



The Macroeconomic and Distributional Effects of Public Investment in Developing Economies

Davide Furceri, Bin Grace Li—Research Department (IMF)
Workshop on “Macroeconomic Policy and Income Inequality”
Washington DC, February 9-10, 2017

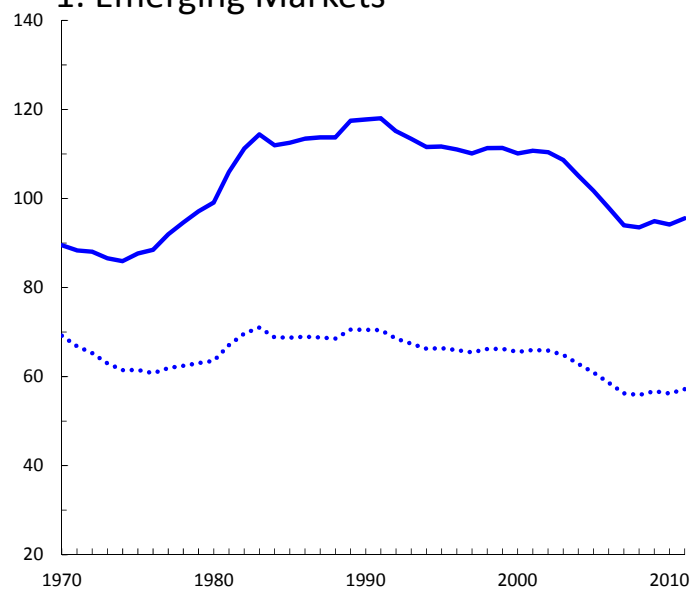
Outline of Presentation

- Motivation
- Contribution
- Methodology
- Results
- Policy implications

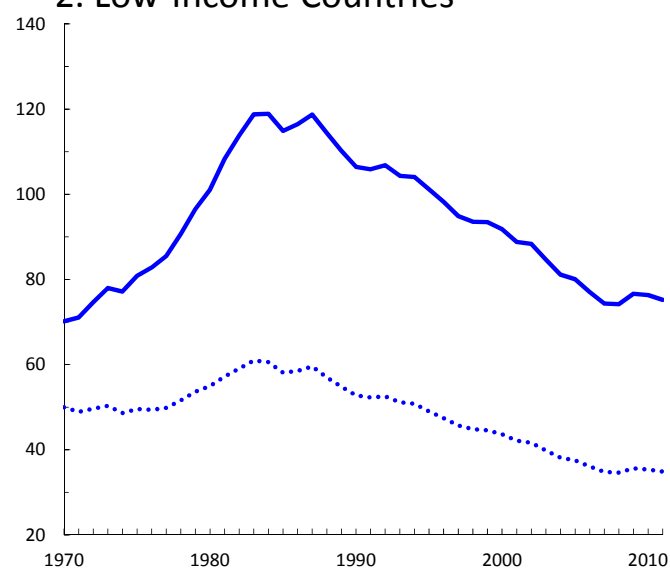
The stock of public capital has declined as share of GDP across many EMDEs...

Real Public Capital Stock (percent of GDP; PPP-weighted)

1. Emerging Markets



2. Low-Income Countries

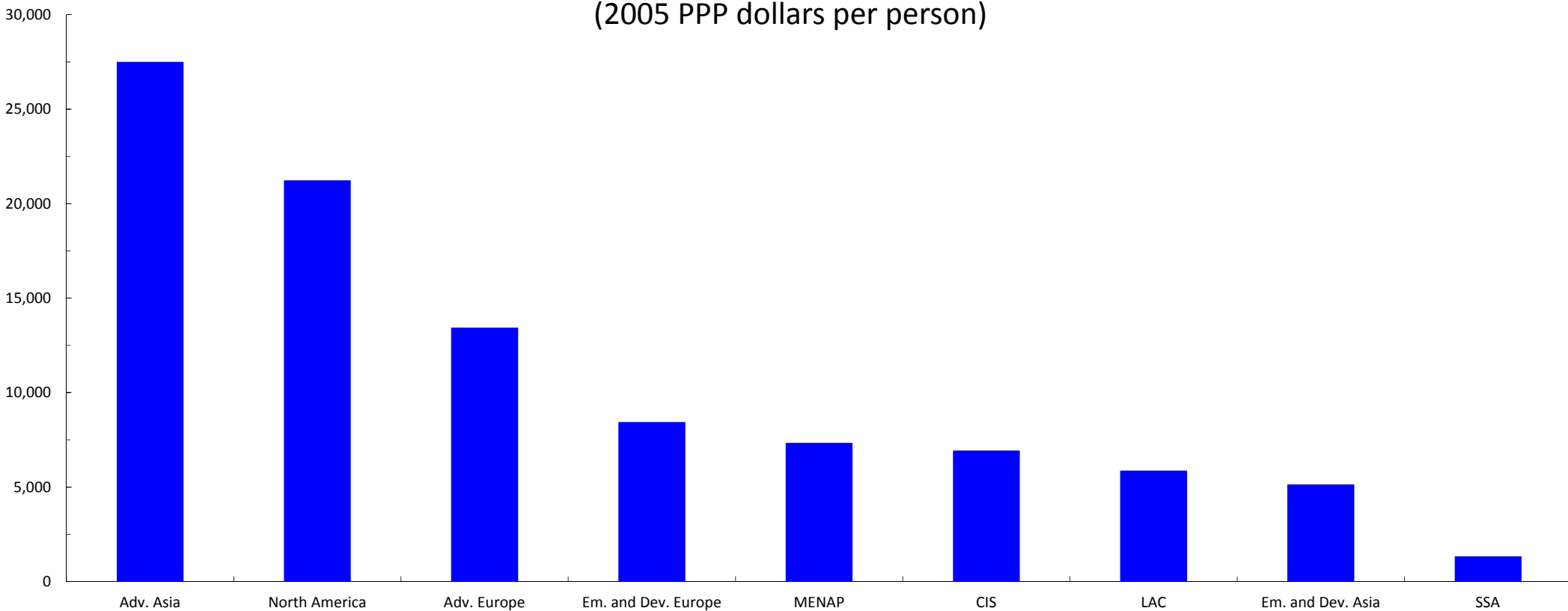


Source: IMF WEO (2015).

Note: Dotted lines represent efficiency adjusted real public capital stock as percent of GDP, PPP-weighted.

...and remains significantly lower than in AEs...

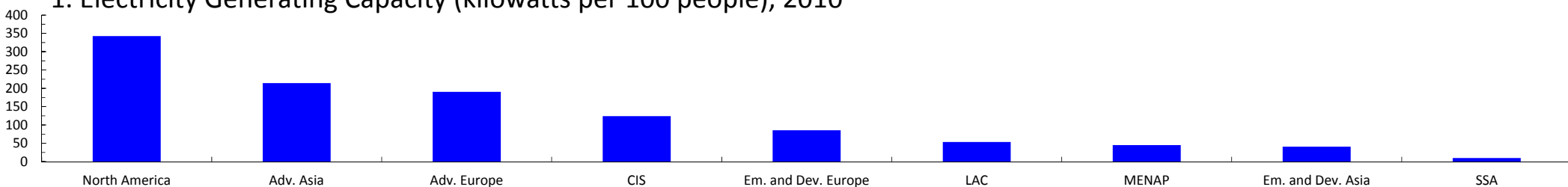
Real Per Capita Public Capital Stock, 2010
(2005 PPP dollars per person)



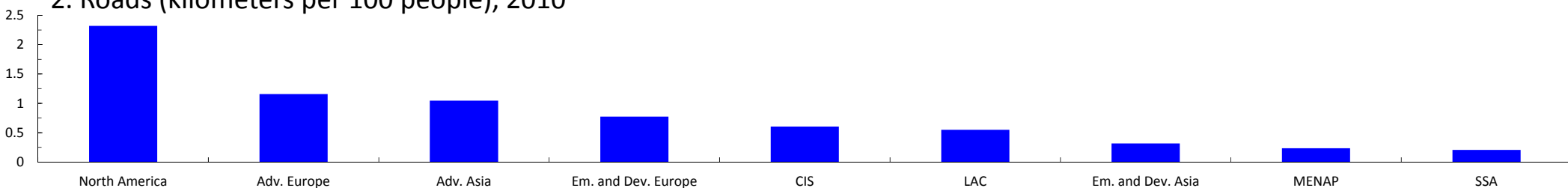
Source: IMF WEO (2015).

