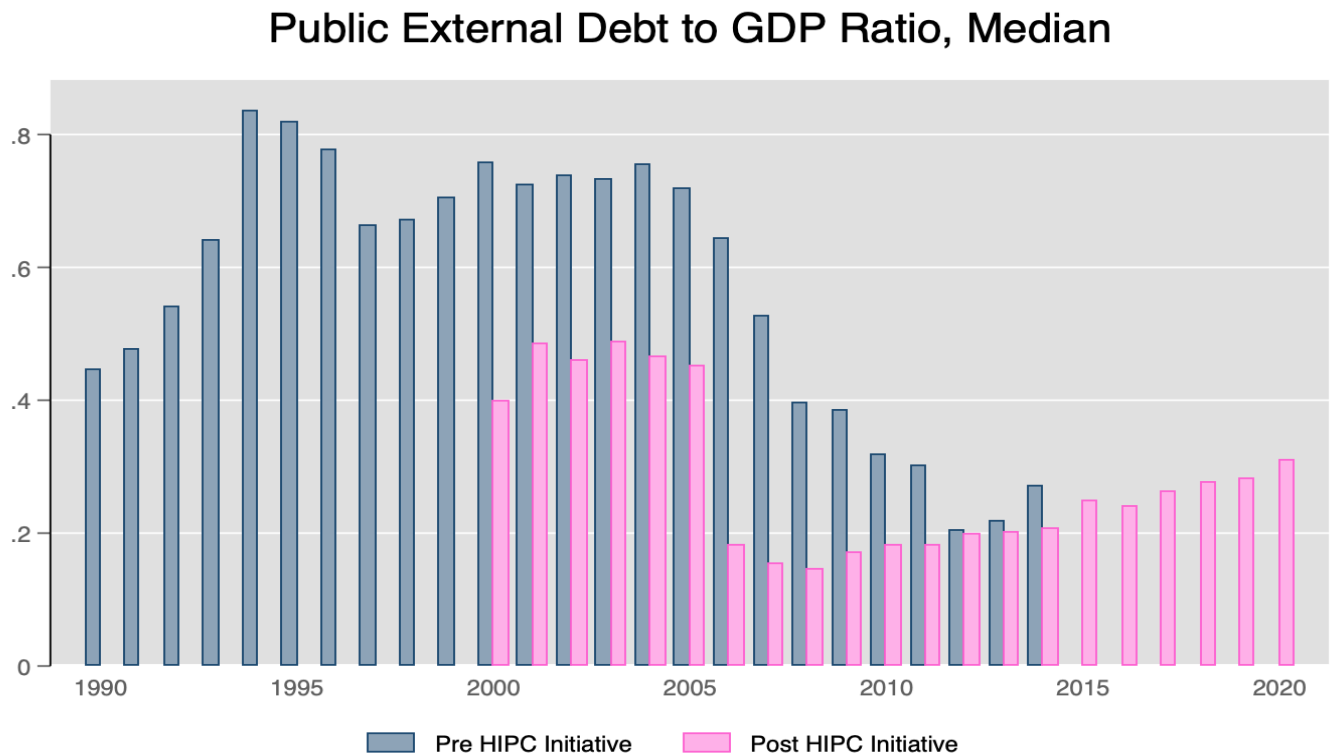


Shock at year = 0

detail 2

HIPC Initiative Effect Over Time

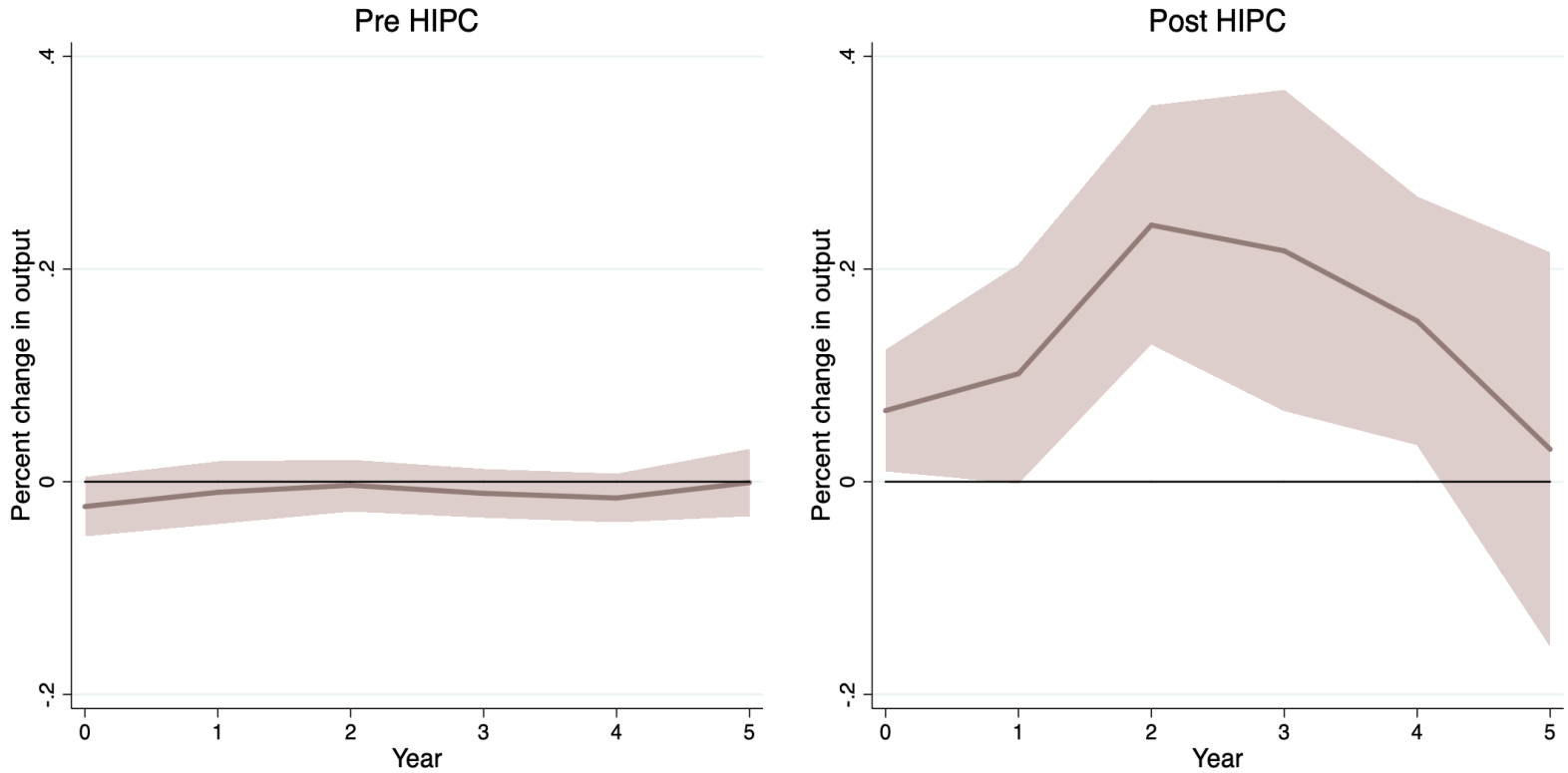
- HIPC Initiative: debt relief introduced by IMF and World Bank
- Initiated in 1996 and has been providing $76 billion in debt-service relief till now
