Threshold Effects of Sovereign Debt: Evidence from the Caribbean

BY:

Kevin Greenidge

Roland Craigwell   Chrystol Thomas
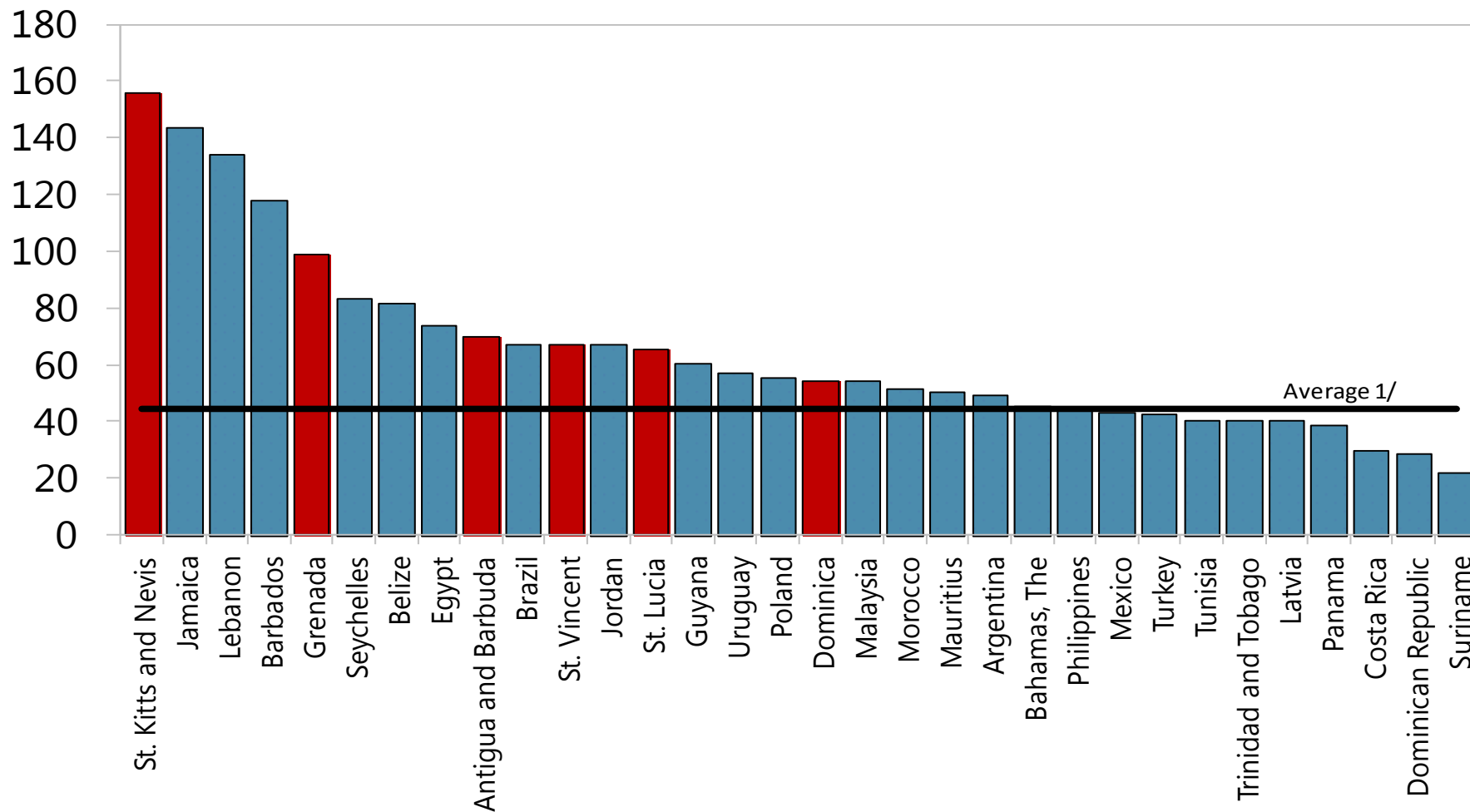
Lisa Drakes

Outline of Presentation

- Introduction
- The Historical Behavior of Debt in the Caribbean
- Brief Review of the Literature
- Methodology & Data
- Results
- Conclusion