...as also evident looking at measures of physical infrastructure.

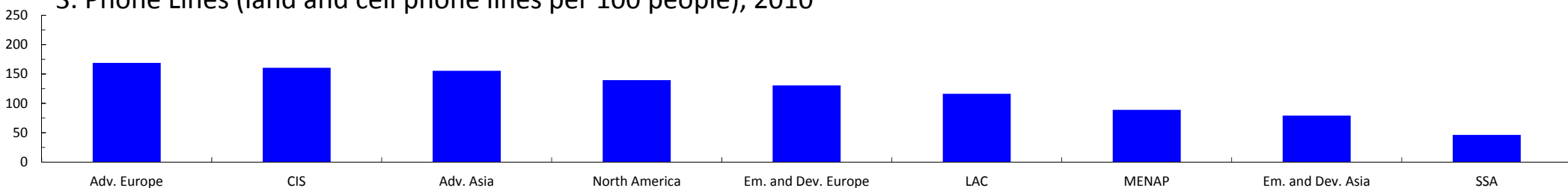
1. Electricity Generating Capacity (kilowatts per 100 people), 2010



2. Roads (kilometers per 100 people), 2010



3. Phone Lines (land and cell phone lines per 100 people), 2010



Source: IMF WEO (2015).

Contributing to a large body of literature...

Long-term effect of public investment on output

- Estimating long-term elasticity of output to public and infrastructure capital using a production function approach (eg Romp and de Haan 2007, Straub 2011, and Bom and Ligthart 2014).
- Estimating the effect of public investment shocks (Abiad et al. 2015 for AEs; Kraay 2012).
- Model-based analysis (Buffie and others 2015).

The relationship between public investment and inequality

- Case studies and panel analysis (Calderon and Serven 2004, Calderon and Serven 2010, Fan and Zhang 2004, Feranti et al 2004, Lopez 2004. Brakman et al 2002. Artadi and Sala-i-Martin 2003).
- Theoretical models with heterogeneous agents to examine the distributional effects of macro policy (Turnovsky 2015, Fabrizio and others 2017).

Role of investment efficiency

- Computing measures of investment efficiency (Dabla-Norris and others 2012; IMF 2014, 2015).
- Assessing the role of investment efficiency (Gupta and others 2012; Berg and others 2016).

in several important ways

- Identifying exogenous public investment shocks for EMDEs (Abiad and others (2015) for AEs; Kraay (2012) for a subset of LICs).
- Examining the macroeconomic and distributional effects.
- Assessing the role of investment efficiency and gaps.

Empirical methodology

Identification of the shocks

FE is fiscal shock, identified as the forecast error of public investment as share of GDP (Auerbach and Gorodnichenko (2012, 2013))

Advantages of the identification method

A problem in the identification of public investment shocks is that they may be endogenous to output growth surprises.

This procedure overcomes the problem of fiscal foresight.

Fiscal shocks are identified as unanticipated changes in public investment; public investment forecasts are used to compute unanticipated innovations.

Empirical methodology: Two Specifications

Baseline

$$y_{i,t+k} - y_{i,t} = \alpha_i^k + \gamma_t^k + \beta^k FE_{i,t}^k + \varepsilon_{i,t}^k$$

FE is fiscal shock, identified as the forecast error of public investment as share of GDP;
And y is the dependent variable (the log of output, productivity, private investment, or the Gini coefficient).

Non-linear effects

$$y_{i,t+k} - y_{i,t} = \alpha_i^k + \gamma_t^k + \beta_k G(z_{it}) FE_{i,t}^K + \beta_k (1 - G(z_{it})) FE_{i,t}^K + \varepsilon_{i,t}^k$$

with

$$G(z_{it}) = \frac{\exp(-\gamma z_{it})}{1 + \exp(-\gamma z_{it})}, \quad \gamma > 0$$

z is an indicator of the degree of public investment efficiency (gap).

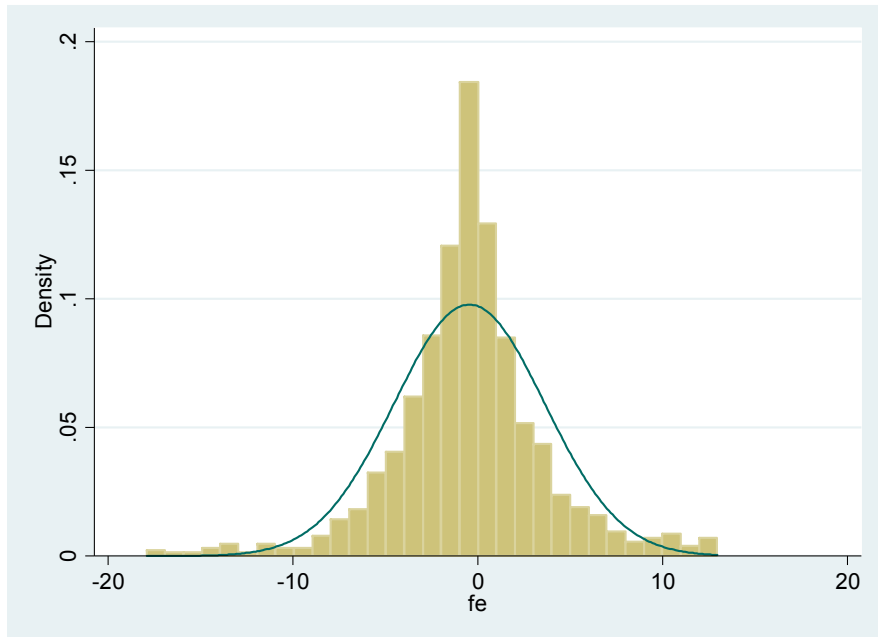
Data Description

Descriptive Statistics

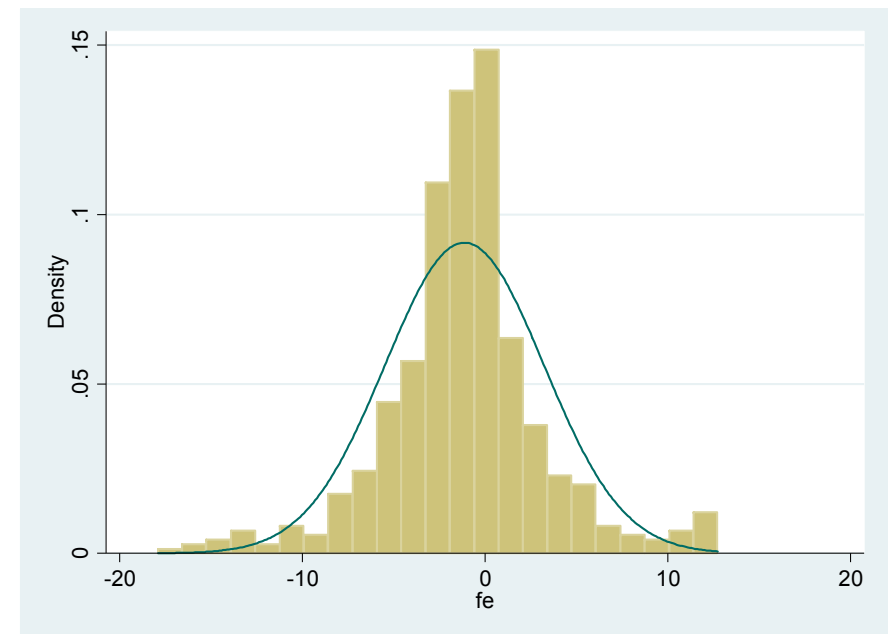
- Unbalanced panel of 74 EMDEs from 1991 to 2015
- Public investment shocks: the forecast errors between the actual public investment and the public investment expected by analysts as of WEO October of the same year
- Macroeconomic series: WEO datasets.
- Inequality index: the market Gini coefficients, from the SWIID dataset (Solt 2016).