- We categorized public external debt data based on pre vs post "Completion Point" of HIPC



Subsample by pre- and post-HIPC

- GDP responds positively to an unanticipated increase in public external debt for Post HIPC Initiative countries

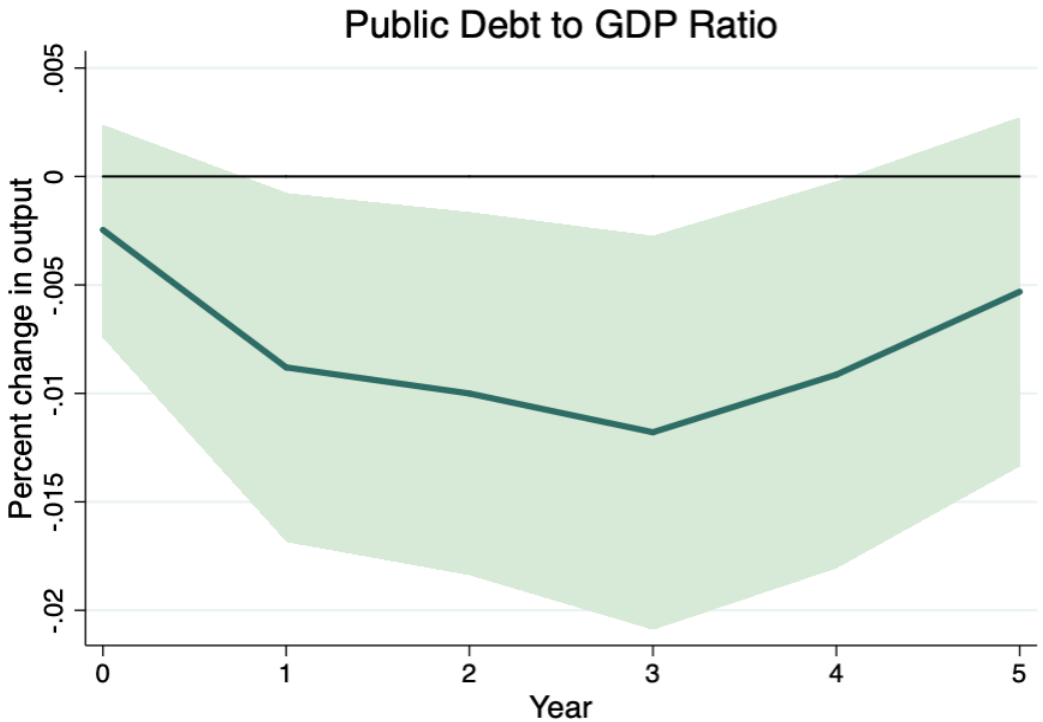
Median Debt to GDP Ratio: 65.28% for Pre HIPC, 23.97% for Post HIPC



