

# Public versus Private Investment Multipliers in EMDEs: Cross-Country Analysis with a Focus on Asia\*

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\* Work-in-progress. The usual disclaimer applies.

# Motivation 1/2

- **Investment (both private and public) is considered one of the key policy levers to foster economic growth, particularly in emerging market and developing economies (EMDEs), including Asia.**
- **Impact of investment on economic growth: transmission channels**
  - Short-term aggregate demand effects.
  - Supply-side effects via improved productivity of private capital and labor.
  - Crowding-in (or crowding-out) of public/private investment.
  - Efficiency and productivity of public/private investment.

# Motivation 2/2

- **Particular attention given to public investment. Why? Public Investment...**
  - ... in building and maintaining key infrastructure.
  - ... in education and healthcare contributes greatly to human capital development.
  - ... benefits technology and innovation.
  - ... can strategically address regional disparities.
  - in an era of climate change and natural disasters, public investment in disaster preparedness, environmental sustainability, and clean energy infrastructure is essential for long-term sustainable development.
  - ... acts as a catalyst for private sector development.
  - ... in social safety nets, healthcare, and education directly impacts poverty reduction by improving living the standards and creating opportunities for disadvantaged groups.
  - as Asian economies heavily rely on international trade, public investment in trade-related infrastructure, such as ports and logistics facilities, enhances a nation's ability to engage in global trade and attract FDI.

# Estimates of (public) spending multipliers

- Empirical estimates vary widely, most fall in the 0.6-1.0 range (Bom and Ligthart 2014; De Jong et al. 2017; Ramey 2019).
- Government investment multipliers tend to be larger than government consumption multipliers (Auerbach and Gorodnichenko 2013; Leduc and Wilson 2012; Eden and Kraay 2014).
- Heterogeneity stems from sensitivity to sample, methodology, state-dependence of multipliers.

# Main Questions

The main problem in performing such research rests in the difficulty of identifying changes in investment shocks that are uncorrelated with contemporaneous macroeconomic shocks and can be deemed as exogenous.

1 What is the impact of public and private investment on output growth?

2 What are the underlying channels? Crowding in/out, labor productivity and employment?

3 How do investment multipliers differ depending on business cycles, fiscal space, public investment efficiency, quality of infrastructure and institutional quality?

# Identification of Public Spending Shocks

- **Recursive identification in SVAR framework**-Blanchard and Perotti (2002), Ilzetzki et al. (2013).
- **Official lending as an instrument for exogenous public spending**-Kraay (2012) and Kraay (2014).
- **“Natural Experiment”** (Barro, 1981): **Military spending as an instrument for exogenous public spending**-Ramey and Shapiro (1998), Ramey (2011a, b), Ramey and Zubairy (2018).
- **Forecast errors of public spending**-Auerbach and Gorodnichenko (2012, 2013), Abiad et al. (2016), Furceri and Li (2017).



# Contributions

1

## **New measure of public and private investment shocks**

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- Based on large changes in cyclically-adjusted real spending

2

## **Global sample of countries**

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- Global sample of 98 EMDE including 20 Asian countries over a long-time span (1980-2021)
- Analysis of heterogeneous effects by EMDE and Asia subgroups

3

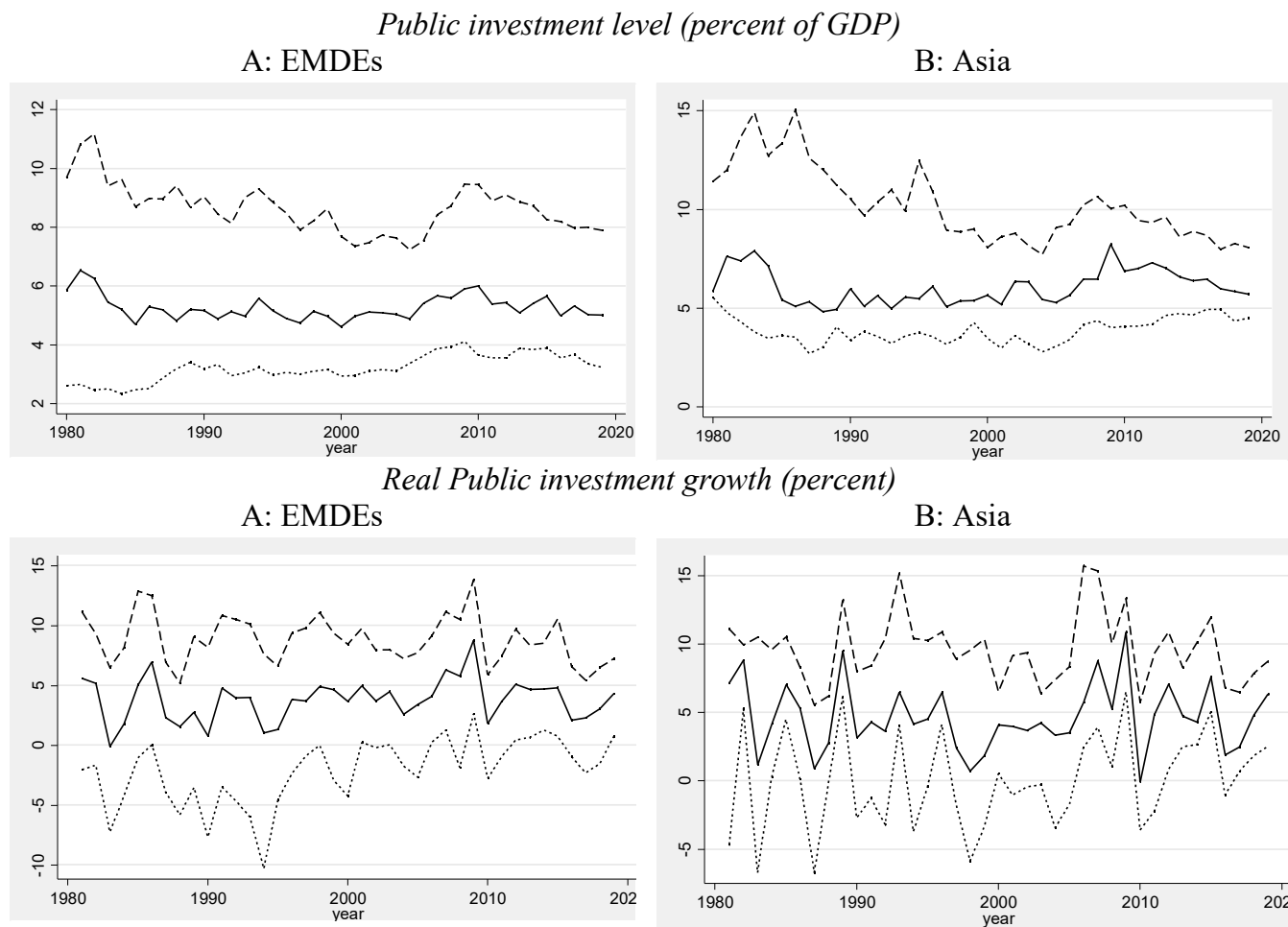
## **Estimation of state-dependent public investment multipliers and effects on private investment**

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- Dynamic effects are estimated via local projections (Jordà, 2005)
- Exploration of underlying channels
- State-dependent multipliers

# Stylized Facts (I)

Figure 1.a Public investment level (percent of GDP) and growth (percent), 1980-2019



- We observe that for EMDEs and Asian countries, public investment-to-GDP ratio has been relatively stable over time, with a median around 5 percent of GDP.
- There is, nonetheless, quite a large degree of heterogeneity as indicated by the wide top and bottom quartiles of the distribution.