Fiscal policy shocks (distribution)

1. Emerging markets and developing countries



2. LICs

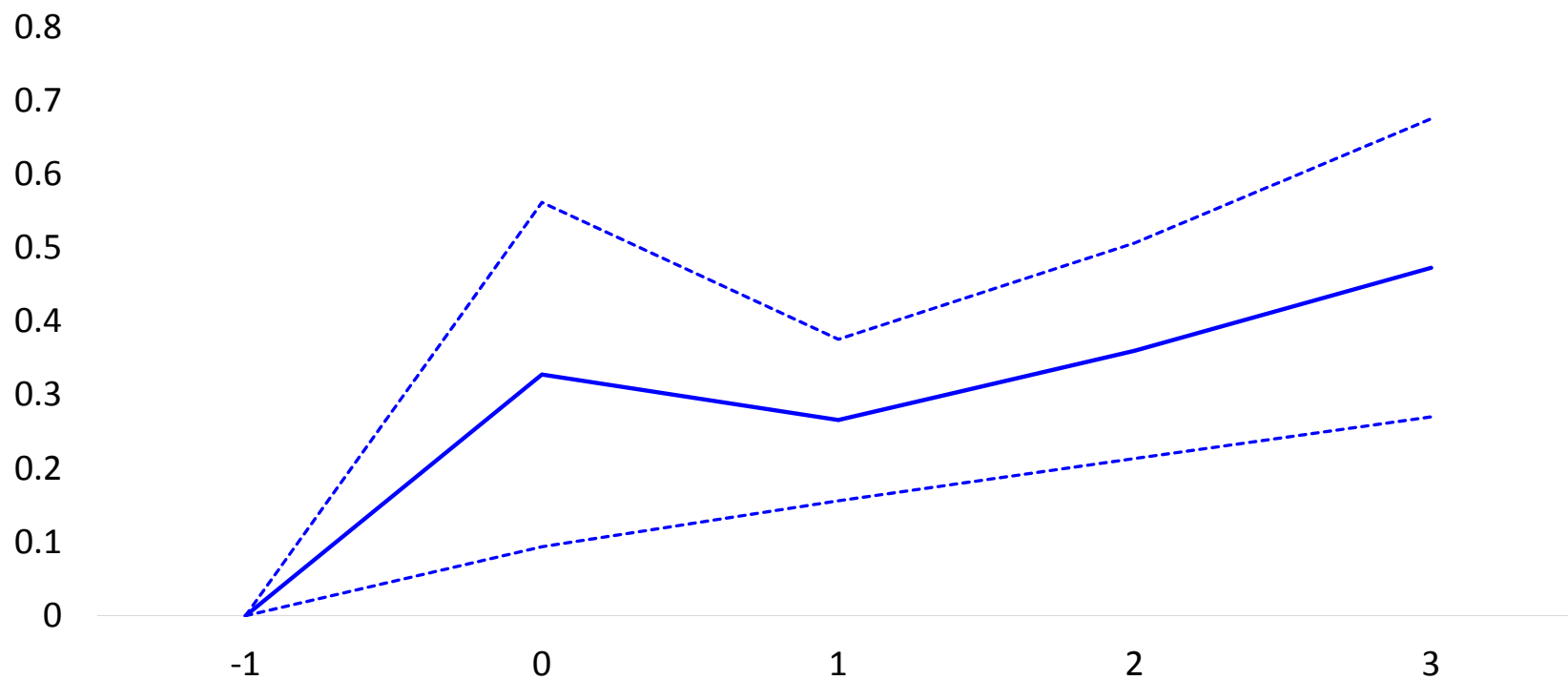


Baseline results

1. Output
(percent)

0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0

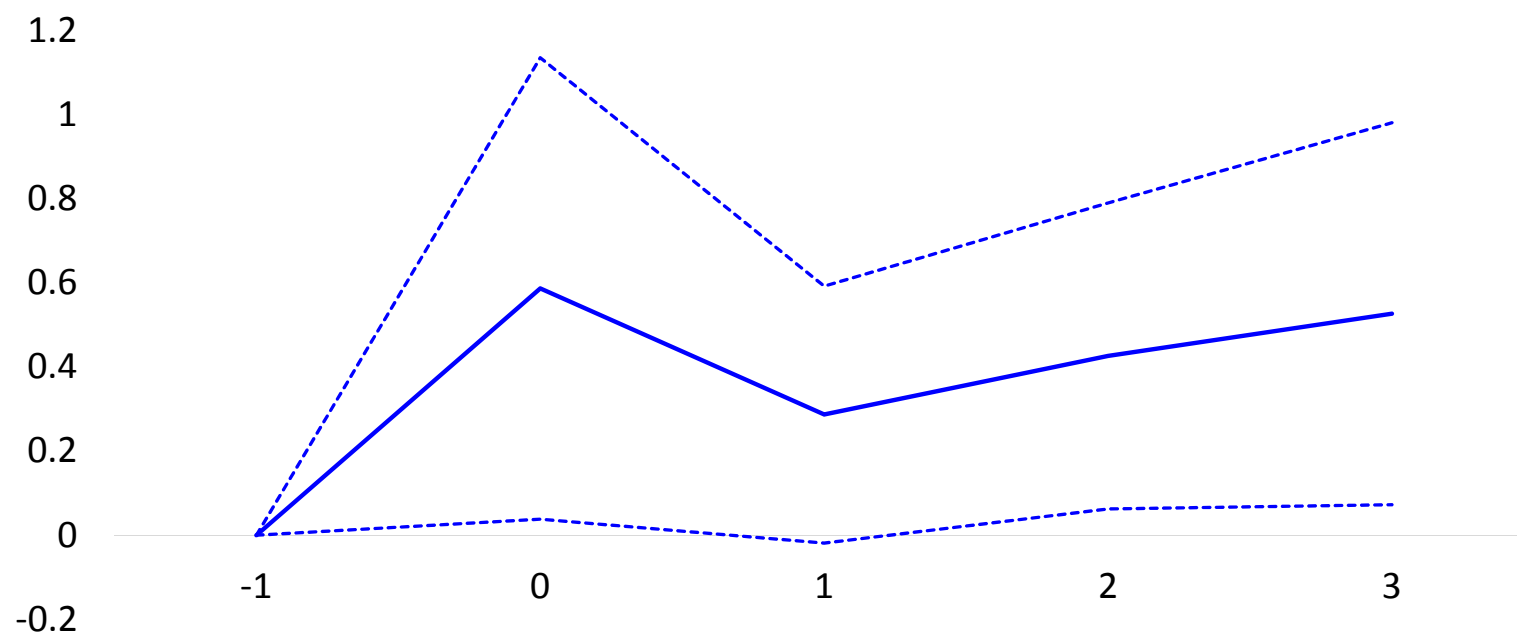
-1 0 1 2 3



Note: $t=0$ is the year of the shock. Solid blue lines denote the response to an unexpected increase in public investment of 1 percent of GDP, and dashed lines denote 90 percent confidence bands. Estimates based on equation (1) using local projection method (Jorda, 2005) for an unbalanced panel of 74 countries over the period 1990-2015.