Shock at year = 0

Baseline Controlling for Level of Debt to GDP Ratio

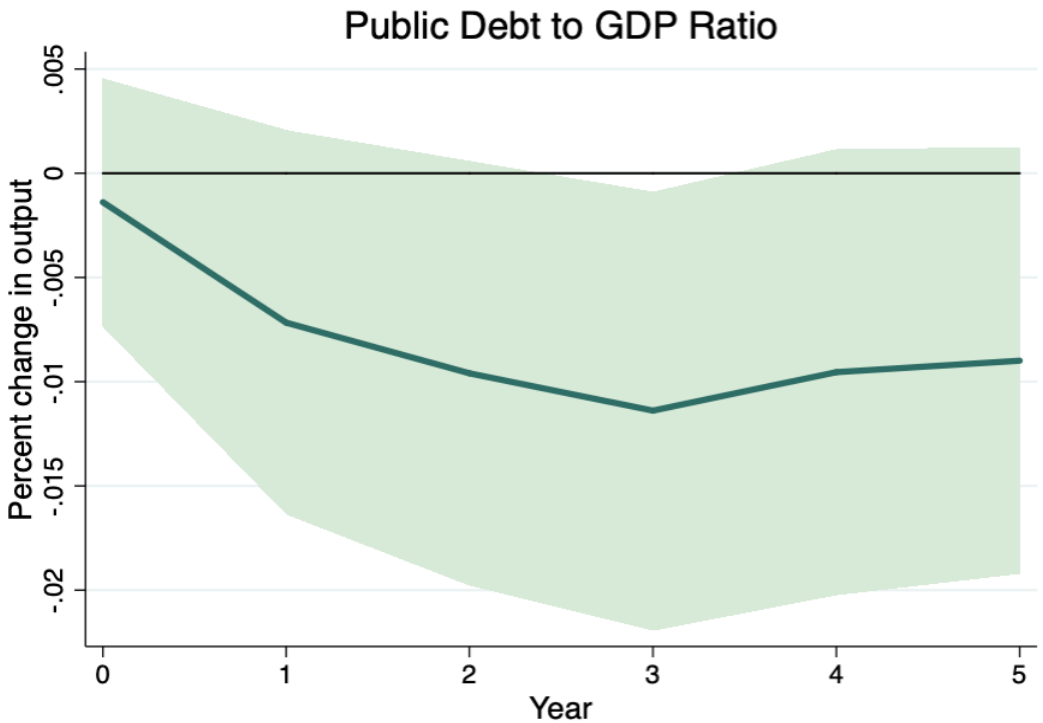
When debt size is controlled for, results remain largely identical



Shock at year = 0

Robustness check without lagged dependent variables as controls

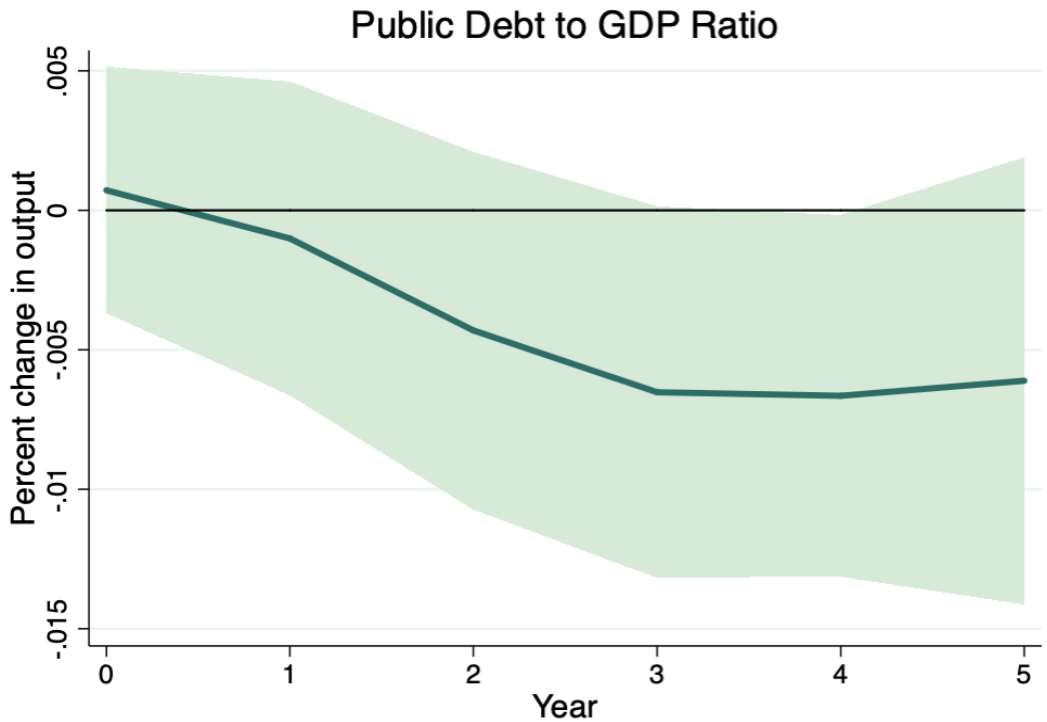
When performance under relatively little time dimension are assessed (Nickell-bias), results remain identical



