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Public versus private investment multipliers in emerging market and developing economies: Cross-country analysis with a focus on Asia

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PUBLIC VERSUS PRIVATE INVESTMENT MULTIPLIERS IN EMERGING MARKET AND DEVELOPING ECONOMIES

CROSS-COUNTRY ANALYSIS WITH A FOCUS
ON ASIA

João Tovar Jalles, Donghyun Park, and Irfan Qureshi

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ABSTRACT

This paper analyzes the growth impact of public and private investment shocks based on a large sample of emerging and developing countries over the period 1980–2021 with a particular focus on the Asian region. We develop new measures of investment shocks based on cyclically adjusted investment data. Estimations using local projections suggest that public investment shocks play a much greater role in boosting economic growth in comparison with private investment shocks. In emerging market and developing economies (EMDEs) (including in Asia), the growth response to investment shocks is positive and much stronger in recessions relative to economic expansions. Finally, public investment shocks in EMDE and Asian samples crowd-in private investment and private consumption.

Keywords: fiscal multipliers, public investment, private investment

JEL codes: C33, E22, H30, H50

1. Introduction

Public investment is considered one of the key policy levers to foster economic growth, particularly in emerging market and developing economies (EMDEs), as it plays a vital role in developing infrastructure, such as roads and utilities, which is critical for reducing transaction costs and improving efficiency (World Bank 2017). It also addresses the market failure of under-investment in areas where the private sector may hesitate to invest due to high risks or low private returns. Moreover, government investment in health, education, and social services is pivotal for building human capital, a key ingredient for a productive workforce and sustainable economic growth.

On the other hand, private investment is driven by profit motive, with efficiency and innovation leading to enhanced productivity and competitiveness. Private investment in new ventures and expansion projects creates jobs and increases incomes, which, in turn, stimulate further consumption and investment. Additionally, private investment plays a significant role in the development of financial markets, improving access to finance and fostering more investments. De Gregorio (1992) has shown its positive impact on economic growth through mechanisms like capital accumulation and efficiency gains.

Against this backdrop, it is not surprising that a large economic literature has emerged to evaluate the macroeconomic effects of investment in general and public investment in particular. First, public investment in building and maintaining key infrastructure such as roads, bridges, ports, airports, and energy facilities is essential. This infrastructure reduces transportation costs, improves connectivity, and enhances the overall business environment. For example, the extensive high-speed rail network

expansion of the People's Republic of China (PRC) has not only improved connectivity but also spurred economic activity across the country (Liu, Niu, and Han 2019).

Second, public investment in education and healthcare contributes greatly to human capital development. Such investments enhance the quality and productivity of the workforce, contributing to economic growth (Hanushek and Woessmann 2012). Public investments in education played a major role in fostering a highly skilled labor force and innovation in highly successful Asian countries such as the Republic of Korea.

Third, public investment benefits technology and innovation. Governments across Asia have recognized the importance of supporting technology-intensive industries through research grants and subsidies (Asian Development Bank [ADB] 2018). This approach helped countries such as Singapore become global technology hubs.

Fourth, public investment can strategically address regional disparities. By promoting the development of less-developed areas, it can alleviate poverty, stimulate economic activity, and reduce rural-to-urban migration (World Bank 2016). For instance, India's investment in rural infrastructure and employment generation programs aims to address regional imbalances.

Fifth, in an era of climate change and disasters, public investment in disaster preparedness, environmental sustainability, and clean energy infrastructure is essential for long-term sustainable development. Asian economies increasingly acknowledge the importance of investing in renewable energy sources and climate resilience measures (ADB 2017).

Sixth, public investment acts as a catalyst for private sector development. Governments can invest in vital infrastructure or provide incentives for private firms,

encouraging them to invest, expand, and create jobs (Woo and Kumar 2015). This synergy between public and private investment can be a powerful driver of economic development.

Seventh, public investment in social safety nets, healthcare, and education directly impacts poverty reduction by improving living standards and creating opportunities for disadvantaged groups (Kose et al. 2017). Programs like conditional cash transfers in countries like Indonesia and the Philippines have demonstrated the poverty-reduction potential of public investment.