Baseline results

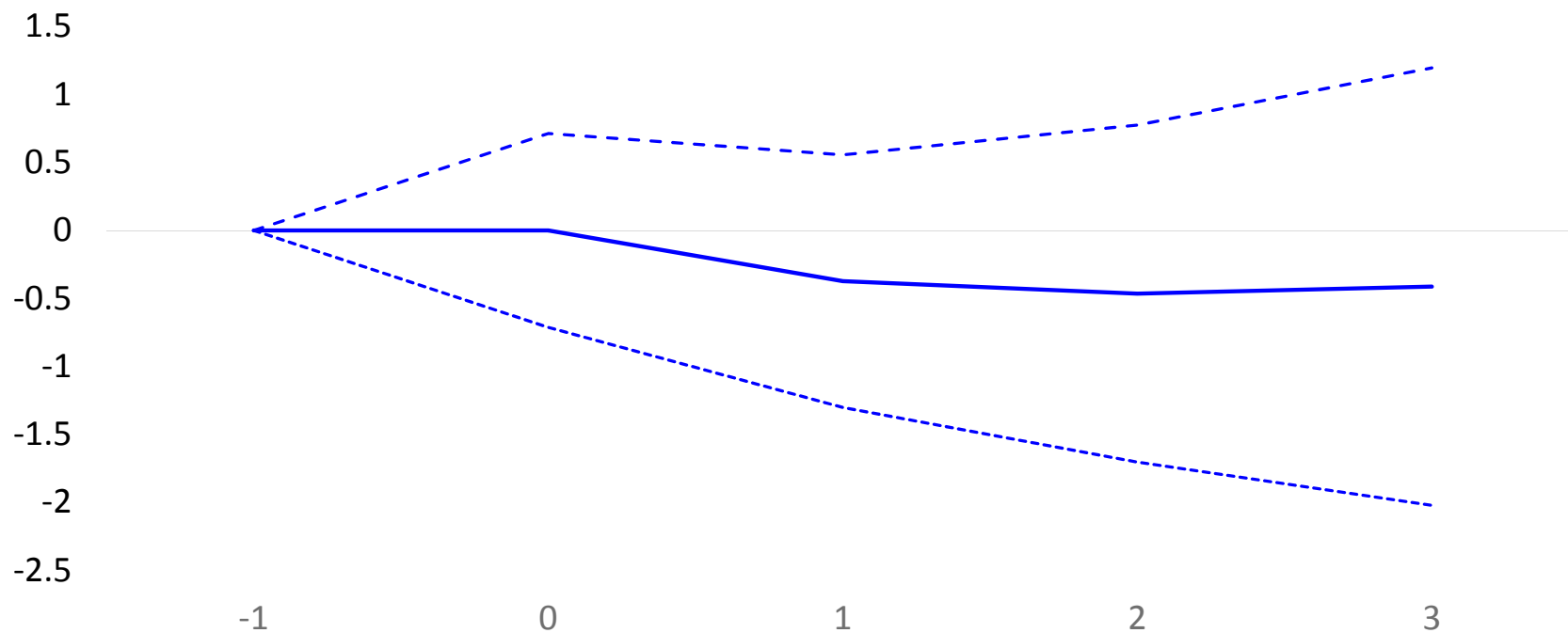
2. Productivity (percent)



Note: $t=0$ is the year of the shock. Solid blue lines denote the response to an unexpected increase in public investment of 1 percent of GDP, and dashed lines denote 90 percent confidence bands. Estimates based on equation (1) using local projection method (Jorda, 2005) for an unbalanced panel of 74 countries over the period 1990-2015.

Baseline results

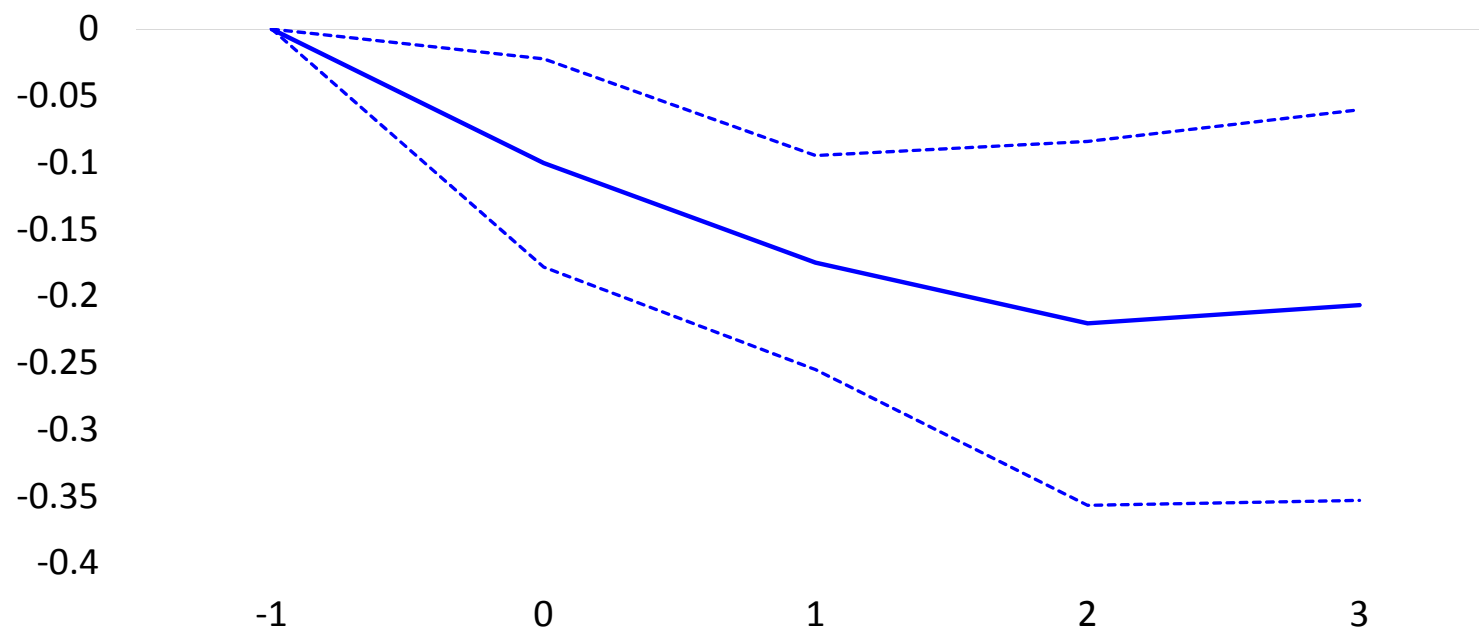
3. Private Investment (percent)



Note: $t=0$ is the year of the shock. Solid blue lines denote the response to an unexpected increase in public investment of 1 percent of GDP, and dashed lines denote 90 percent confidence bands. Estimates based on equation (1) using local projection method (Jorda, 2005) for an unbalanced panel of 74 countries over the period 1990-2015.