Introduction

Public Sector Debt in Selected Countries, end-2010
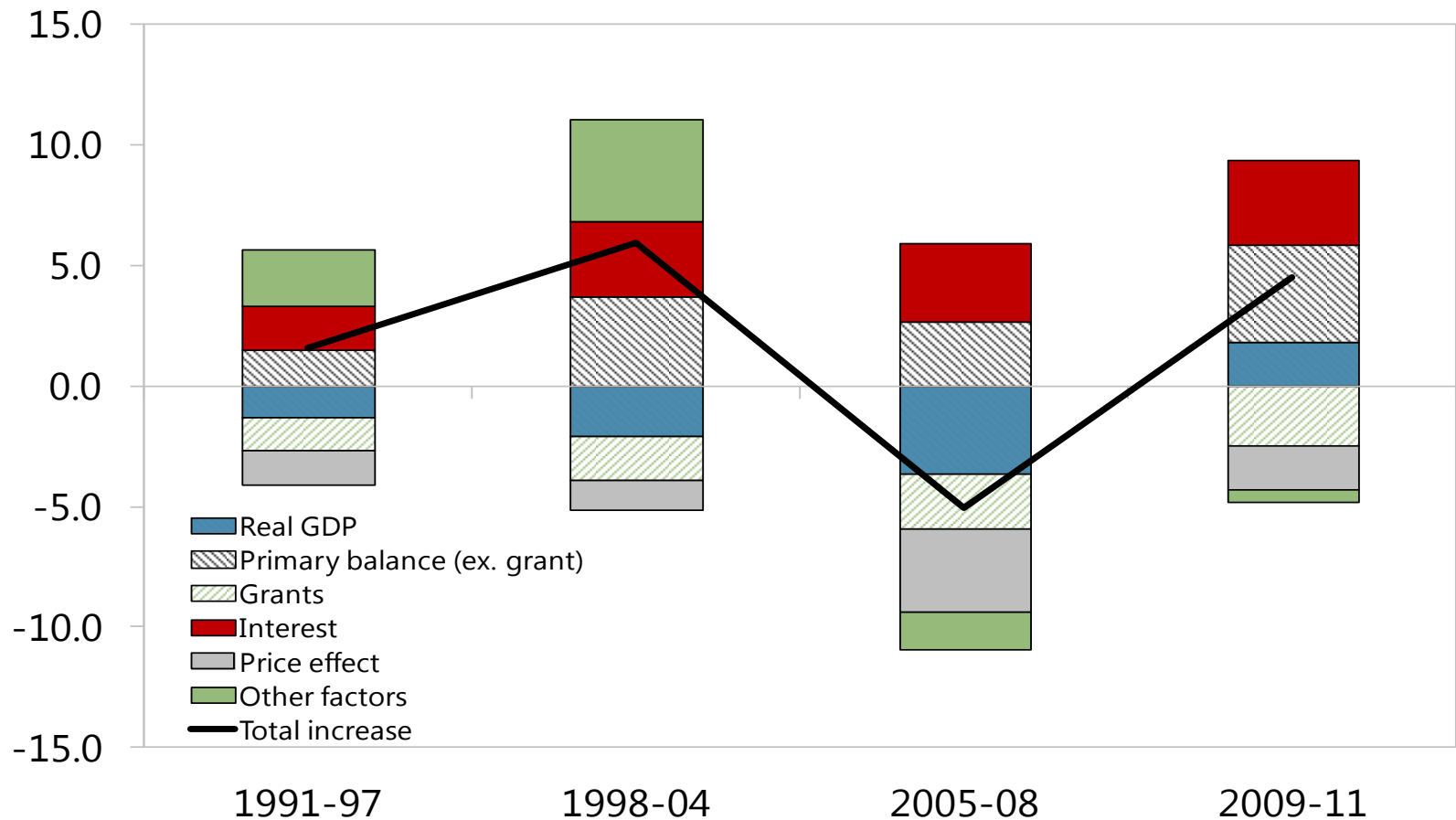(In percent of GDP)

Sources: IMF, WEO;
1/ Average of Emerging Markets and Developing Economies.

Introduction

- Debt of Caribbean countries has been increasing over the last decade, and at a particularly faster rate during this crisis period.

ECCU: Contribution to Changes in Public Debt
(In percent of GDP)

Legend:
- Real GDP
- Primary balance (ex. grant)
- Grants
- Interest
- Price effect
- Other factors
- Total increase

1991-97   1998-04   2005-08   2009-11

**Sources: Country authorities' and Fund staff calculations.**

Introduction

- Allowing debt to grow too large can offset its positive growth effects.

- Past studies have tried to identify the threshold level (w.r.t growth) for the debt-to-GDP, but do not focus specifically on the region.

- This study identifies a threshold level for the Caribbean using the Hansen (1996, 2000) approach, as well as a new approach that is adopted to a growth model specifically designed for CARICOM.