Shock at year = 0

Robustness check with actual data from t+2 WEO vintage

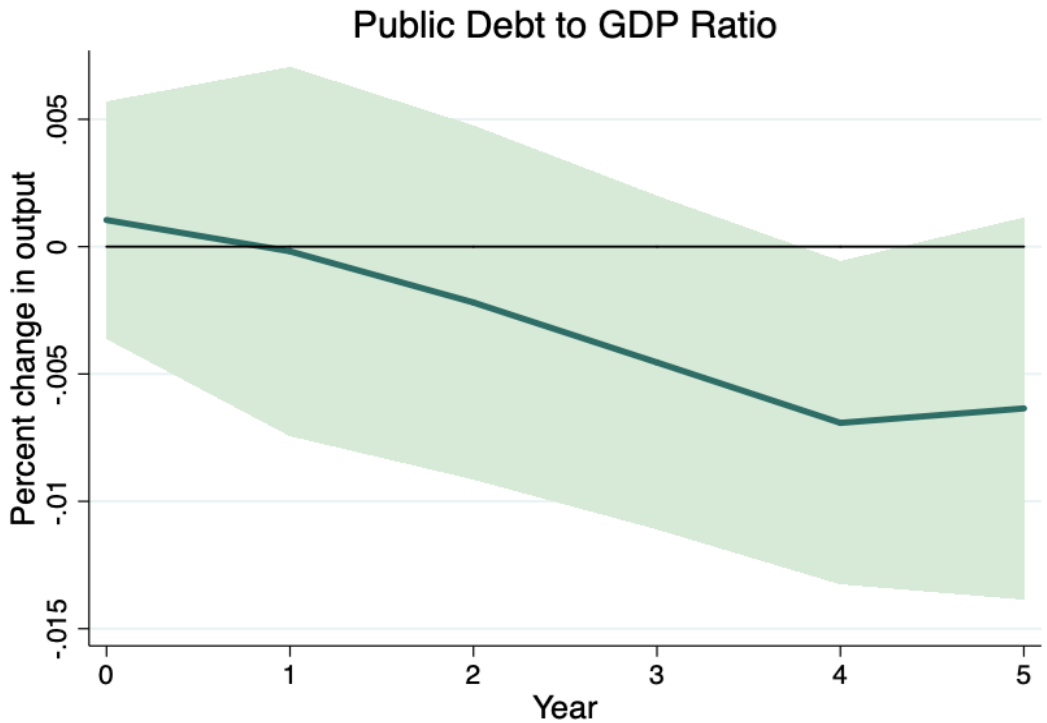
Using t+2 WEO Vintage for actual data, results remain identical



Shock at year = 0

Robustness check with actual data from t+3 WEO vintage

Using t+3 WEO Vintage for actual data, results remain identical



Shock at year = 0

Conclusion

- Impact of an unanticipated increase in debt on real GDP growth is negative at a 3-year horizon in the baseline

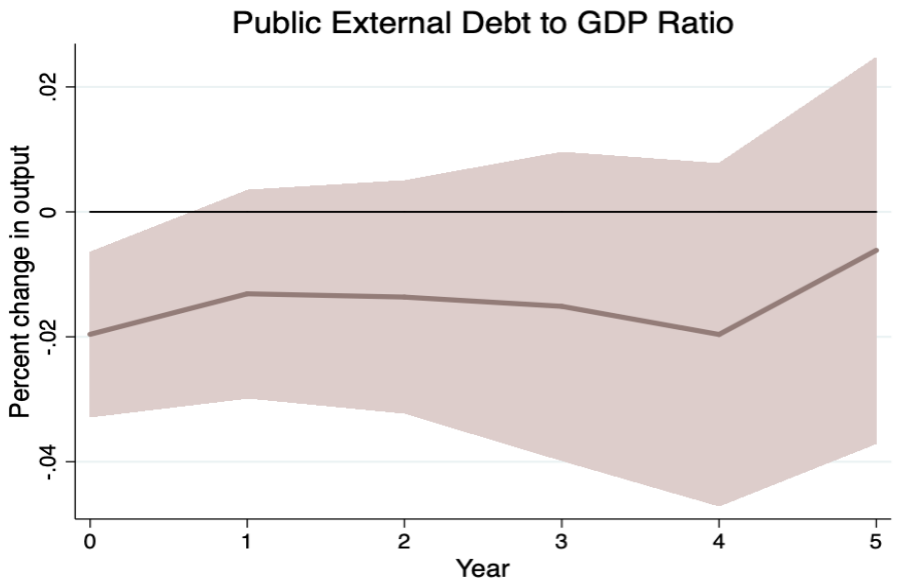
- Our results on impact of debt on real GDP growth for each subsample are as follow:

  An unanticipated increase in debt:
  - Hurts growth when initial **debt level** is high
  - Hurts growth for countries with a positive debt **trajectory** over preceding five years
  - Boosts growth for lower **income level** countries.
  - Boosts growth for countries after the **HIPC Initiative**

Baseline Public External Debt Response

- 1% unanticipated increase in public external debt to GDP ratio leads to significant contemporaneous -0.02% decrease in real GDP level
- Example using a typical shock during the GFC: An unanticipated 2.22 percentage points raise in public external debt to GDP ratio reduces the level of output by about -.16 percent for the median country.