Source: IMF Investment and Capital Stock Dataset; World Bank's WDI.

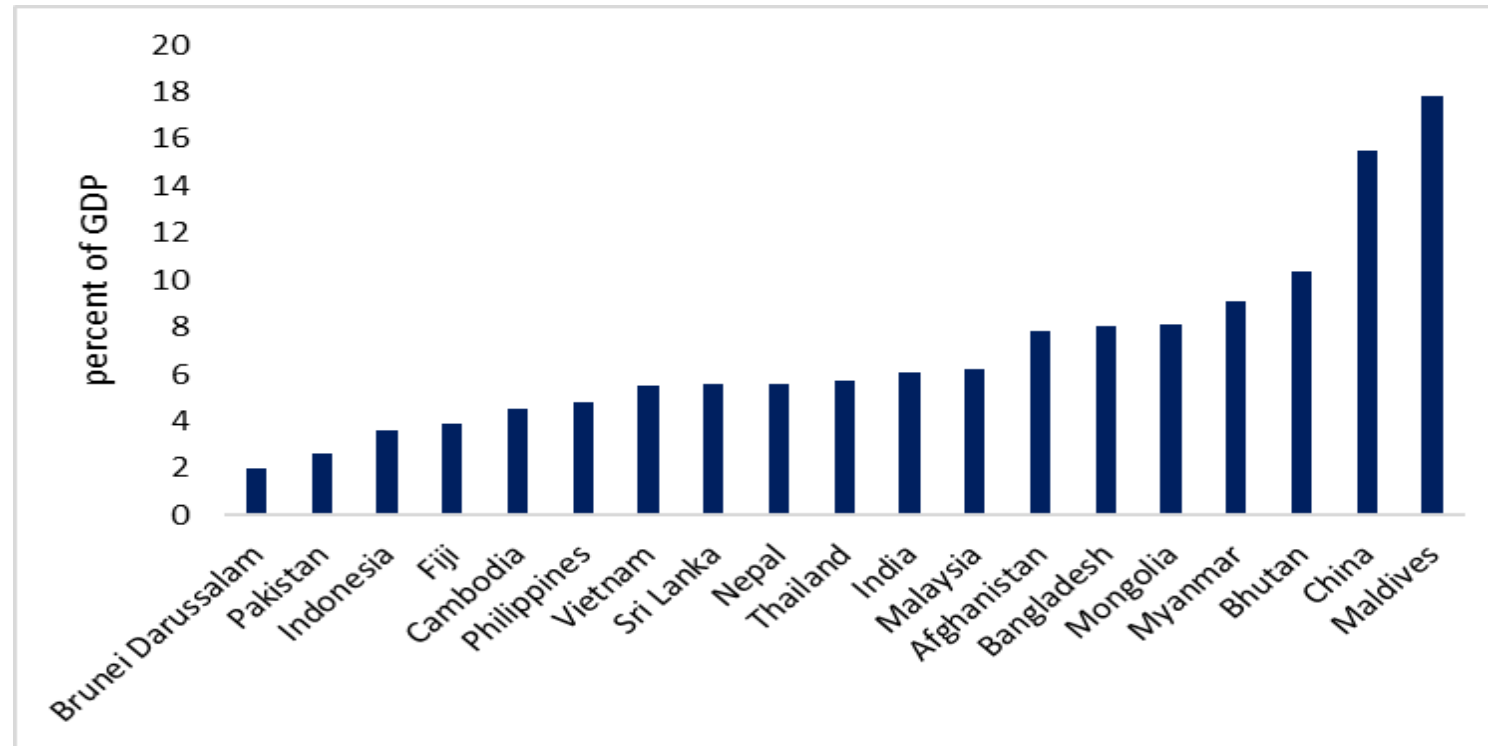
Note: Solid continuous lines denote the median value. Dashed lines indicate the interquartile ranges.



# Stylized Facts (II)

- Heterogeneity also visible when we zoom into the Asian region and observe large public investment ratios in Maldives or China and low ratios in Brunei or Pakistan.

**Figure 2. Public Investment in Asia by country (percent of GDP), 2019**



Source: IMF Investment and Capital Stock Dataset; World Bank's WDI.

# Methodology: Identification of Spending Shocks (I)

- New approach to measure spending shocks by constructing a measure of cyclically adjusted (real) public investment ( $CAP_{pubI}$ ) and cyclically adjusted (real) private investment ( $CAP_{priI}$ ).
- We get inspiration from the work of Alesina and Ardagna (1998, 2010) that assessed the effects of changes in cyclically adjusted fiscal variables on growth.
- Shock identification framework involves several steps:

**Step 1.** We estimate via OLS output elasticities of public and private investment for each country with at least 20 continuous observations. Real public investment and real private investment variables are used.

**Step 2.** Measures of potential output  $GDP^{pot}$  are obtained via a Hodrick-Prescott (HP) filter as the baseline estimate; Baxter-King, Christiano-Fitzgerald Random Walk and the Hamilton (2018) as a robustness check.

# Methodology: Identification of Spending Shocks (II)

**Step 3. Cyclically** adjusted real public investment ( $CAP_{pubI}$ ) and real private investment ( $CAP_{priI}$ ) are computed as follows:

$$CAP_{pubI} = PubI \left( \frac{GDP^{pot}}{real\ GDP} \right)^{\varepsilon_{PubI}} \text{ and } CAP_{priI} = PriI \left( \frac{GDP^{pot}}{real\ GDP} \right)^{\varepsilon_{PriI}}$$

where  $PubI$  is real public investment,  $PriI$  is real private investment,  $\varepsilon_{PubI}$  denotes the output elasticities of public investment and  $\varepsilon_{PriI}$  denote the output elasticities of private investment.

**Step 4.** Public investment (PubIS) and private investment (PriIS) shocks are defined as a variable taking the value of one when a country's first difference of  $CAP_{pubI}$  ( $CAP_{priI}$ ) exceeds its country-specific mean by one standard deviation:

$$PubIS = 1 \text{ if } \Delta CAP_{pubI}_{it} > \overline{\Delta CAP_{pubI}_i} + SDCAP_{pubI}_i, \text{ 0 otherwise}$$
$$PriIS = 1 \text{ if } \Delta CAP_{priI}_{it} > \overline{\Delta CAP_{priI}_i} + SDCAP_{priI}_i, \text{ 0 otherwise}$$

# Methodology: Identification of Public Spending Shocks (II)

**Step 5.** Focus on large fiscal adjustments in the spirit of Alesina and Ardagna (1998, 2010). *[They argue that looking at relatively large fiscal adjustments helps identify changes in fiscal variables that are policy-induced, rather influenced by the business cycle.]*

Our approach also makes our results more robust to any imperfections in measuring the effect of the cycle on fiscal variables, as small changes in cyclically adjusted fiscal variables are excluded from the econometric analysis.