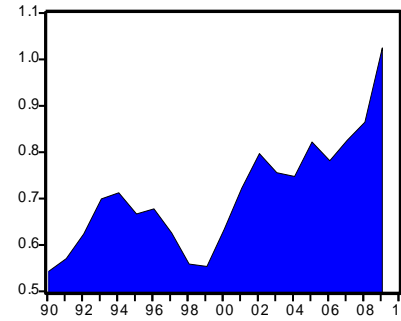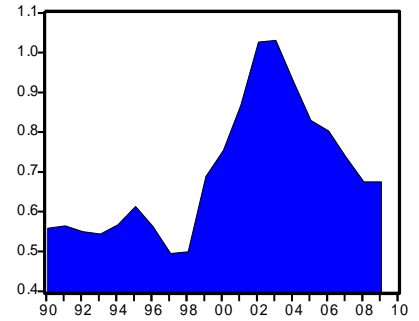# The Historical Behavior of Debt in the Caribbean
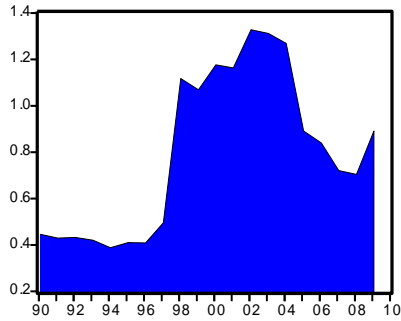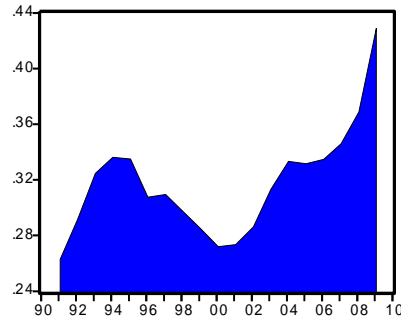
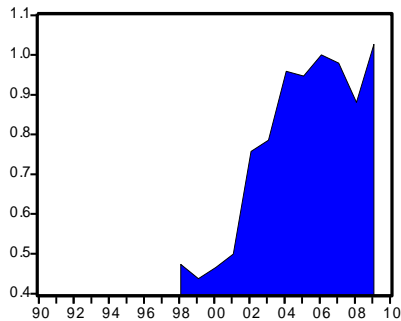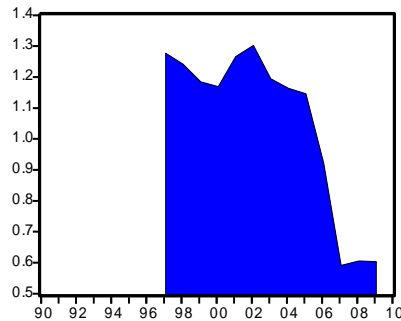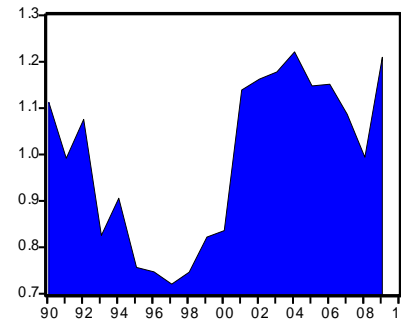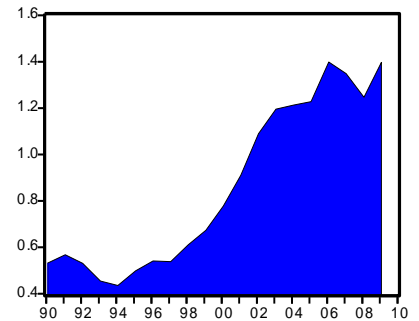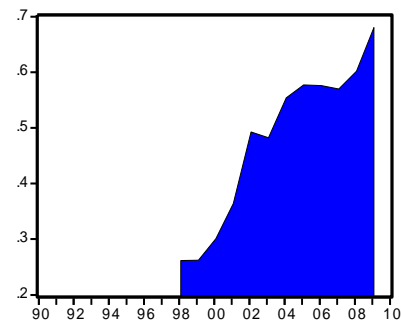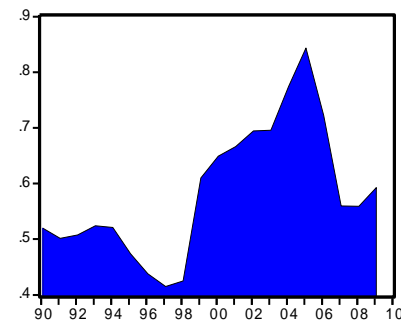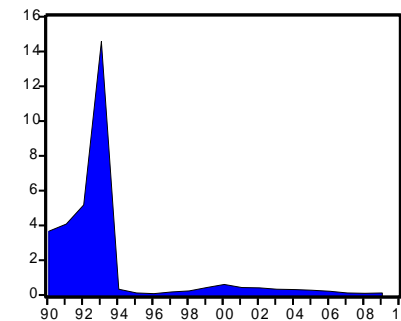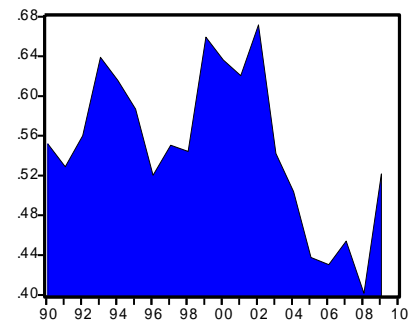# Brief Review of the Literature

- Empirical studies on growth usually use the following regression:

Original model of Mankiw, Romer & Weil (1992)

$$y_{i,t} = \gamma X_{i,t} + \varepsilon_{i,t} + \pi Z_{j,t} + \varphi D_{i,t} + \omega(D_{i,t}.?_{i,t})$$

Barro Regression

- Y is real GDP per capita. X are the determinants suggested by the Solow growth model. Z are those that lie outside the original Solow theory. D is the indicator for the variable under study

- There is a wide range of Z variables used in growth empirics, but few are applicable to the region

- Z determinants used in this study are: Fiscal policy; Openness to international trade; Inflation; Investment; and the Population growth rate.