Baseline results

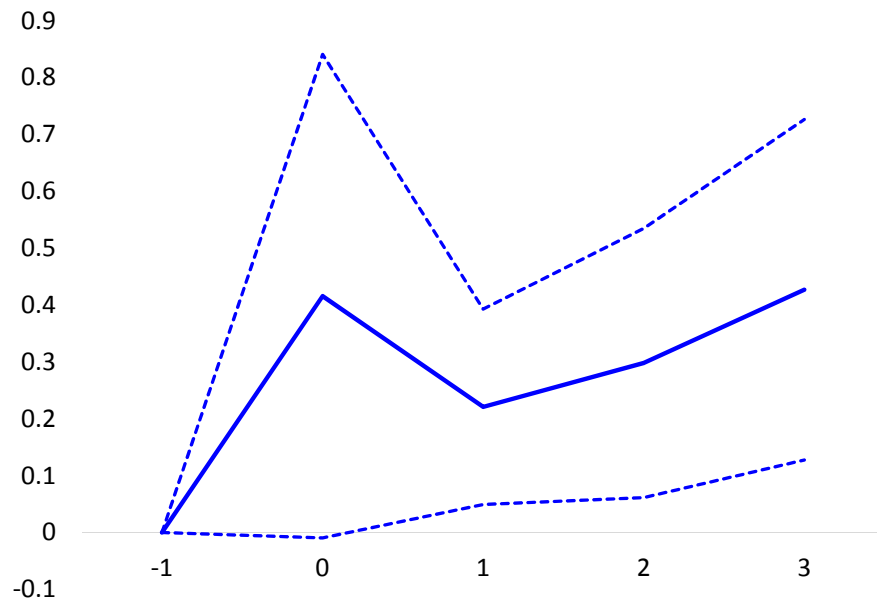
4. Inequality--Gini coefficient (percent)



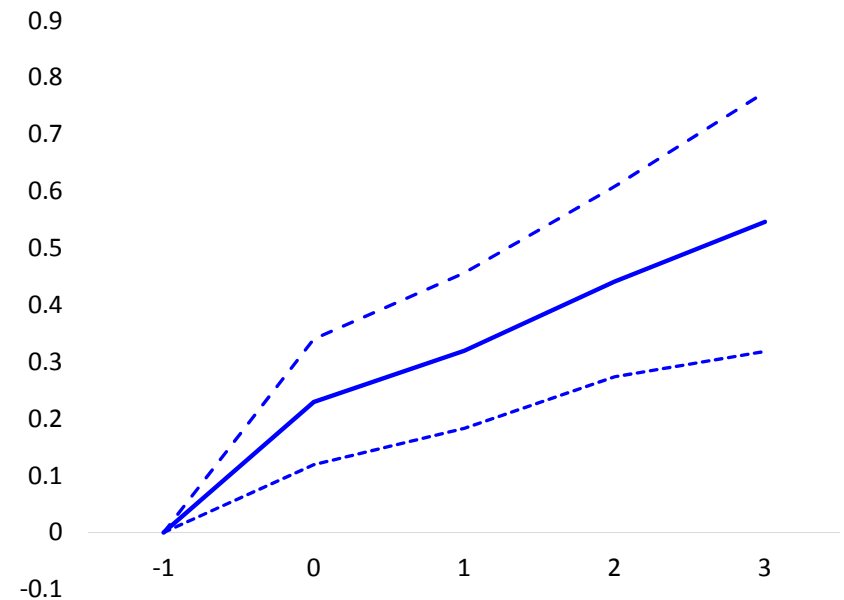
Note: $t=0$ is the year of the shock. Solid blue lines denote the response to an unexpected increase in public investment of 1 percent of GDP, and dashed lines denote 90 percent confidence bands. Estimates based on equation (1) using local projection method (Jorda, 2005) for an unbalanced panel of 74 countries over the period 1990-2015.

2.1 Output effects: EMs vs. LICs

1. Emerging markets



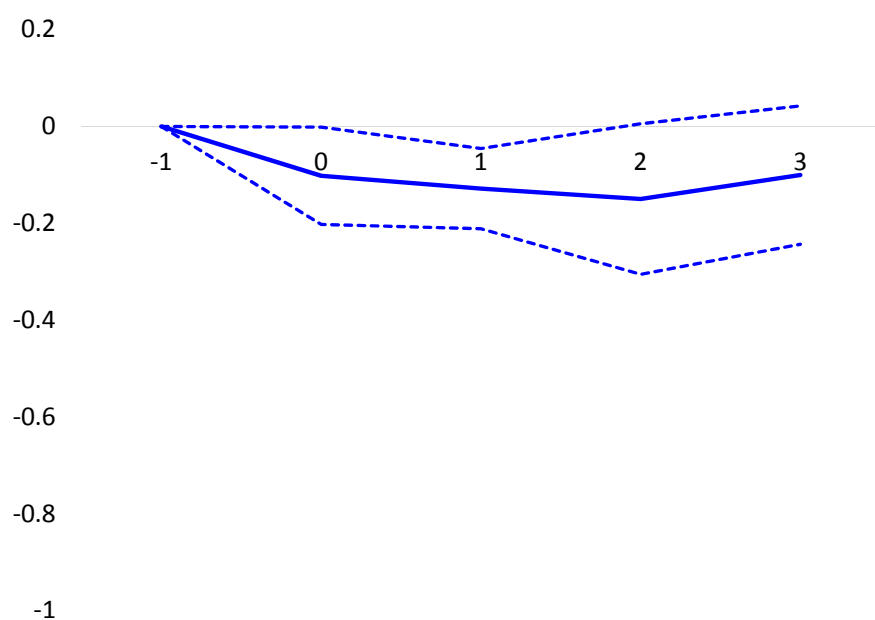
2. LICs



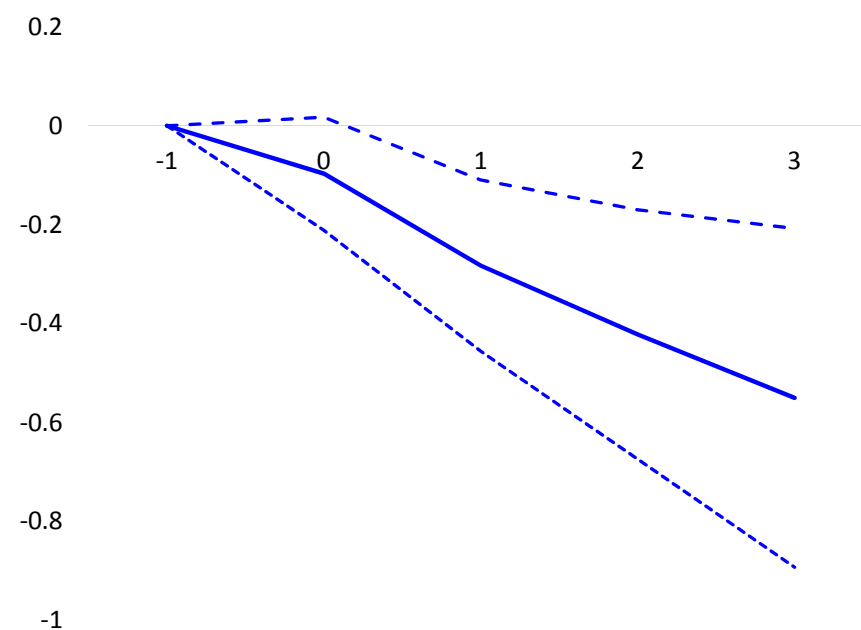
Note: $t=0$ is the year of the shock. Solid blue lines denote the response to an unexpected increase in public investment of 1 percent of GDP, and dashed lines denote 90 percent confidence bands. Estimates based on equation (1) using local projection method (Jorda, 2005) for an unbalanced panel of 74 countries over the period 1990-2015.