In addition to the binary shock variable, we use 2 versions of continuous shocks as robustness:

> *shocks based on the growth rate of the CAPubl and CAPril ;*

> *shocks based on the yearly changes in the CAPubl and CAPril expressed in percent of GDP (winsorized to account for outliers).*

# Methodology: Estimation of Public Spending Multipliers

- Local projections (LPs) - Jordà (2005) – are used to obtain impulse-response functions (IRFs).

## Baseline specification:

$$\Delta \log y_{i,t+h} = \alpha_{i,h} + \delta_{t,h} + \sum_{j=0}^5 \beta_{j,h} d_{i,t-j} + \sum_{l=0}^4 \beta_{l,h} (\log y_{i,t-l} - \log y_{i,t-1-l}) + \sum_{h=1}^h \beta_h d_{i,t+h} + \sum_{c=0}^1 \beta'_{c,h} X_{i,t-c} + u_{i,t+h} \quad (1)$$

in which  $y$  is the dependent key economic variable of interest;  $\beta_j$  denotes the (cumulative) response of the variable of interest in each  $h$  year after the public and private investment shocks;  $\alpha_i, \delta_i$  are country and time fixed effects;  $d_{i,t}$  denotes the public or private investment shocks PubIS or PriIS;  $X_{i,t}$  is a set of control variables. Treatment lags are included to capture the effect that previous shocks may have on the outcome variable. We use the AIC to determine the lag length. The term  $\sum_{h=1}^h \beta_h d_{i,t+h}$  captures the Teulings and Zubanov (2014)

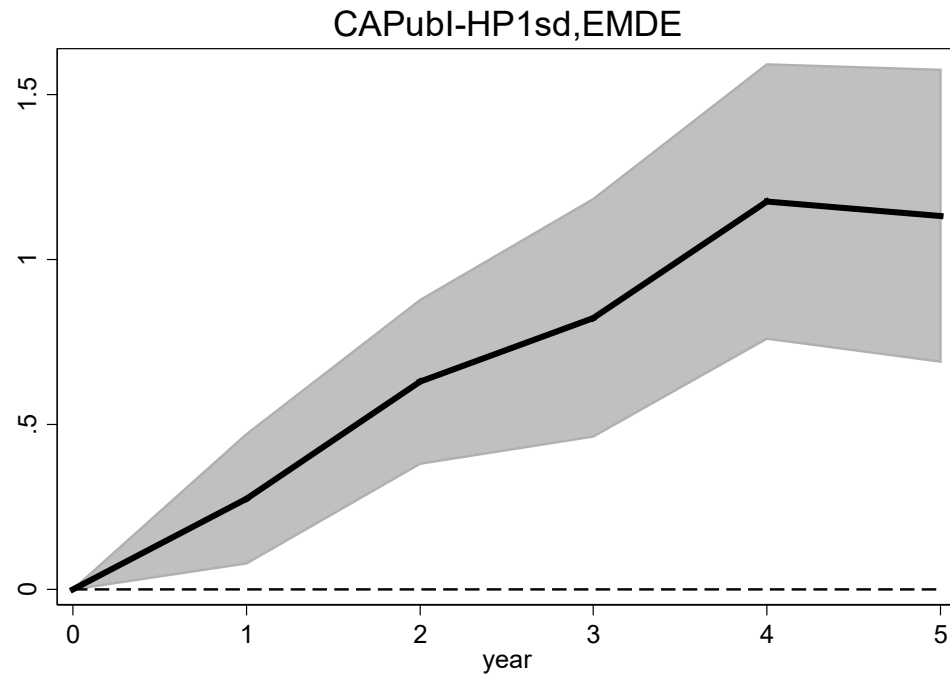


# Spending Multipliers (EMDE Sample)

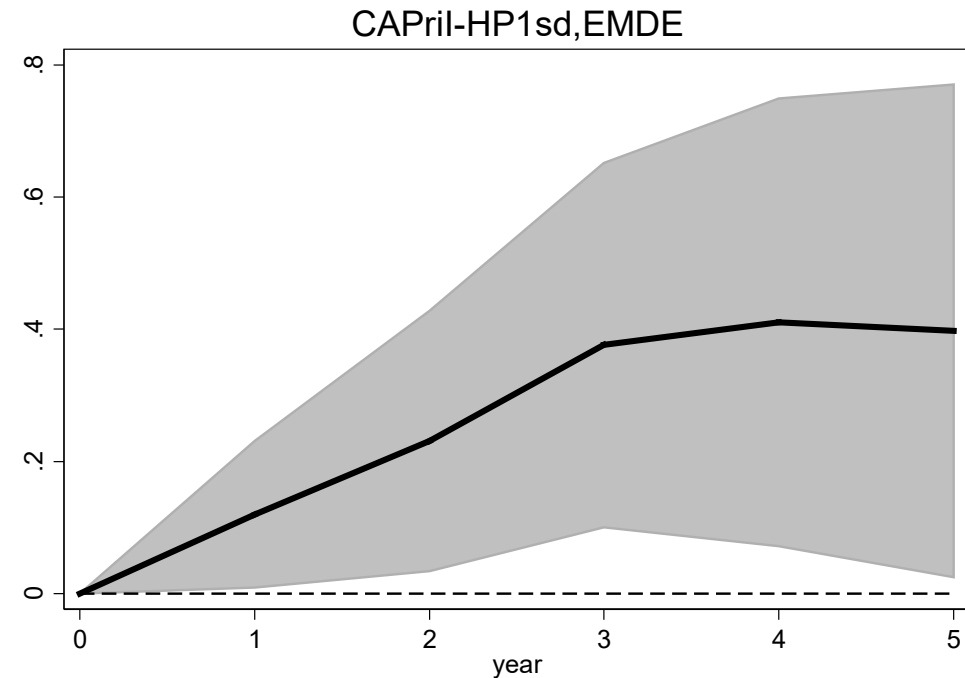
*Public and private investment shocks lead to highly statistically significant growth responses with a larger effect stemming from the former*

## Growth effects of public and private investment shocks in EMDE

*Public Investment*



*Private investment*



The binary shocks are scaled by the average ratio of public (or private) investment to GDP of the shock sample to provide a scale in the IRFs and a more direct interpretation. The IRFs can then be interpreted as the effect of a one-percent-of-GDP unanticipated increase in public (private) investment on real GDP growth.