Finally, 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 foreign investment (ADB 2018). Examples include the development of export-processing zones in Bangladesh and the PRC.

The empirical estimates of public investment multipliers reported to date, however, differ significantly, depending on the sample of countries and timeline investigated, estimation methodology, incorporation of non-linear effects, and fiscal shock identification strategies (Section 2). The main problem in performing such research rests in the difficulty of identifying exogenous changes in public spending that are uncorrelated with contemporaneous macroeconomic shocks.

Considering these caveats, we aim to contribute to this literature in several ways. First, we use updated data on public (and private) investment covering a large sample of 98 EMDEs, including 20 Asian economies, over a long-time span, from 1980 to 2021. Previous generalizations of research that only looked at samples of emerging market economies to “developing countries” were misleading. Our results are thus based on a

broader, more heterogeneous sample of countries and over a longer time span compared to previous studies, which either focused on specific geographical regions, single countries, or over shorter and less recent time horizons. Inter alia, our broader sample allows us to explore heterogeneity across EMDEs. Second, we introduce a new approach to measuring spending shocks for public (and private) investment. Under this approach, we construct a measure of cyclically adjusted real public investment (CAPubl) and cyclically adjusted real private investment (CAPrnl). Spending shocks can then be measured as large deviations from the variation in these variables.

After identification of the investment shocks, we use the local projections approach of Jordà (2005) to trace out the short- and medium-run responses of real gross domestic product (GDP). Analyses based on local projections indicate that public investment shocks enhance economic growth significantly more than private investment shocks. In EMDEs, particularly in Asia, the impact of investment shocks on growth is more pronounced and positive during downturns than upturns. Moreover, in EMDEs overall and especially Asian EMDEs, public investment shocks tend to stimulate both private investment and consumption.

The rest of the paper is structured as follows. Section 2 reviews the empirical literature, with an emphasis on cross-country studies discussing the association between public and private investment shocks and macroeconomic conditions. Section 3 presents the framework for the identification of public and private investment shocks, discusses the data and estimation methodology, and compares our approach to that of previous scholarly work. Section 4 reports the stylized facts while Section 5 presents the empirical results. Section 6 concludes.

2. Literature Review

The research on government spending multipliers and, more generally, fiscal multipliers, is voluminous (Batini et al. 2014; Galí 2020; Ghassibe and Zanetti 2022; Barnichon, Debortolo, and Matthes 2022). Our paper is most closely related to the literature that estimates government spending multipliers for public investment.¹ While estimates vary from study to study, there appears to be an emerging consensus that public investment multipliers are larger than public consumption multipliers, owing to the former's positive impact on the productivity of labor and private capital, as well as the productive capacity of the economy over the medium term.

In this respect, and consistent with this line of argument, the early literature on the impact of public investment on economic growth was modeled in the context of the endogenous growth framework in Barro (1990), Barro and Sala-i-Martin (1992), Futagami, Morita, and Shibata (1993), Glomm and Ravikumar (1994), and Turnovsky (1997).² The implications of public investment for growth and development have also been modeled with more complex impact channels, including models incorporating foreign aid and aid-funded public investment (Adam and Bevan 2006; Cerra, Tekin, and Turnovsky 2008; Berg, Gottschalk, et al. 2010; Berg, Mirzoev, et al. 2010; Chatterjee and Turnovsky 2007), infrastructure networks (Agénor 2010), and public debt accumulation (Buffie et al. 2012; Greiner, Semmler, and Gong 2005; Greiner 2007), and dynamic

¹ Furceri et al. (2022), for example, use projections from IMF World Economic Outlook publications to measure public investment shocks as the difference between the growth rate of actual real public investment and the rate from analysts' forecast as of October of the same year.

² See also Gramlich (1994) for a review of the earlier literature on public investment and its macroeconomic implications.

stochastic general equilibrium (DSGE) models that endogenize public sector inefficiencies (Ganelli and Tervala 2020).