Review of the Literature (cont'd)

- Debt is another variable that could be influencing growth in the region:
  - Borrowed capital can be used to boost investment
  - Debt can have a growth-reducing effect above a certain threshold [see, eg: debt overhang theory; liquidity/budget constraint hypothesis]

- There is therefore likely to be a non-linear relationship between debt and growth
  - Empirical evidence: Chowdhury (2001), Pattilo et al. (2004) and Kumar and Woo (2010)

- Recent studies now focus on identifying a turning point/threshold.

Review of the Literature (cont'd)

- Varied results for studies that try to estimate the point at which debt begins to negatively affect growth:

Study	Estimated Threshold
Reinhart & Rogoff (2010)	90% central government to GDP
	60 % external debt to GDP
Caner et al. (2010)	77% public debt to GDP
	64% public debt to GDP for (emerging markets)
Patillo et al (2002)	30-40% external debt to GDP
Clements et al (2003)	50% external debt to GDP

- Common approaches used: histograms, spline functions, threshold estimations.

- Much of the work on the debt-growth link has been for developed and developing countries.

- Most research for the Caribbean assumed a linear specification, and found that debt is negatively related to economic growth. See for instance: Caldentey (2007); Branch & Adderley (2007)

- Boamah & Moore (2009) assumed nonlinearity and found a threshold of 63% for external public debt to GDP

Methodology

- The following threshold least square regression model is adopted:

$$y_{it} = \alpha_i(D_{it} \leq \lambda) + \alpha_i(D_{it}\lambda) + \beta_{1i}X_{it}(D_{it} \leq \lambda) + \beta_{2i}X_{it}(D_{it} > \lambda) + \beta_{3i}D_{it}(D_{it} \leq \lambda)$$
$$+ \beta_{4i}D_{it}(D_{it} > \lambda) + \varepsilon_{it}$$

- We begin at $\lambda = 22\%$ and increase it by 1 percentage point up to 110%, each time estimating the above relationship.

- Results are graphed, and we can identify a turning point

- This approach does not allow for an accurate assessment of the statistical significance of the thresholds by providing confidence intervals. The Hansen (1996, 2000) framework is therefore estimated.

Methodology (cont'd)

- The Hansen (1996, 2000) threshold framework:

$$y_{it} = \gamma_1 \left(1 - I_{it}^{D^*}\right)(D_{it} - D^*) + \gamma_2 I_{it}^{D^*}(D_{it} - D^*) + \theta' X_{it} + e_{it}$$

$$I_{it}^{D^*} = \begin{cases} 1 \; if \; D_{it} > D^* \\ 0 \; if \; D_{it} < D^* \end{cases} \quad i = 1, ..., N \; \; t = 1, ..., T$$

- The model is again estimated with a threshold search over the range 22 to 112 percent in increments of 0.1%   a total of 900 regressions.

- Under the hull hypothesis of no threshold, classical tests have non-standard distributions and are not appropriate for econometric inferences.

- Hansen (1996, 2000) recommended a bootstrap technique to simulate the empirical distribution of the following likelihood ratio test:

$$LR_0 = \frac{S_0 - S_1(D^*)}{\sigma^2}$$

Results

Impact of Debt on Growth (in percentage points)
at debt thresholds up to and including the indicated debt-to-GDP ratio