# Spending Multipliers in Asia vs Latin America

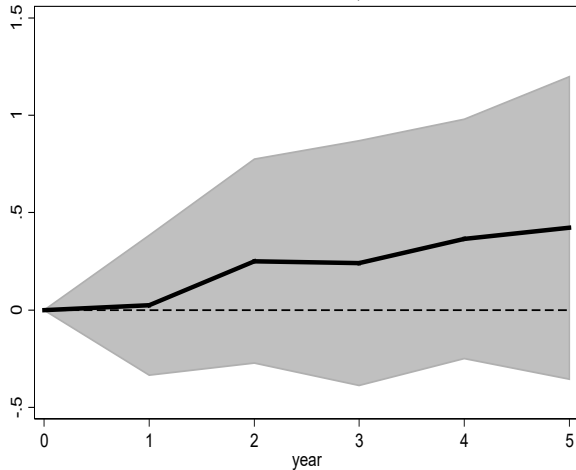
*Public investment shocks lead to highly statistically significant growth responses*

Growth effects of public investment shocks by EMDEs country group

Growth effects of private investment shocks: by EMDEs country group

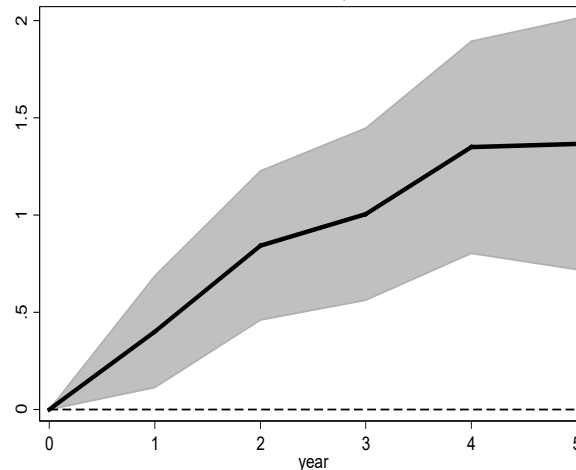
E. Asia

CAPubl-HP1sd,Asia



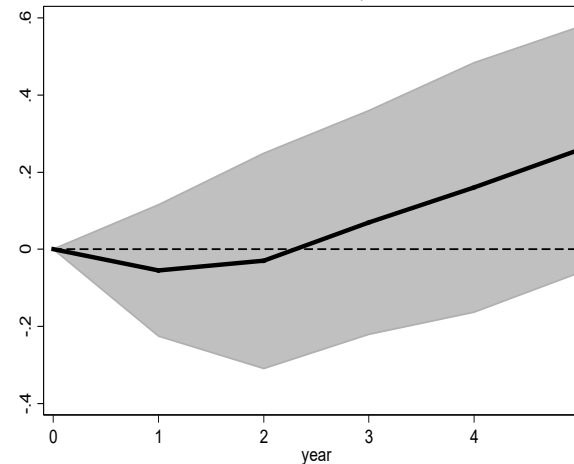
F. Latin America

CAPubl-HP1sd,Latam



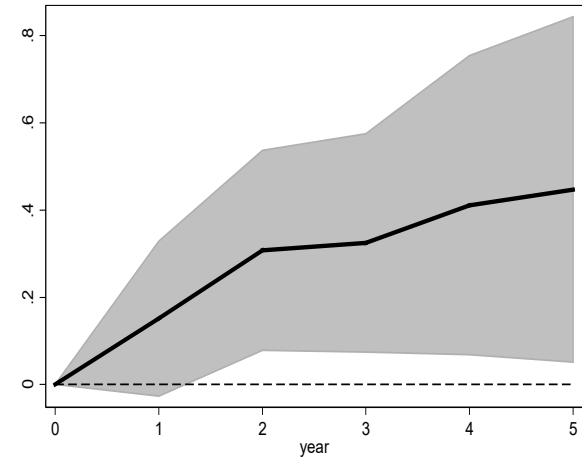
E. Asia

CAPrvtl-HP1sd,Asia



F. Latin America

CAPrvtl-HP1sd,Latam



South Asia region seems to yield a positive growth response from public investment shocks from year two with relatively strong and permanent effects. In contrast, what seems to be driving the whole regional result is the East Asia and Pacific region whose growth effect is on average zero.

# Main Questions

- 2 What are the underlying channels? Crowding in/out, labor productivity and employment?





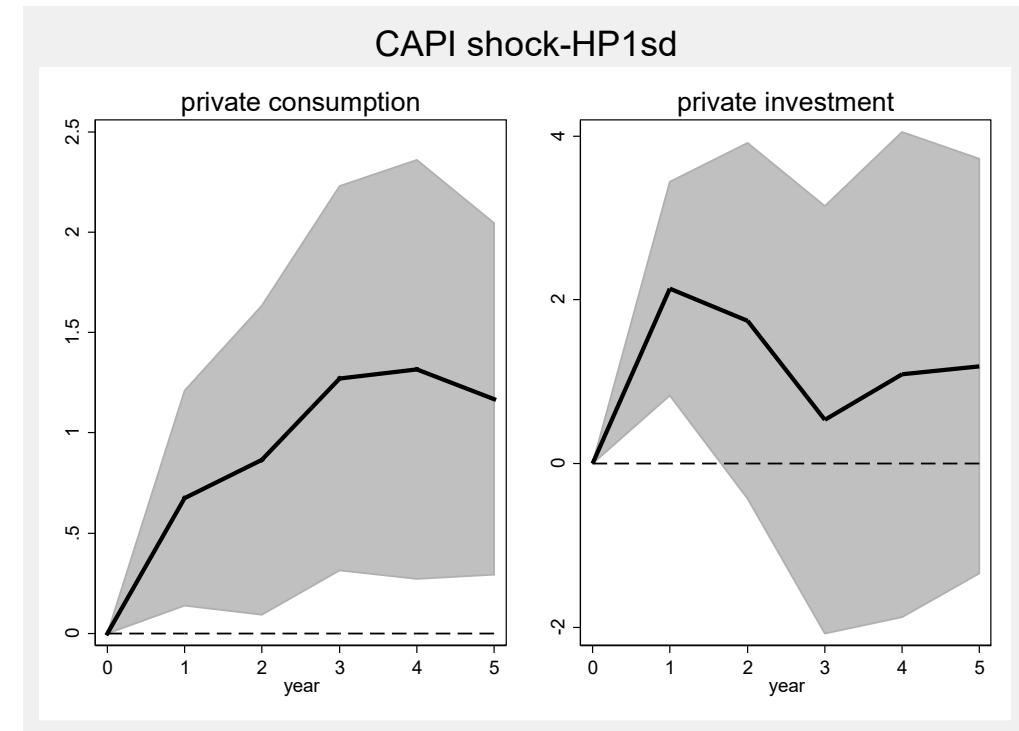
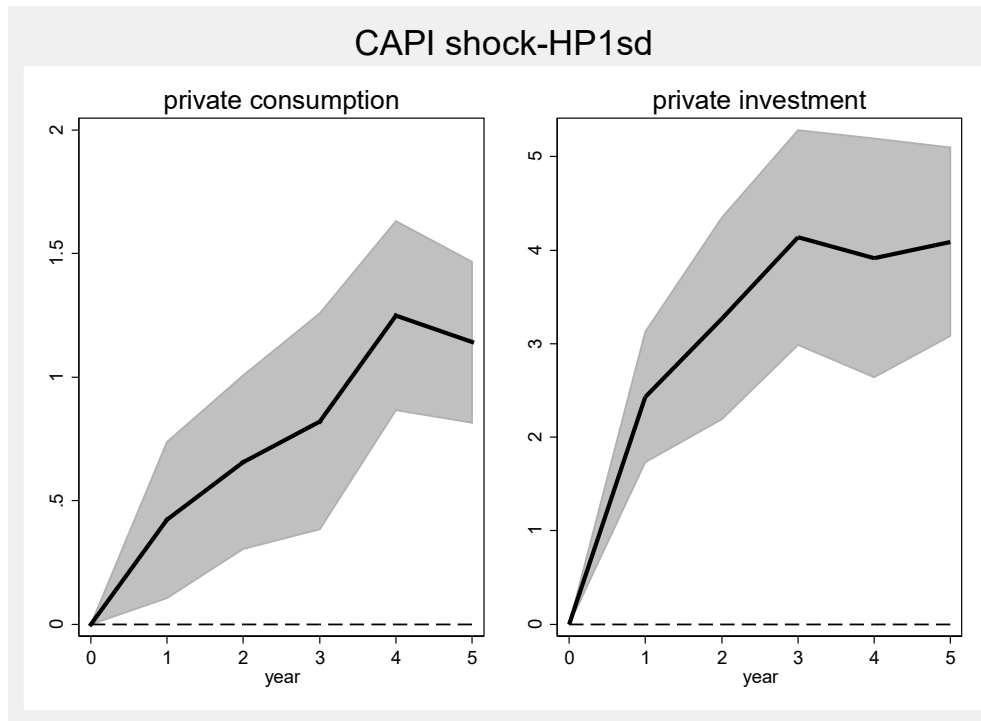
# Channels: Crowding-in/out