Median Debt to GDP Ratio: 27.5%

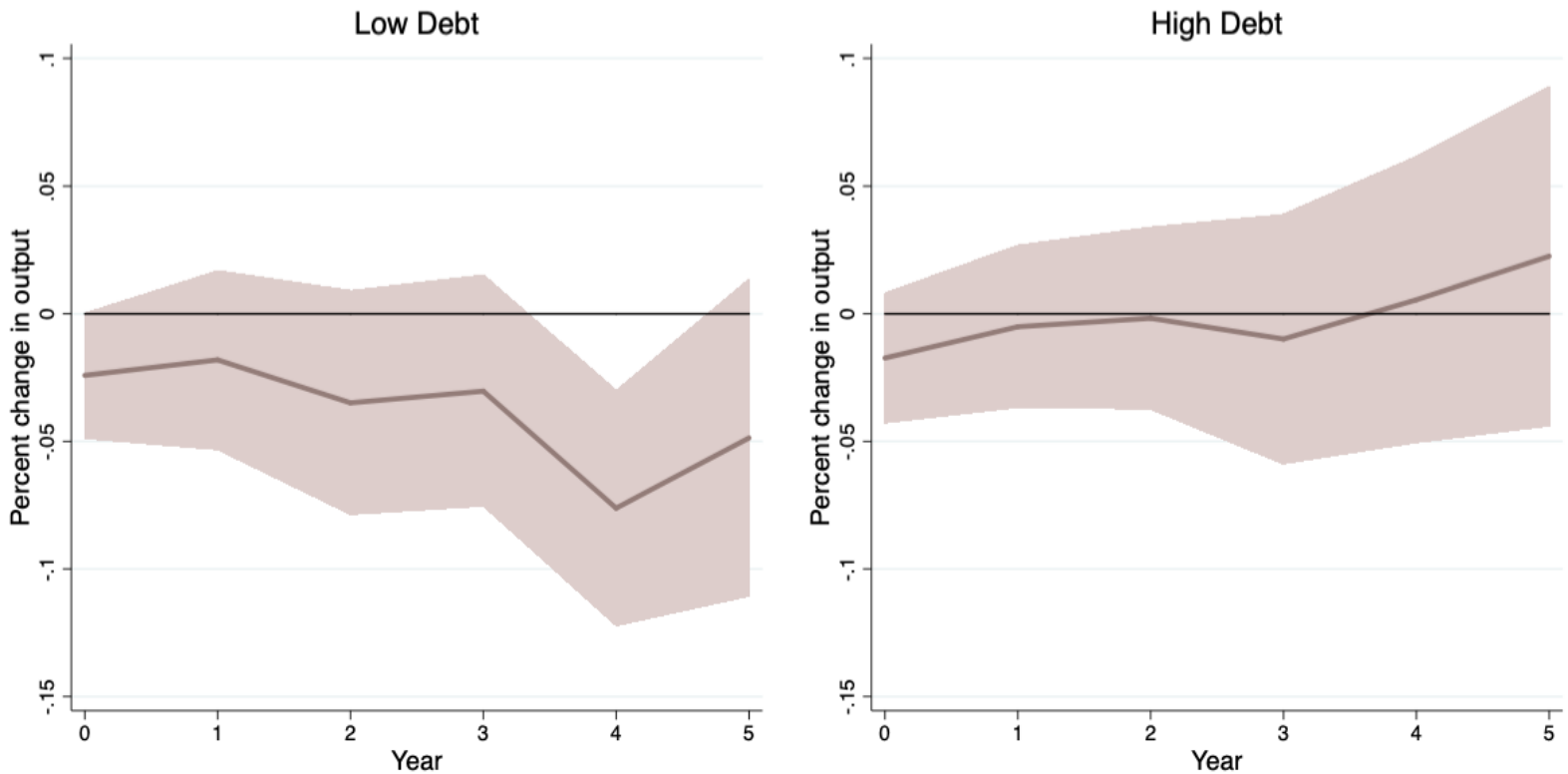


Shock at year = 0

Debt Level: Public External Debt Response

- Trend goes opposite: **debt intolerance**

  Median Debt to GDP Ratio: 16.38% in Low Debt; 49.56% in High Debt