Inequality effects: EMs vs. LICs

1. Emerging markets



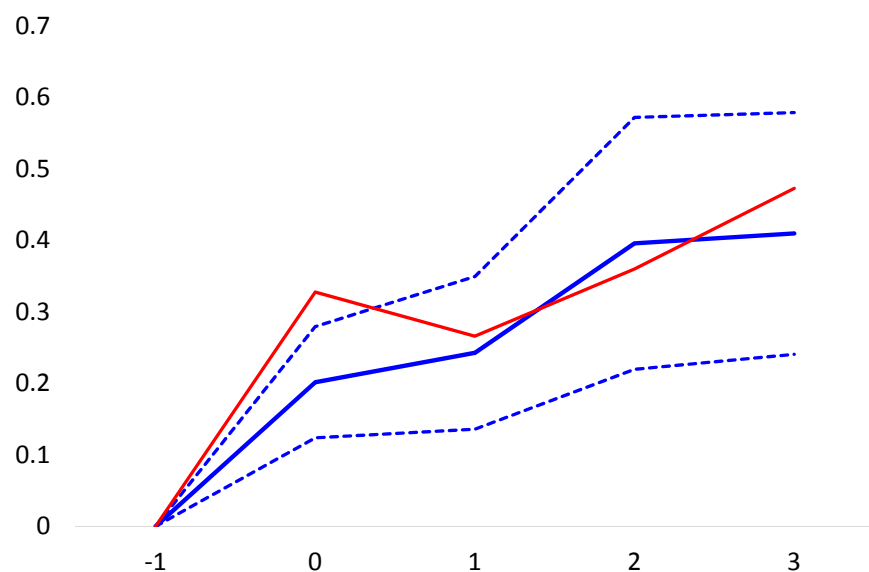
2. LICs



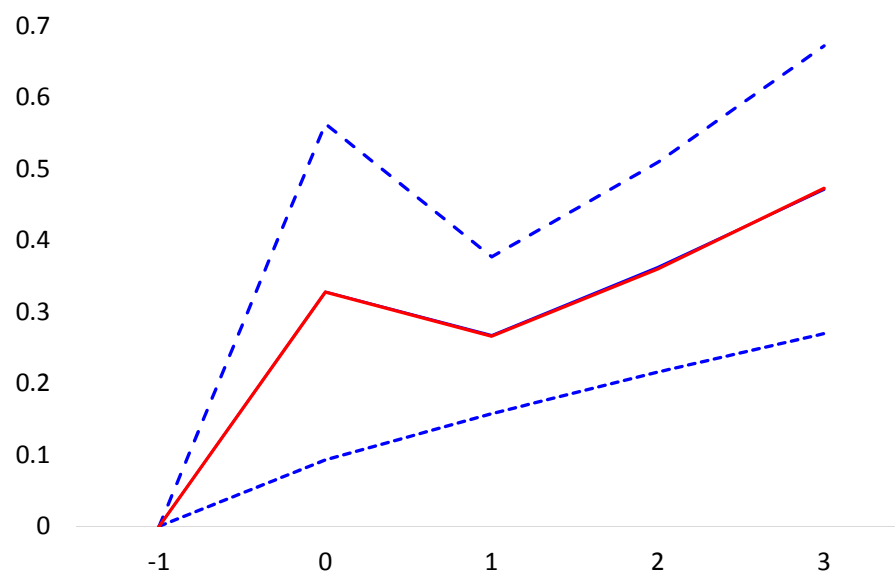
Note: $t=0$ is the year of the shock. Solid blue lines denote the response to an unexpected increase in public investment of 1 percent of GDP, and dashed lines denote 90 percent confidence bands. Estimates based on equation (1) using local projection method (Jorda, 2005) for an unbalanced panel of 74 countries over the period 1990-2015.

Output Effects—Additional controls

1. Controlling for other forecast errors in the budget



2. Controlling for other forecast errors in growth

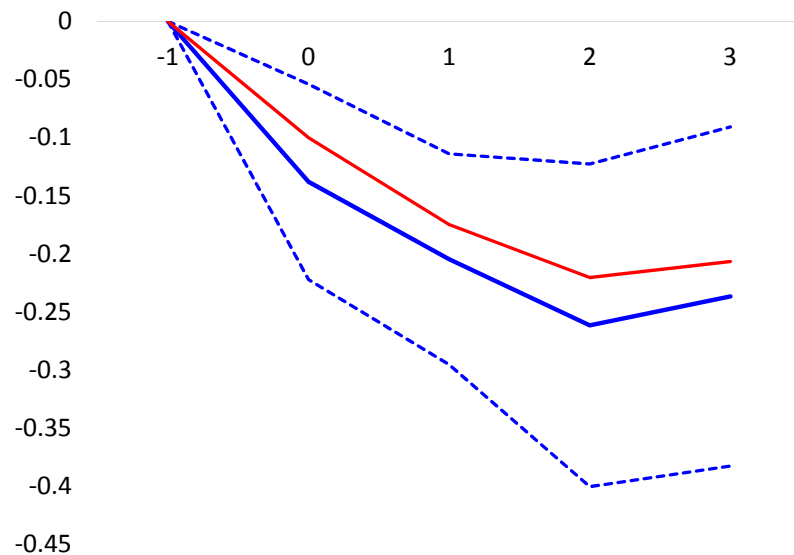


Note: $t=0$ is the year of the shock. Solid blue lines denote the response to an unexpected increase in public investment of 1 percent of GDP, and dashed lines denote 90 percent confidence bands. Solid red lines denote the baseline response. Estimates based on equation (1) using local projection method (Jorda, 2005) for an unbalanced panel of 74 countries over the period 1990-2015.

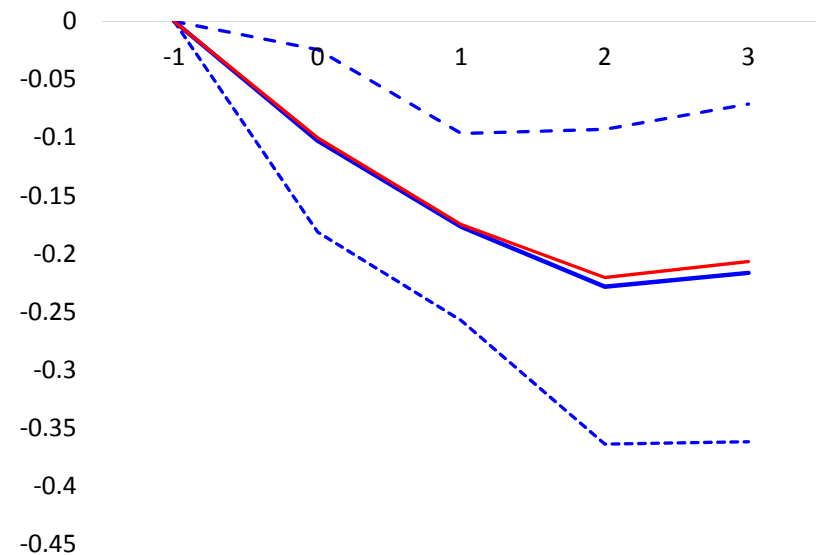
Robustness of Inequality Results

Additional controls

1. Controlling for other forecast errors in the budget



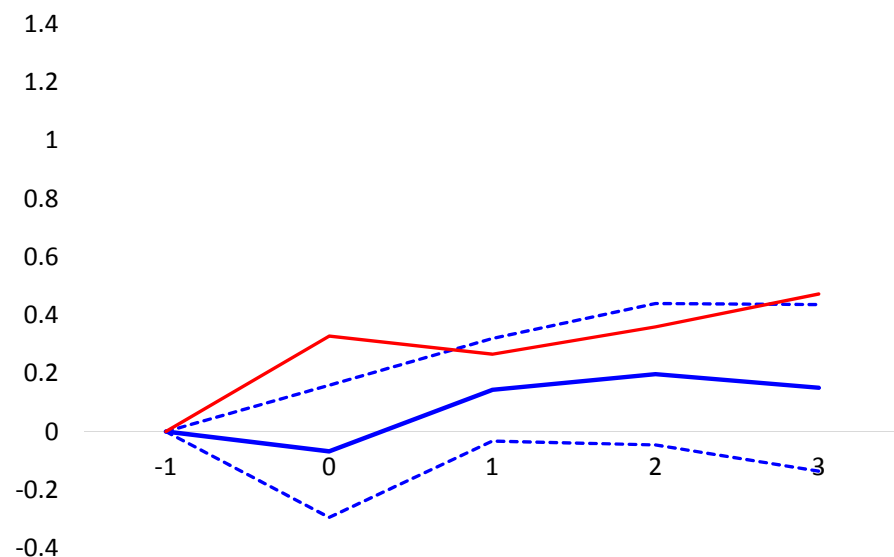
2. Controlling for other forecast errors in growth