*Public investment shocks in EMDE and Asian samples crowd-in private investment and private consumption*

**Effects of public investment shocks on private investment and consumption (percent)**

EMDE

Asia

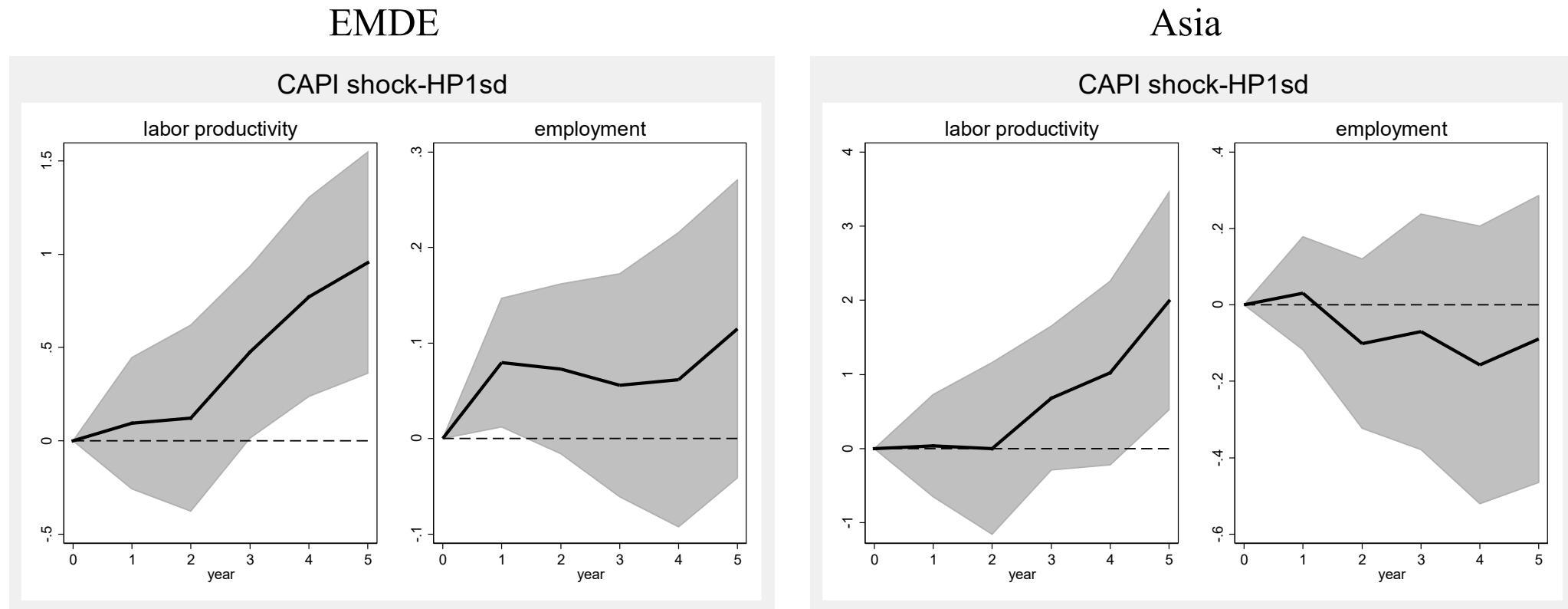


The positive effects are especially strong in the case of private investment in EMDEs while being smaller and shorter lived for Asia.

# Channels: Productivity and Employment

*Public investment shocks lead to a rise in employment in the very short term while productivity follows slightly later*

**Effects of public investment shocks on labor productivity and employment (percent)**



Zooming in on Asia, the effect from public investment shocks on productivity is similar in shape to that of EMDEs but with a larger magnitude (twice as big after 5 years). The employment effect is on average zero in the region.

# Empirical Results: Robustness checks

- **Sensitivity checks for public spending shock parameterization** - alternative threshold levels for shock identification and the Baxter-King, Christiano-Fitzgerald Random Walk, and Hamilton filters instead of the HP filter.
- **Sensitivity to country time trends**
- **Sensitivity to alternative lag/lead parametrization**
- **Omitted variables.** augmented to include episodes of fiscal consolidations as additional control variables; adding country-specific time trends; augmented by additional covariates that may affect real GDP, including real exchange rates, terms of trade, short-term interest rate etc. (see, for instance, Barro 2003; Barro and Sala-i-Martin, 1995).
- **Controlling for growth expectations-** source of potential endogeneity is that public and private investment programs may be implemented because of concerns regarding future economic growth.

# Main Questions

- 3 How do investment multipliers differ depending on business cycles, fiscal space, public investment efficiency, quality of infrastructure and institutional quality?