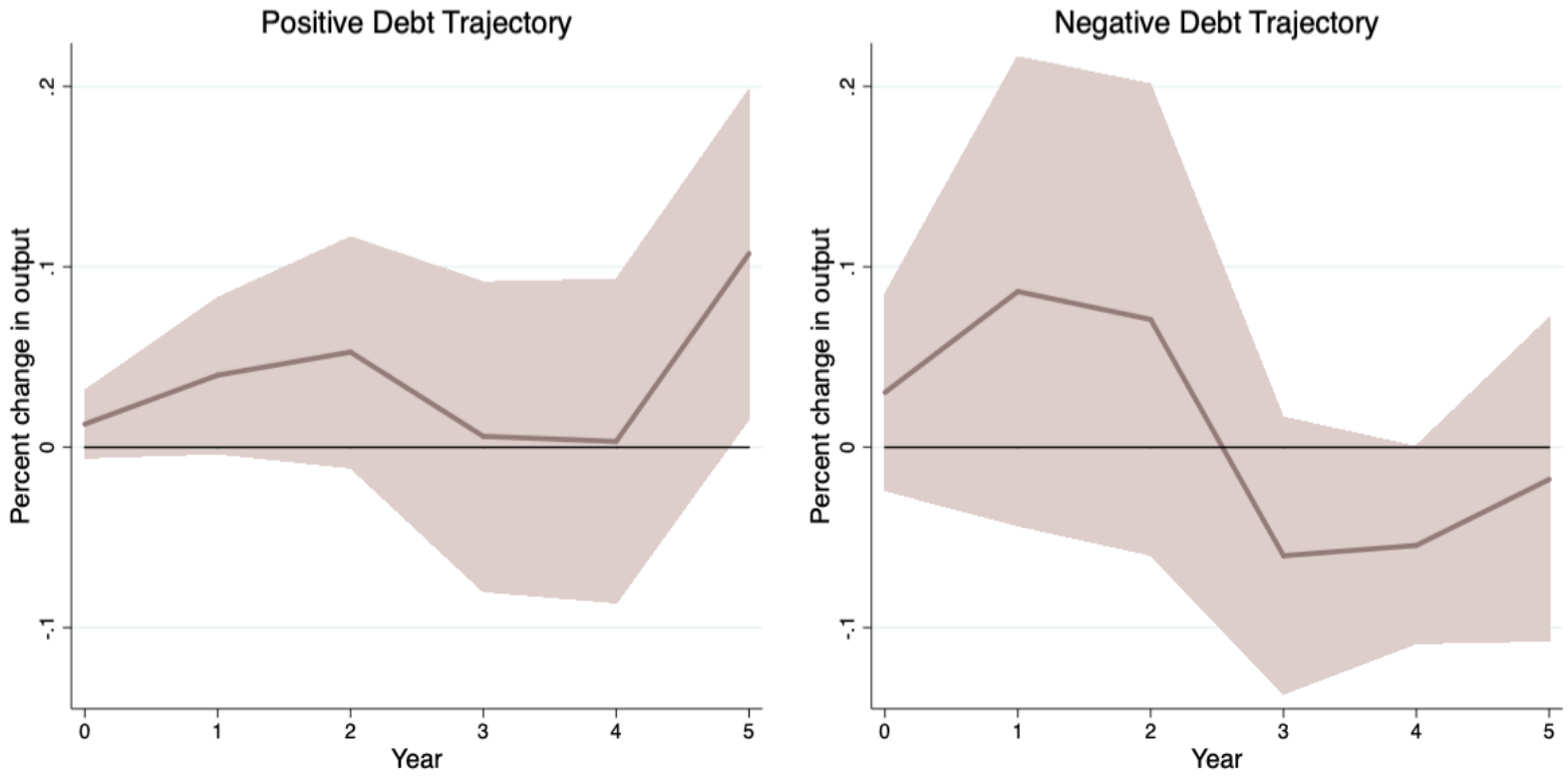


Shock at year = 0

Trajectory: Public External Debt Response

- We don't observe a remarkable response

  Median Debt to GDP Ratio: 23.9% in Positive Trajectory; 23.9% in Negative Trajectory