The growing availability of data has facilitated the surge in empirical studies investigating the investment-growth nexus. Pereira and Andr  z (2013), Romp and De Haan (2007) and Bom and Ligthart (2014) provide comprehensive overviews of the literature estimating the growth effects of public investment. Bom and Ligthart (2014) report that the estimates of the output elasticity of public capital range widely, from -1.7 to 2.04 , with the average elasticity value of 0.106 . In a large sample of 102 developing countries over the period 1970–2010, Kraay (2014) find that the 1-year spending multiplier is reasonably precisely estimated to be around 0.4 . Related, Gbohoui (2021) investigate how increases in public investment have larger and longer-lasting effects on output, investment, and employment, with multipliers above 2 during periods of high uncertainty.

The empirical literature on public investment multipliers in EMDEs is more limited but also finds significant growth impacts of public investment in the short and medium run (Furceri et al. 2022, Miyamoto et al. 2020). Ramey (2019) reviews estimates of fiscal multipliers in the literature, mostly for advanced economies, and reports that they tend to fall in the range of 0.6 to 1 . Despite heterogeneity in estimation methods across studies, De Jong et al. (2017) note several common results. First, public capital contributes positively to output, with a relatively stronger impact of core infrastructure such as roads, railways, and telecommunications. Second, the aggregate country-level impact of public investment is strong in comparison with intra-country regional impacts, implying significant spillover and network effects across regions of a country. Third, the impact of

public capital on growth may decline over time. Econometric and DSGE-based estimates also consistently find that public investment multipliers are larger than those for government consumption (Coenen, Straub, and Trabandt 2012, Auerbach and Gorodnichenko 2013, Leduc and Wilson 2012, Eden and Kraay 2014, Calderon et al. 2015, Furceri et al. 2022, Izquierdo et al. 2019, Ganelli and Tervala 2020).

Given Asia's changing dynamics, including increasing openness, the rise of manufacturing, and shifting economic structures, the region might provide interesting insights into the relationship between public investment and growth. In this connection, Gao and Zhang (2018) assessed fiscal policy, green growth, and the Sustainable Development Goals in Asia and the Pacific. At a broader level, Clements, Sanjeev, and Jalles (2022) discuss how fiscal policy can help foster more inclusive growth in developing Asia, looking both via a comparative analysis with Latin America and also through different types of spending. The paper finds that eliminating inefficiencies in health, education, and public investment would generate the equivalent of 3% of GDP. Curtailing fossil fuel subsidies could also generate resources for more redistributive spending. Heshmati, Kim, and Park (2015) contend that Asian countries employed fiscal policy to strengthen the fundamentals for macroeconomic stability and, as a result, economic growth by avoiding budget deficits.

Fiscal policy has also contributed to Asian prosperity through massive expenditures in growth-promoting infrastructure and education, which have increased the stock of physical and human capital. Some country-specific studies examine the impact of public investment multipliers in various Asian nations. Ilzetzi, Mendoza, and Végh (2013) explored the size of fiscal multipliers of the PRC.

The Indian experience with public investment and its effects on economic growth has been a subject of interest. A Mallick (2016) study shocks in government investment on private investment and national income, focusing on the “crowding-in” or “crowding-out” effect in India. The analysis finds evidence of a crowding-out impact of government spending, mostly owing to the non-infrastructure component. Private investment has a greater impact on income than either form of governmental investment. In the short and medium run, the infrastructure component of public investment has a greater impact on income than the non-infrastructure component does. However, government investment in non-infrastructure remained dominant in the infrastructure component. Rangarajan and Srivastava (2008) examined fiscal policy and economic growth in India.

Various studies investigate the impact of Japanese public investment. For instance, Furukawa and Naoi (2016) examined the macroeconomic impact of public investment on Japan's regional economies. Choi and Son (2016) investigate how expansionary government spending shocks in the Republic of Korea influenced GDP growth since the 1980s through the lenses of time-varying parameter structural vector autoregression (TVP-SVAR) approach. Haughton, Jitsuchon, and Rukumnuaykit (2016) examine the effectiveness of Thailand's policy response to the global financial crisis, focusing in particular on government spending.