# Methodology: Augmented specification for state-dependent spending multipliers

- IRFs are allowed to vary according to a continuous function  $F(z_{it})$ , as follows (simplified version of 1)):

$$y_{i,t+k} - y_{i,t-1} = \alpha_i + \tau_t + \beta_k^L F(z_{i,t}) d_{i,t} + \beta_k^H (1 - F(z_{i,t})) d_{i,t} + \boldsymbol{\theta} \mathbf{X}_{i,t} + \varepsilon_{i,t}$$

$$\text{with } F(z_{i,t}) = \frac{\exp(-\gamma z_{i,t})}{1 + \exp(-\gamma z_{i,t})}, \quad \gamma > 0.$$

in which  $z_{i,t}$  is the value of a conditioning variable, normalized to have zero mean and unit variance. The coefficients  $\beta_k^L$  and  $\beta_k^H$  capture the output impact of investment shocks at each horizon  $k$  for the state characterized by low values of a conditioning variable ( $F(z_{i,t}) \approx 1$  when  $z$  goes to minus infinity) and the state characterized by high values of a conditioning variable ( $1 - F(z_{i,t}) \approx 1$  when  $z$  goes to plus infinity).

# Conditioning Variables

- business cycle: using the output gap.
- fiscal space: the need for support to economic activity in the aftermath of the COVID-19 crisis presents a painful reminder of the importance of a government's ability to implement effective fiscal stimulus. This ability is predicated on the availability of fiscal space. From Kose et al. (2022) Fiscal Space Database.
- public sector efficiency: a country's macroeconomic performance is, in part, dictated by the size of its public sector and its efficiency. It is important to evaluate how public sector efficiency affects the public spending multipliers. This issue is even more relevant for governments that face strict government budget constraints and low growth prospects in the post-pandemic era, while public and institutional scrutiny in using public money is especially high. From IMF (2021).
- quality of infrastructure: this aspect will explore the marginal productivity of investment. From the Global Quality of Infrastructure Index (GQII) 2023.
- Institutional Quality: when institutions are strong, public investment is more likely to be directed toward projects with the highest potential for growth, rather than being siphoned off by corruption or wasted on inefficient projects. From World Bank CPIA and Corruption Perceptions Index (CPI) from Transparency International.

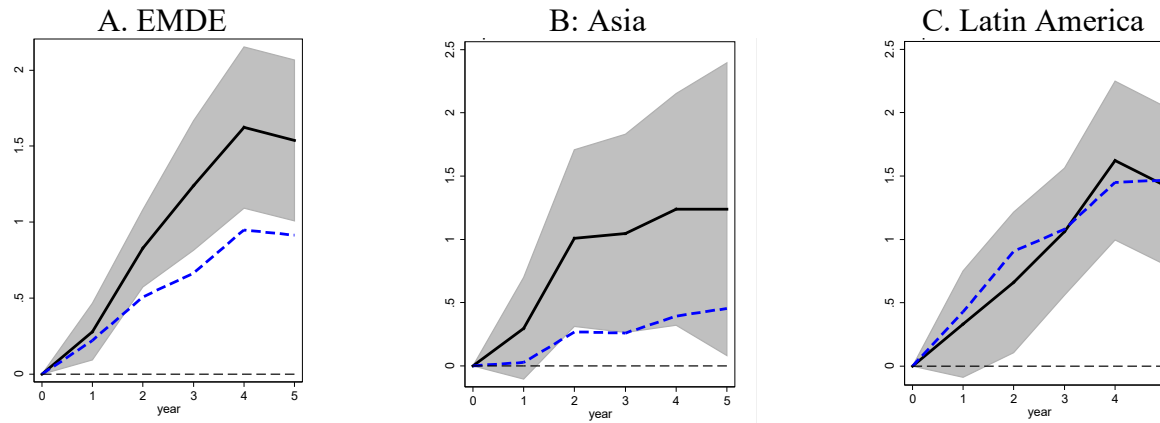


# Investment Multipliers Conditional on Business Cycle

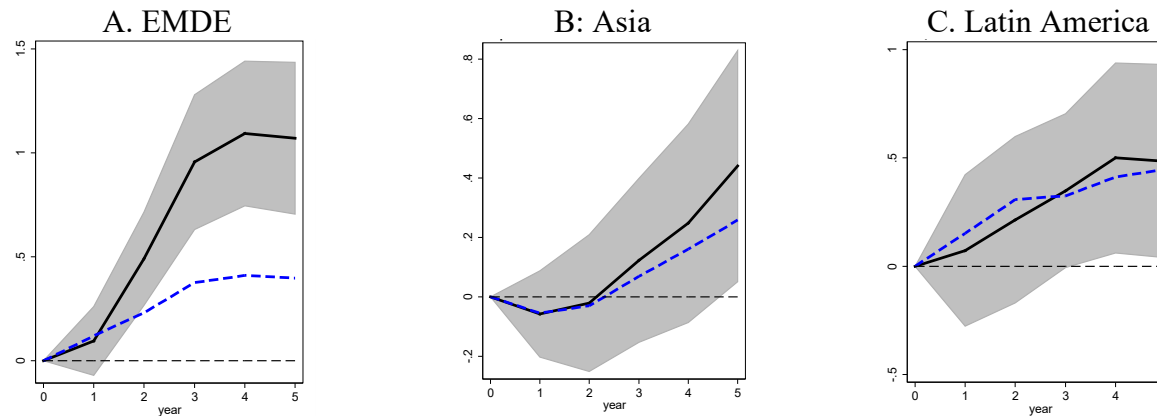
*Response of economic growth to investment shocks is positive and much stronger in recessions relative to economic expansions.*

**Growth effects of public and private investment shocks in EMDEs, Asia and Latin America conditional on business cycle (percent)**