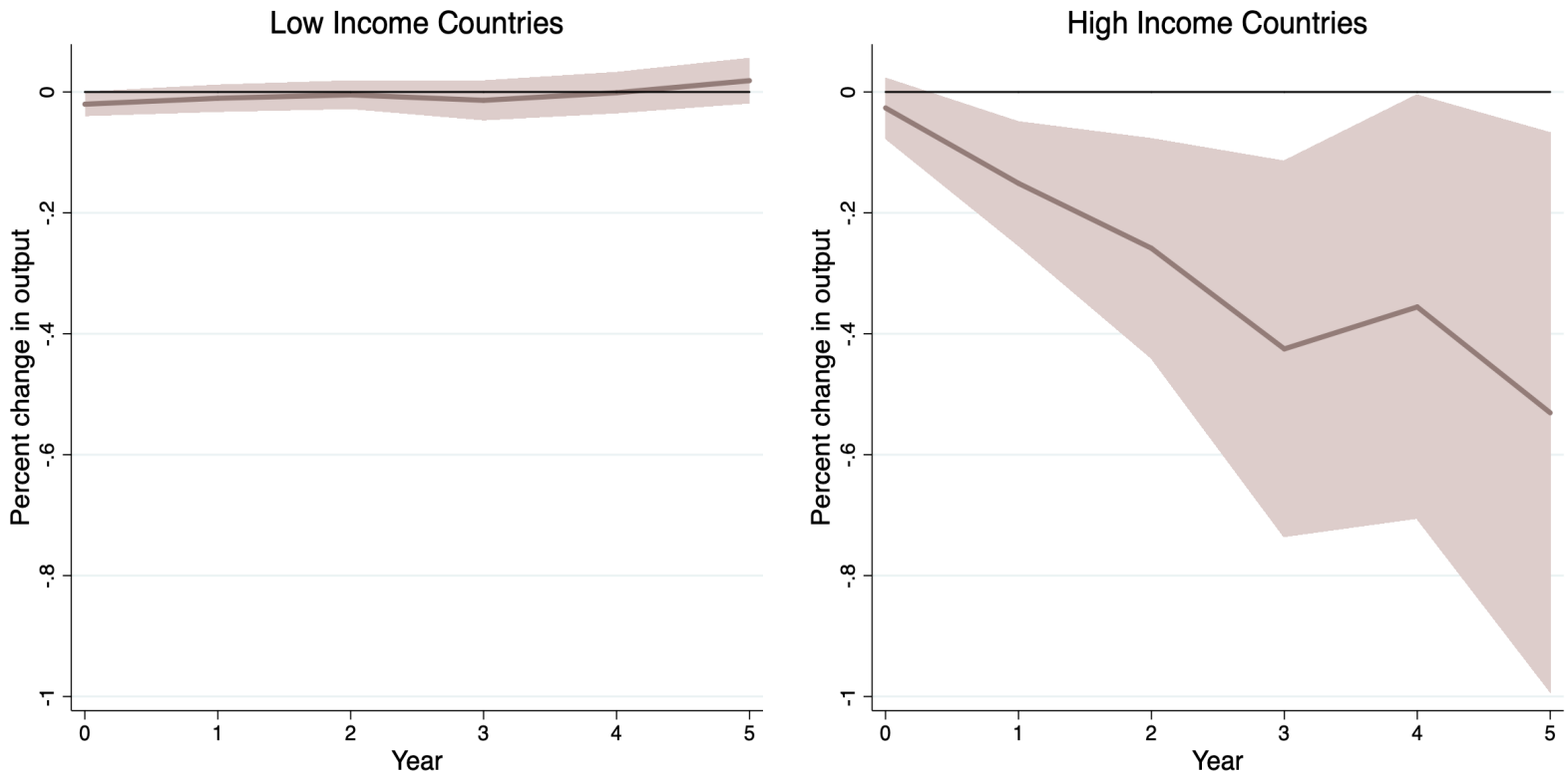


Shock at year = 0

Income Level: Public External Debt Response

- Trend largely similar to public debt in high income countries

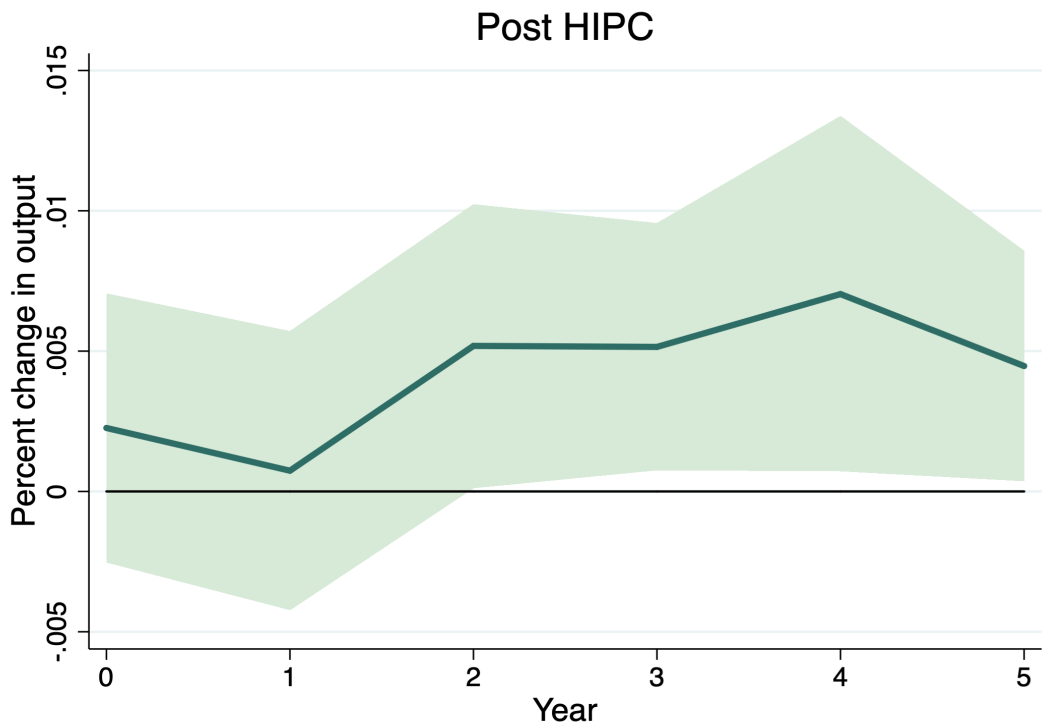
Median Debt to GDP Ratio: 26.07% in Low Income Countries; 40.04% in High Income Countries



detail 3 Shock at year = 0

HIPC: Public Debt

- GDP responds positively to an unanticipated increase in public debt for Post HIPC Initiative countries