positve & significant

positve & insignificant

negative & insignificant

Debt Threshold Levels
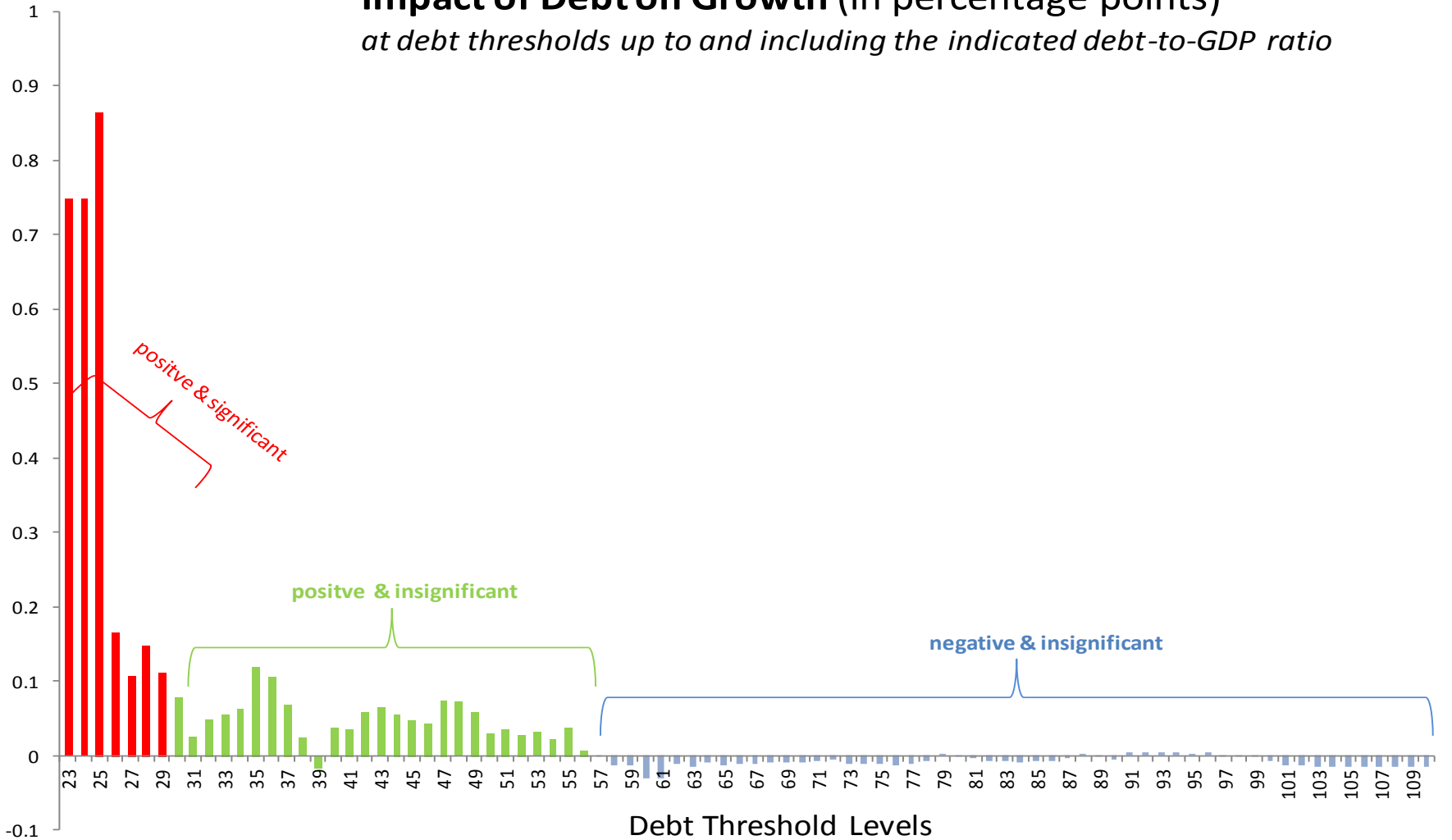
Results

Impact of Investment on Growth (in percentage points)
at debt thresholds up to and including the indicated debt-to-GDP ratio