*Public Investment shocks in recessions*



*Private Investment shocks in recessions*



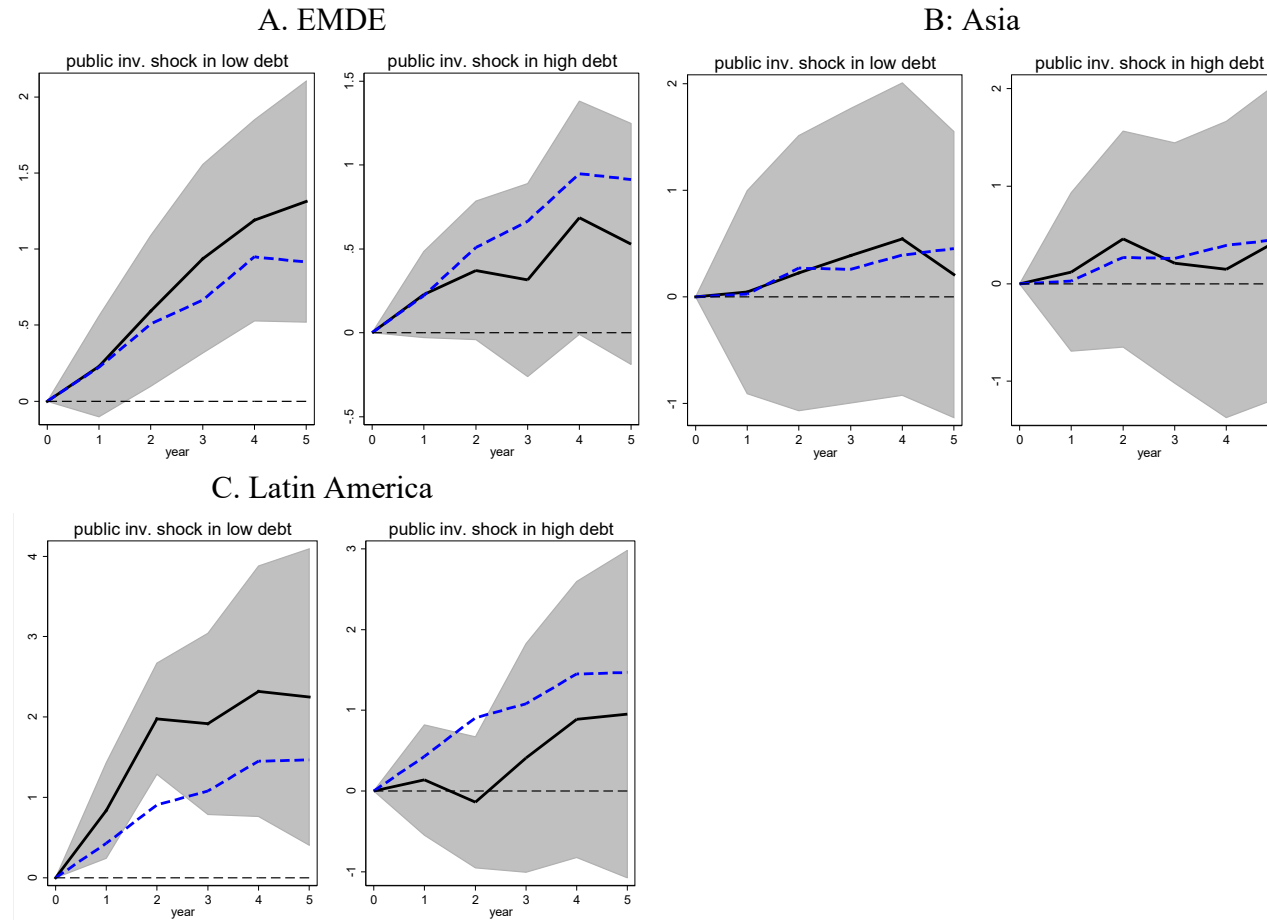
Fiscal multipliers tend to be larger during recessions - meta-analysis by Gechert and Rannenber (2018). According to Ramey (2019) the estimates of higher multipliers in recessions (above one) may not be robust on account of their sensitivity to sample composition and methodology.



# Investment Multipliers Conditional on Fiscal Space

*EMDEs with more fiscal space enjoy substantially higher multipliers for public investment shocks.*

Growth effects of public investment shocks in EMDEs, Asia and Latin America conditional on fiscal space (percent)



In countries with high debt, public spending multipliers are insignificant or even negative (Ilzetzi et al. 2013; Huidrom et al. 2020). Two transmission channels are at work (Blanchard, 1990): the wealth effects on consumption, and the interest rate effect.

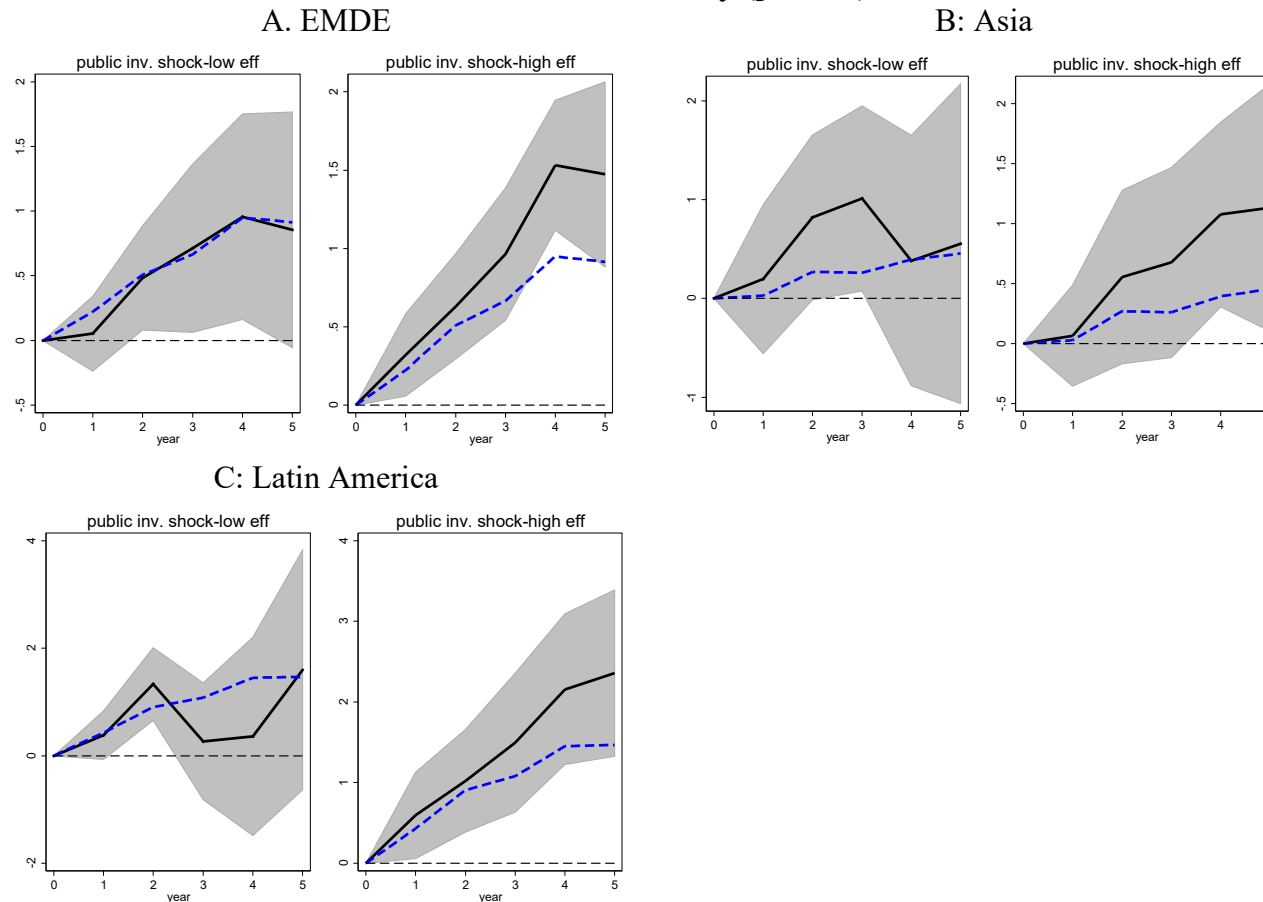




# Public Investment Multipliers Conditional on Investment Efficiency

*Public spending multipliers are statistically significant only in the case of high-public investment efficiency countries*