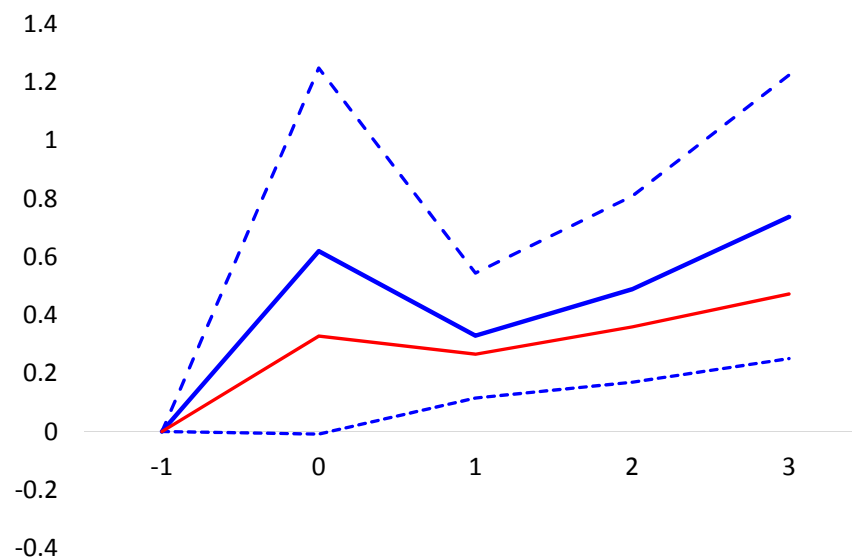
Note: $t=0$ is the year of the shock. Solid blue lines denote the response to an unexpected increase in public investment of 1 percent of GDP, and dashed lines denote 90 percent confidence bands. Solid red lines denote the baseline response. Estimates based on equation (1) using local projection method (Jorda, 2005) for an unbalanced panel of 74 countries over the period 1990-2015.

Output: the role of efficiency (quality of infrastructure)

1. Low Efficiency



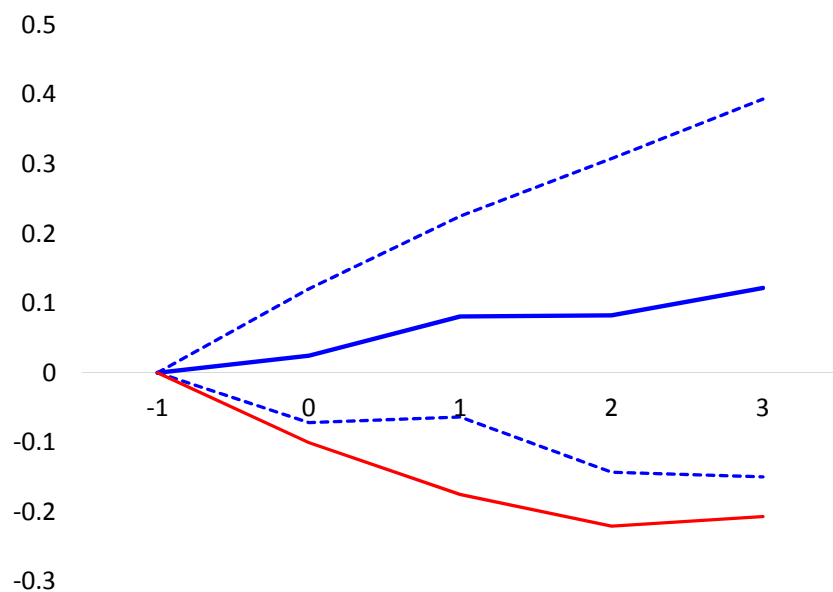
2. High Efficiency



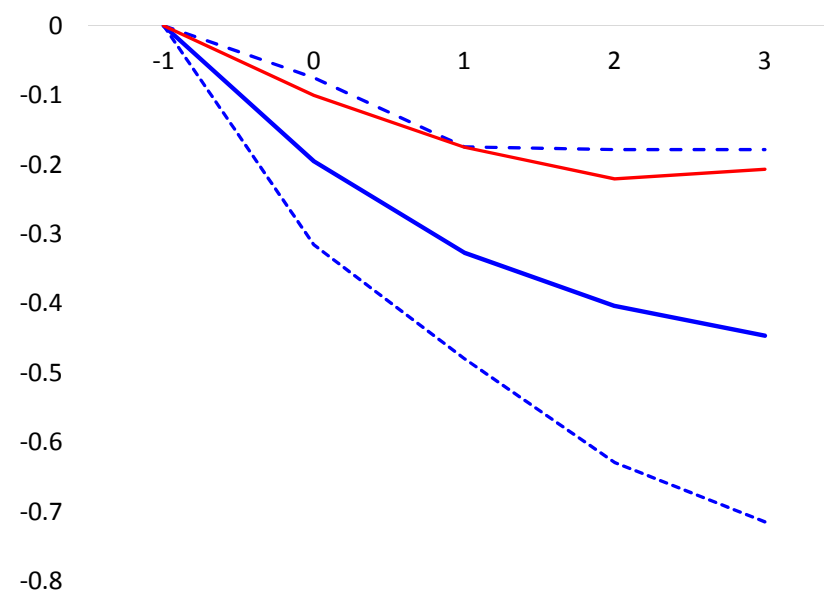
Note: $t=0$ is the year of the shock. Solid blue lines denote the response to an unexpected increase in public investment of 1 percent of GDP in countries with low (high) investment efficiency, and dashed lines denote 90 percent confidence bands. Solid red lines denote the unconditional response. Estimates based on equation (1) using local projection method (Jorda, 2005) for an unbalanced panel of 74 countries over the period 1990-2015. Efficiency based on the WEF measure of quality of infrastructure. Results robust using PIMI.

Inequality: the role of efficiency (quality of infrastructure)