positve & significant

insignificant

Debt Threshold Levels

Results

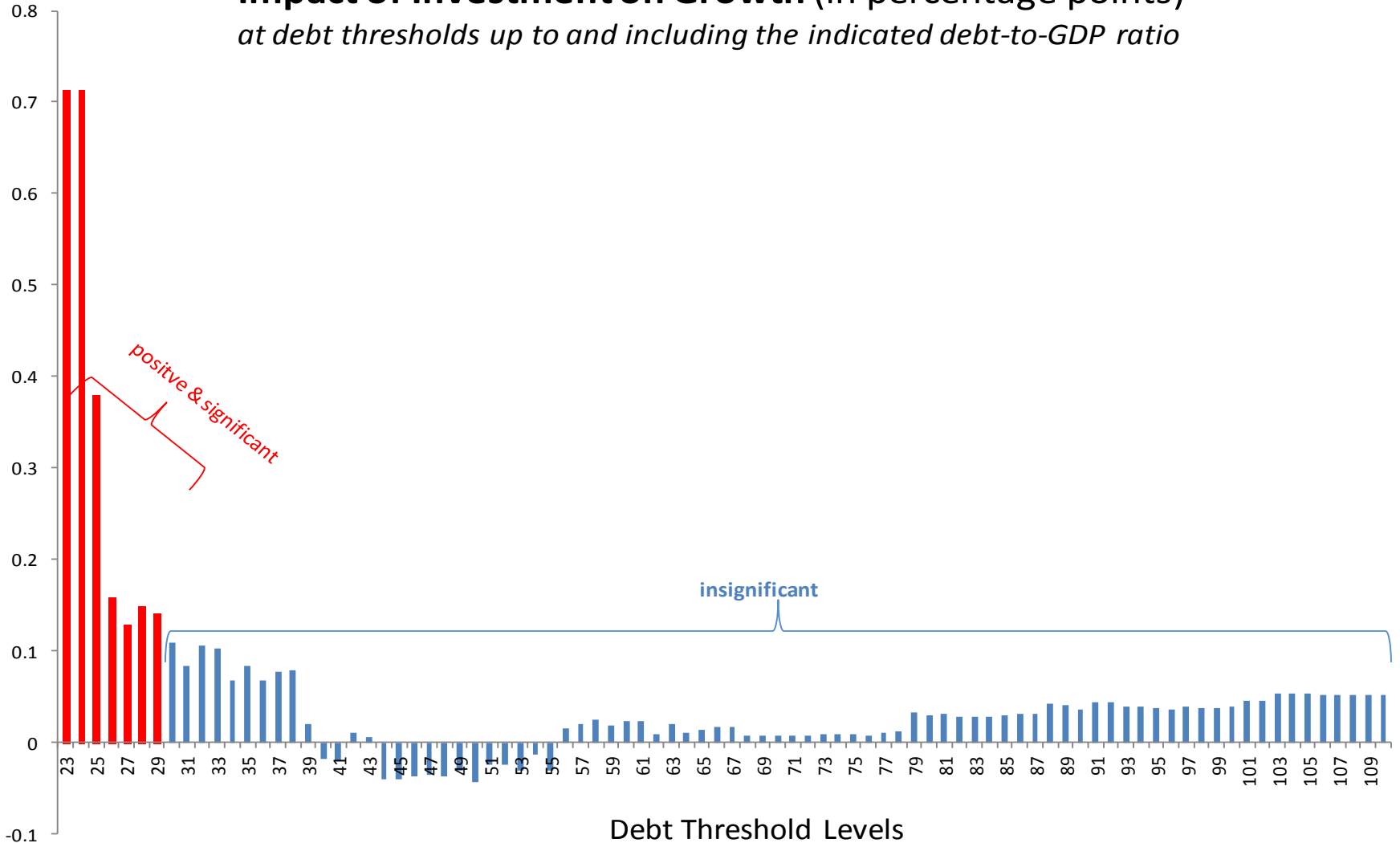**Impact of Trade on Growth** (in percentage points)
at debt thresholds up to and including the indicated debt-to-GDP ratio