Growth effects of public investment shocks in EMDEs, Asia and Latin America conditional on investment efficiency (percent)

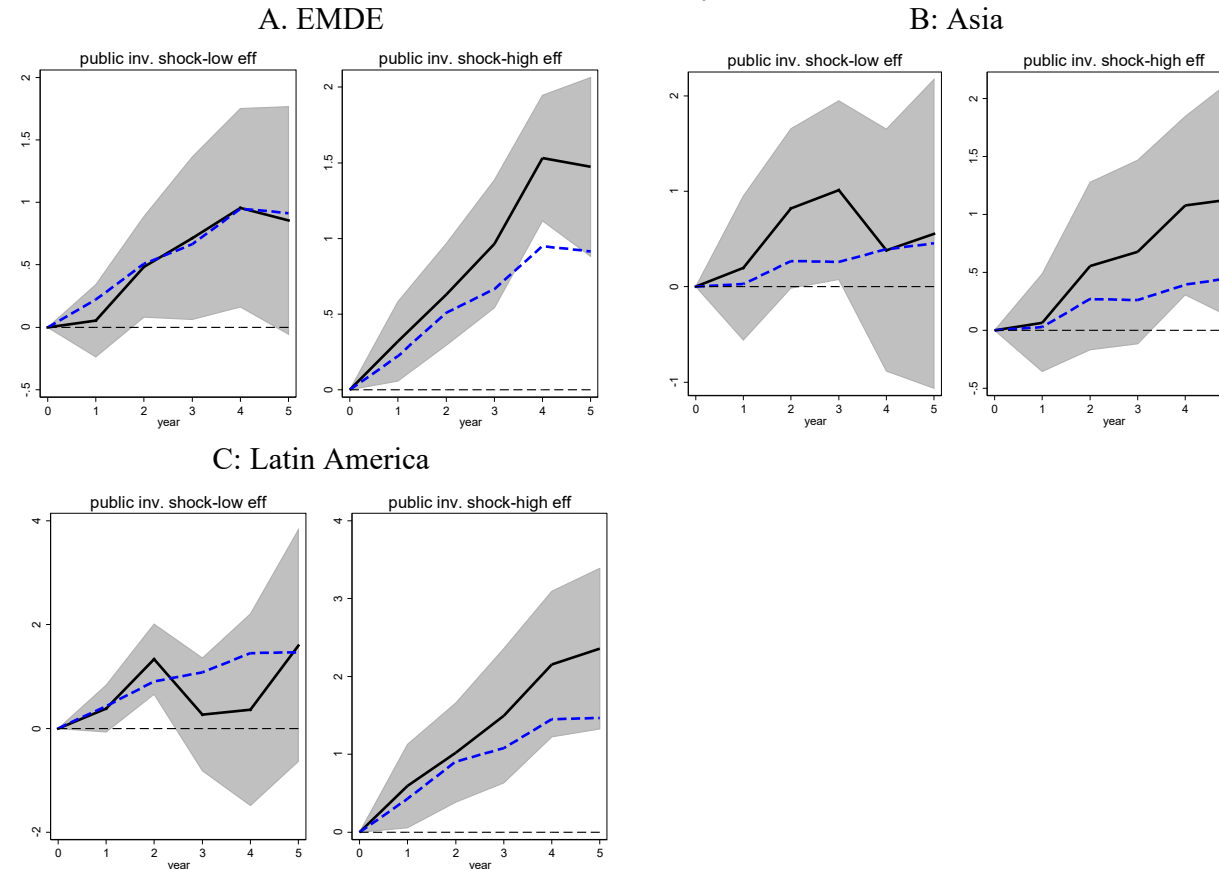


Favorable supply-side effects of public investment are only realized in countries where public investment is efficient (Leeper et al. 2010; Cavallo and Daude, 2011, Furceri and Li, 2017).

# Public Investment Multipliers Conditional on Infrastructure Quality

*Growth effect of public investment shocks is larger and statistically significant in countries with lower infrastructure quality.*

Growth effects of public investment shocks in EMDEs, Asia and Latin America conditional on investment efficiency (percent)



In economies with poor infrastructure, as in many EMDEs, investment in basic infrastructure in countries with lower quality infrastructure directly contributes to fulfilling basic needs like water supply, sanitation, and electricity. This not only improves the quality of life but also boosts economic productivity and growth.

# Summary: Questions and Answers

1

**What is the impact of public investment on output growth?** *Scaling up of public investment leads to significant real output growth effects, and so does private investment to a lesser extent.*

2

**What are the underlying channels? Crowding in/out, labor productivity and employment?** *Public investment shocks crowd-in private investment and private consumption.*

3

**Is there evidence of state-dependent investment multipliers?** *Yes! Potency of multipliers is larger during recessions, in countries with high public investment efficiency and lower infrastructure quality and when corruption is low.*

# What do our results mean for Asia?

- *Within Asia, we do observe a positive growth response to public investment shocks South Asia, in contrast with East Asia where there is no growth effect. One possible explanation is that the returns to public investment in infrastructure is higher in South Asia, which has an under-developed infrastructure compared to East Asia.*
- *In Asia, there is a positive and significant medium-term private investment multiplier for highly indebted countries. This findings strengthens the case for expanding fiscal space during upturns to secure policy flexibility in responding to downturns.*
- *The effect of public investment in Asia in recessions is positive and significant.*
- *While results for Asia are surrounded by greater uncertainty, we still uncover a stronger fiscal multiplier in the medium-term for countries with higher efficiency.*
- *Low corruption increases public investment multipliers in Asian countries.*

***Thank you for your attention!***

**Questions and Comments**

# Extra slides

# Literature Overview

- **Literature on government spending multipliers** (Owyang et al. 2013; Ramey 2011; Auerbach and Gorodnichenko 2013; Gechert and Rannenberg 2018; Barnichon et al. 2022):
  - Government investment multipliers tend to be larger than government consumption multipliers (Auerbach and Gorodnichenko 2013; Leduc and Wilson 2012; Eden and Kraay 2014); yet estimates vary widely (Bom and Ligthart 2014; De Jong et al. 2017).
  - Heterogeneity of the estimates may be associated with **economic development level** and sample composition (Abiad et al. 2016; Furceri and Li 2017; Miyamoto et al. 2020), **business cycle** (Auerbach and Gorodnichenko 2013; Riera-Crichton et al. 2015), **exchange rate flexibility** (Ilzetzki et al. 2013), **debt level** (Ilzetzki et al. 2013; Huidrom et al. 2019), **monetary policy stance** (Christiano et al. 2011; Coenen et al. 2013), **openness to trade** (Gonzalez-Garcia et al. 2013), **public investment efficiency** (Dabla-Norris et al. 2011; Izquierdo et al. 2018).