1. Low Efficiency



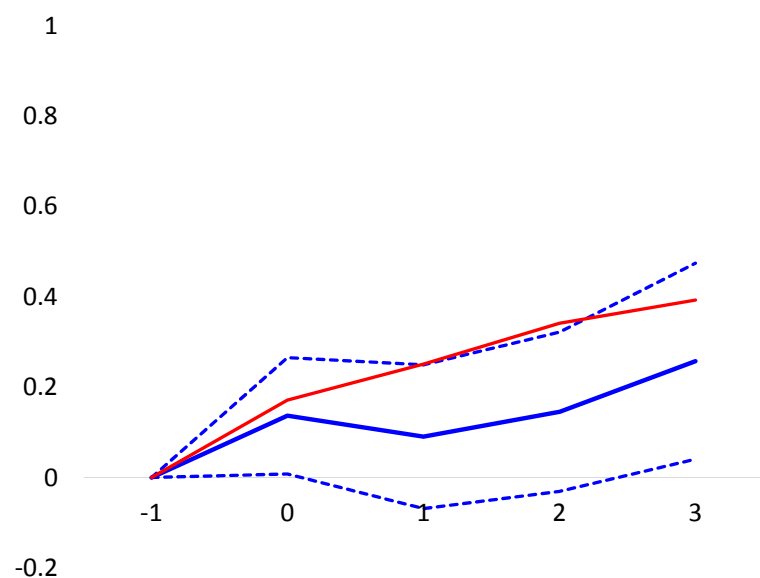
2. High Efficiency



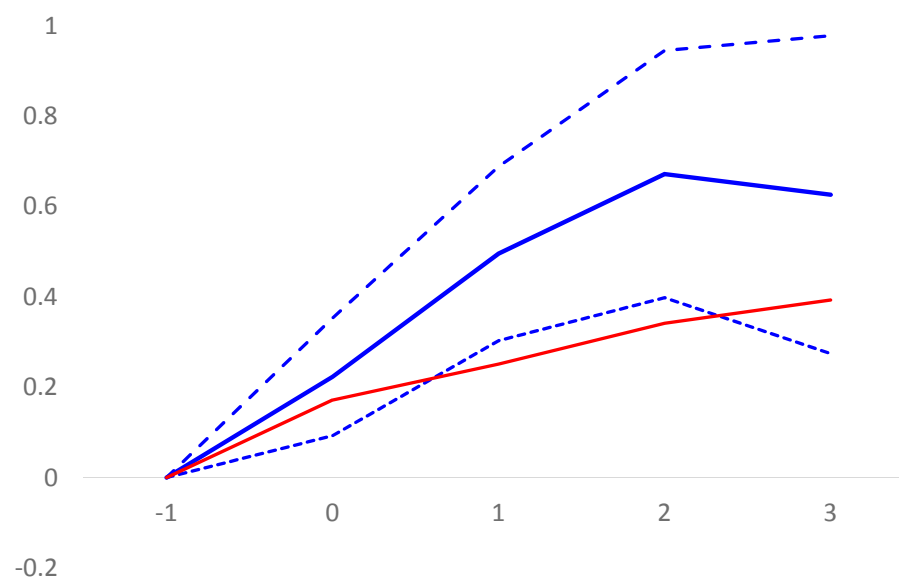
Note: $t=0$ is the year of the shock. Solid blue lines denote the response to an unexpected increase in public investment of 1 percent of GDP in countries with low (high) investment efficiency, and dashed lines denote 90 percent confidence bands. Solid red lines denote the unconditional response. Estimates based on equation (1) using local projection method (Jorda, 2005) for an unbalanced panel of 74 countries over the period 1990-2015. Efficiency based on the WEF measure of quality of infrastructure. Results robust using PIMI.

Output: the role infrastructure gaps

1. Low Infrastructure Gap



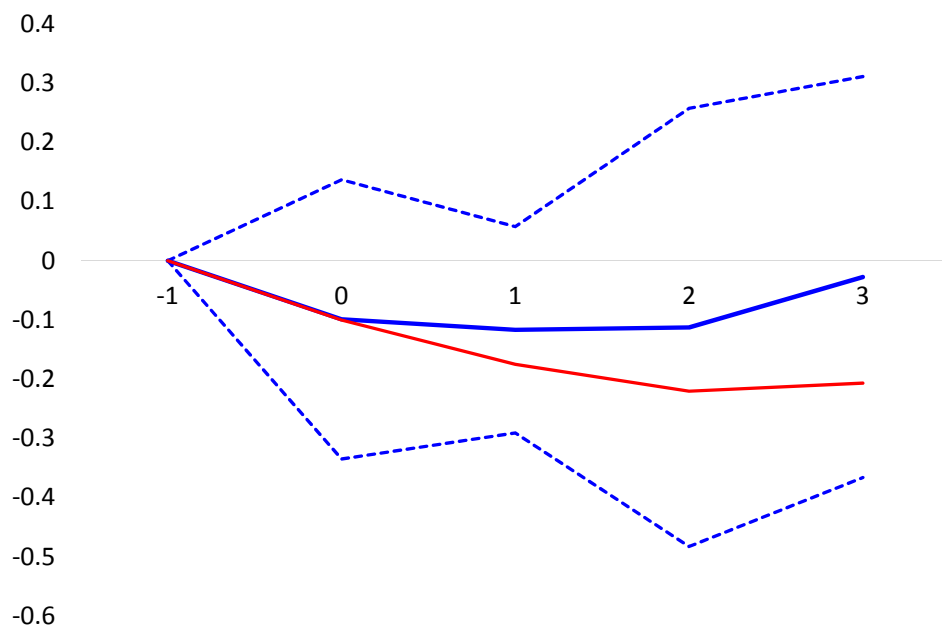
2. High Infrastructure Gap



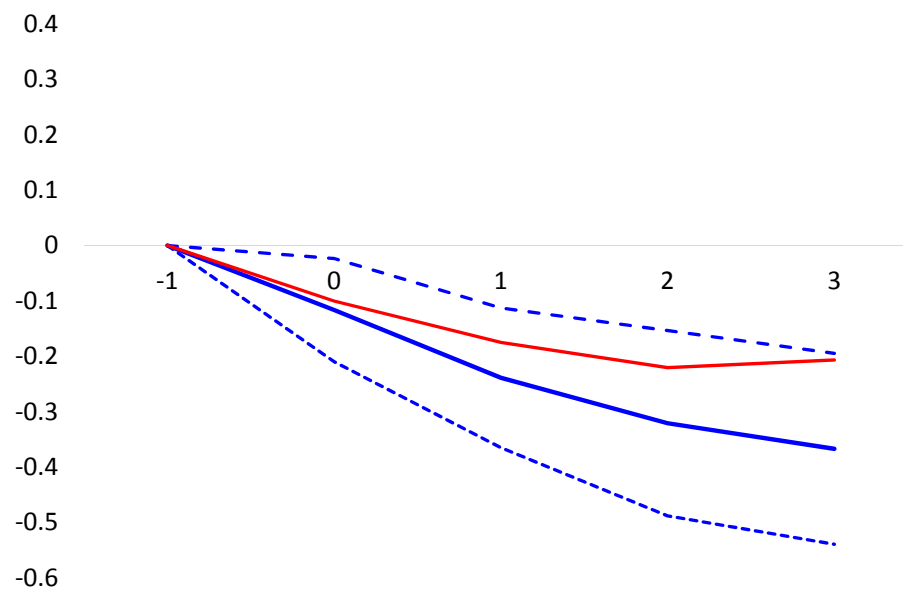
Note: $t=0$ is the year of the shock. Solid blue lines denote the response to an unexpected increase in public investment of 1 percent of GDP in countries with low (high) investment gap, and dashed lines denote 90 percent confidence bands. Solid red lines denote the unconditional response. Estimates based on equation (1) using local projection method (Jorda, 2005) for an unbalanced panel of 74 countries over the period 1990-2015. Gaps based on the WB measure of infrastructure impediment (electricity, similar results for transportation).

Inequality: the role of infrastructure gaps

1. Low Infrastructure Gap



2. High Infrastructure Gap



Note: $t=0$ is the year of the shock. Solid blue lines denote the response to an unexpected increase in public investment of 1 percent of GDP in countries with low (high) investment gap, and dashed lines denote 90 percent confidence bands. Solid red lines denote the unconditional response. Estimates based on equation (1) using local projection method (Jorda, 2005) for an unbalanced panel of 74 countries over the period 1990-2015. Gaps based on the WB measure of infrastructure impediment (electricity, similar results for transportation).

Conclusions

Public investment has a positive and long lasting effect on the level of output and productivity, and a reduces income inequality for EMDEs.

No evidence of crowding out private investment.

Macroeconomic response is shaped by:

- **Efficiency of public investment:** countries with greater efficiency of public investment get a bigger bang for their buck.
- **Infrastructure gap:** countries with greater infrastructure gap get higher output and inclusiveness effects from public investment.



Thank you