positive & significant

insignificant

Debt Threshold Levels

Results

Impact of Government Expenditure on Growth (in percentage points)
at debt thresholds up to and including the indicated debt-to-GDP ratio

Debt Threshold Levels
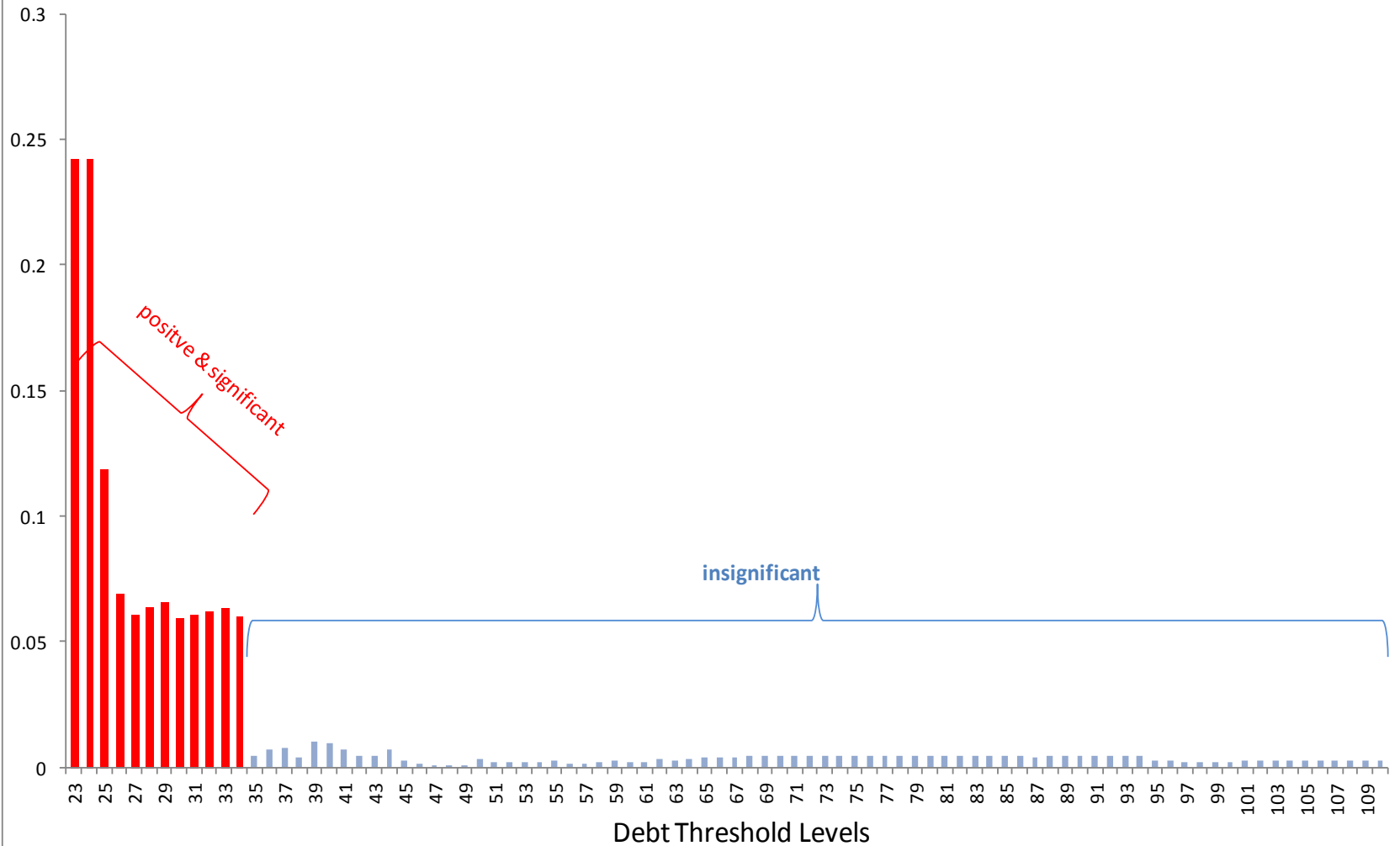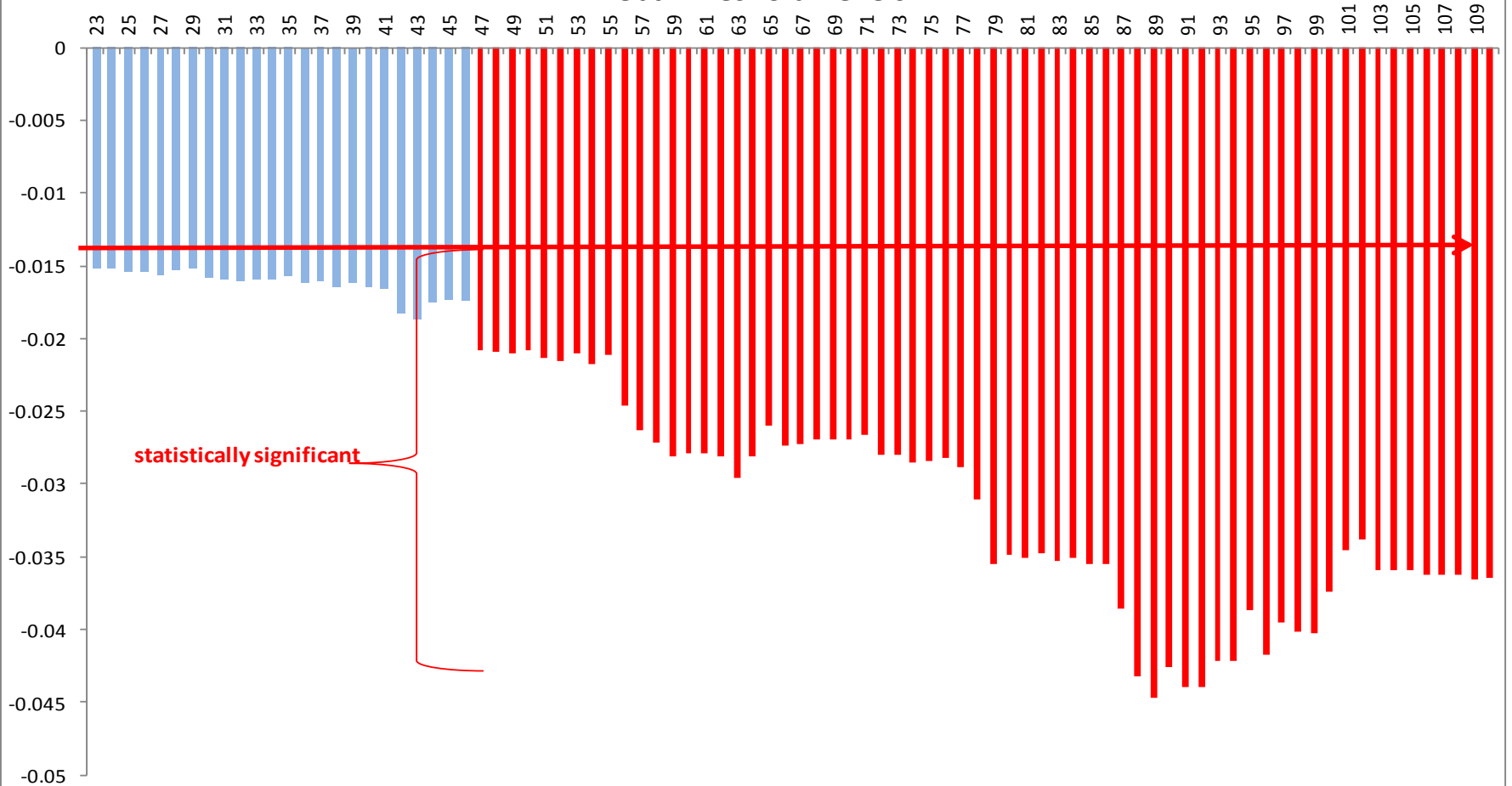
statistically significant