Shock at year = 0

Detail 1

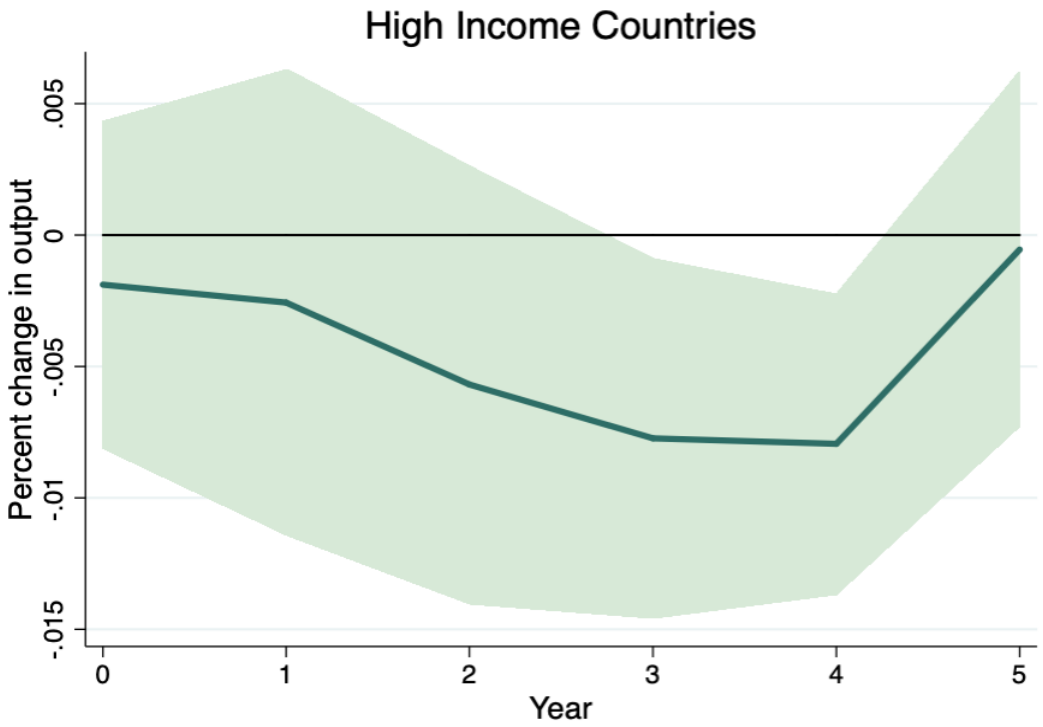
- The median debt to GDP shock during GFC is 8%
- The median debt to GDP ratio is 46.12 %

$$\begin{aligned} &46.12\% \text{ debt to GDP ratio} \times 8\% \text{ increase} \\ &= 3.69 \text{ Percentage point} \end{aligned}$$

$$\text{Output growth level} = \beta * \% \text{ increase} = -0.01 * 8 = -0.08$$

Back

Detail 2



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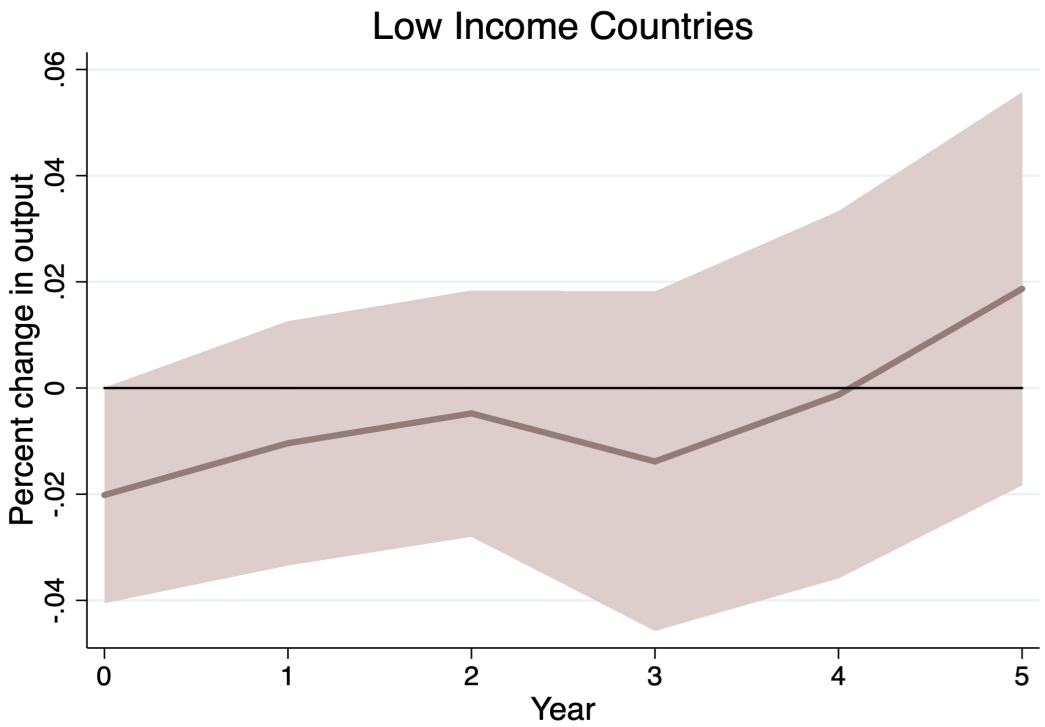
Detail 3



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