Results

Impact of Inflation on Growth (in percentage points)
at debt thresholds up to and including the indicated debt-to-GDP ratio
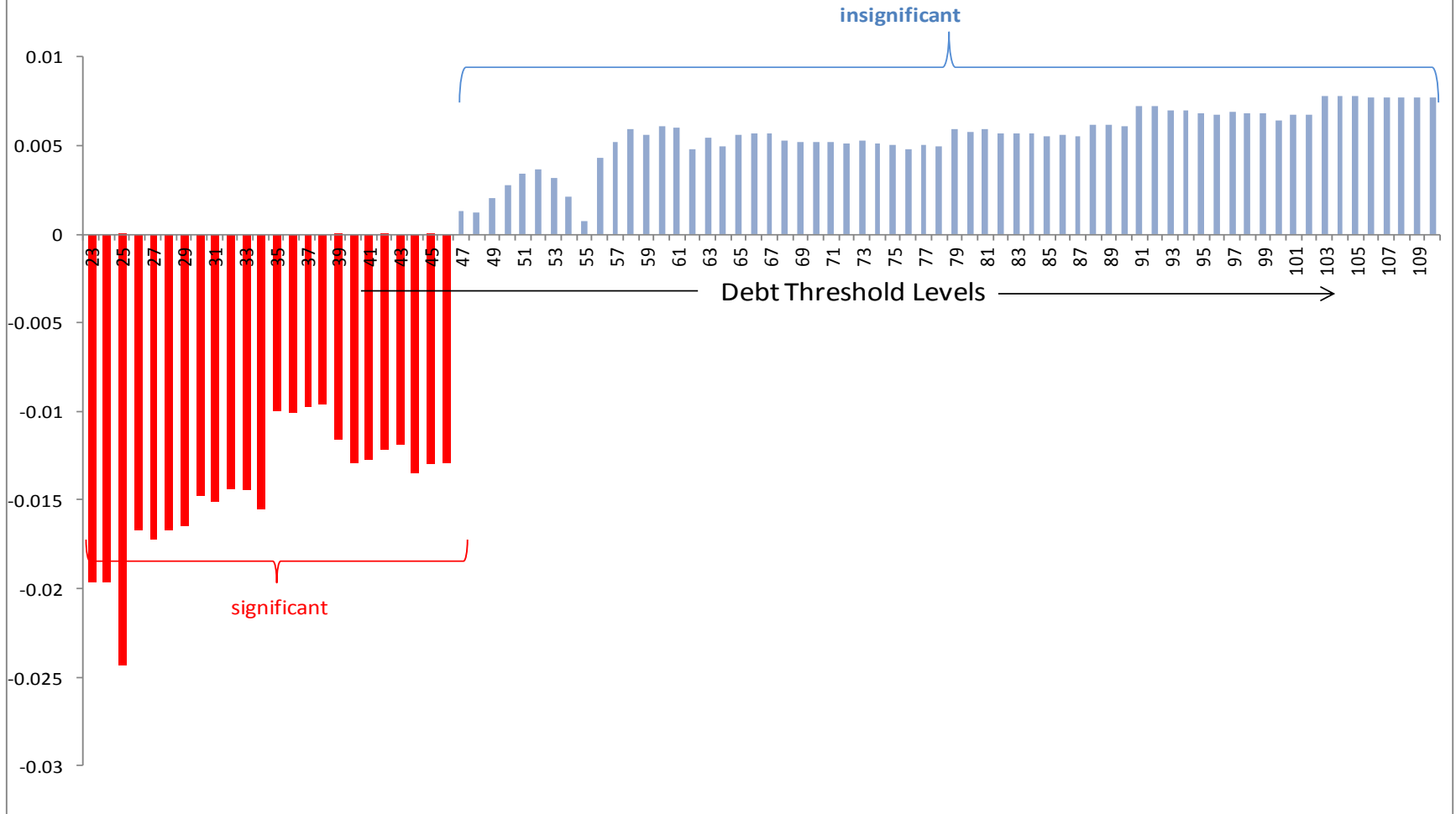
Results – the Hansen Approach

- A threshold of 30.6 % is identified.
- The bootstrap estimation for the significance of threshold estimates suggests that the threshold estimate is significant at 1%.
- The model is re-estimated with the corresponding threshold and the results are consistent with the above analysis.
- Specifically, the coefficient on γ_1 is positive and significant suggesting that debt level lower then 30 percent of GDP is associated with positive economic growth.
- However, the coefficient γ_2 is negative and significant, which implies that once the debt rises above 30 percent of GDP the relationship between debt and growth becomes negative.

Conclusion

- We contribute to the literature by identifying the effects different levels of debt-to-GDP ratios have on economic growth rates in the Caribbean.

- The study adopted the threshold estimation approach as described by Hansen (1996, 2000) and a variant thereof.

- The findings validated the notions that emerging markets face lower thresholds of debt-to-GDP (Reinhart and Rogoff, 2010a) and that high levels of debt, especially for low income or developing countries, can have adverse effects on growth levels.

- The results indicated that debt contributes positively to growth when it is below 30% of GDP but becomes a main concern for output beyond 56% of GDP.

Conclusion

- Compared to Reinhart and Rogoff, (2010a) and Caner et al. (2010), a much lower threshold was found for the Caribbean region because of its small size and lack of physical resources.

- Given that most of the countries under investigation currently have high debt-to-GDP ratios that are above the suggested turning point threshold, it is critical for governments to engage in fiscal consolidation.

Thanks for your attention.