The observed heterogeneity in the estimates of government spending multipliers across countries prompted additional empirical inquiry into the factors that can explain these differences. There could be several nonlinearities at play. In a synthesis review, Izquierdo et al. (2019) note that cyclical conditions, exchange rate flexibility, debt levels, monetary policy stance, public investment efficiency, institutions, and trade openness are

important determinants of the size of multipliers. Furthermore, the literature clearly points to larger fiscal multipliers during recessions (Auerbach and Gorodnichenko 2012a, 2012b, and 2013; Riera-Crichton, Vegh, and Vuletin 2015; also the meta-analysis in Gechert and Rannenberg 2018); during periods of easier monetary policy (Christiano, Eichenbaum, and Rebelo 2011; Coenen et al. 2012); in countries with fixed exchange rate regimes (Ilizetzki, Mendoza, and Végh 2013); in low-debt countries (Ilizetzki, Mendoza, and Végh 2013; Huidrom et al. 2020); and countries less open to trade (Ilizetzki, Mendoza, and Végh 2013; Gonzalez-Garcia, Lemus, and Mrkaic 2013).

In addition, recent empirical evidence suggests that the size of fiscal multipliers may also be positively associated with macroeconomic uncertainty (Gbohoui 2021), financial development (Koh 2017), as well as overall economic development (Ilizetzki et al. 2013), and negatively associated with the degree of informality in the economy (Colombo et al. 2022). Barnichon, Debortolo, and Matthes (2022) also argue that the direction of fiscal interventions is critical. More specifically, they find that the contractionary multiplier is above 1, reaching higher magnitudes in recessions. On the other hand, the expansionary multiplier is significantly below 1, regardless of the cyclical position of the economy. According to Gaspar et al. (2015), economies with stronger infrastructure governance tend to have lower average incremental public-capital-to-output ratios, resulting in more growth “bang” for their investment “buck.” They also found that economies with higher public investment efficiency receive greater output dividends. In contrast, poor infrastructure governance might result in increased public debt without any growth dividend. Governance issues in project execution can limit the amount of public

capital created by a unit of public investment, while a poor project selection process can result in the creation of “white elephants” that have marginal contribution to the economy.

More generally, the literature suggests that a strong cost-benefit analysis is needed to select and prioritize projects that would meaningfully raise growth without jeopardizing fiscal sustainability. Another important factor that may explain the productivity of public investment is the initial stock of public capital. Among the recent studies, Izquierdo et al. (2019) find that public investment multipliers are higher in countries with a relatively low level of initial public capital stock (as a share of GDP). The level of public investment and public capital can be excessive if resources are diverted away from other more productive uses or crowd out private investment (Devarajan, Swaroop, and Zou 1996; Canning and Pedroni 2008).

This line of argument is related to the more general strand of the literature emphasizing the critical role of public investment efficiency in determining its macroeconomic effects. Dabla-Norris et al. (2012) find that the quality of public investment management practices varies widely in a global sample of 71 countries. Gupta et al. (2014) compute “efficiency adjusted” public capital stocks and find that the growth effects of efficient public investment are higher. The impact of efficiency on the productivity of public investment is also evaluated empirically in Leeper, Walker, and Yang (2010); Cavallo and Daude (2011); Leduc and Wilson (2012); Izquierdo et al. (2018); Berg et al. (2013); Miyamoto et al. (2020); and Furceri et al. (2022).

Finally, it should be noted that the observed heterogeneity in the estimates of fiscal spending multipliers also reflects differences in the methodologies used to identify exogenous shocks in public investment. These alternative shock identification strategies

are discussed in more detail in the next section, along with the new method developed in this paper.

3. Methodology and Data

3.1. Constructing Government Spending Shocks

A review of existing public spending shock identification frameworks. Several strategies have been devised in the literature to identify government spending shocks. Among the most widely applied methods, an approach based on (structural) vector autoregression frameworks relies on recursive identification schemes and other parameter restrictions with the assumption that government spending does not respond to macroeconomic shocks in the same period (Blanchard and Perotti 2002, Ilzetzki et al. 2013). Besides the timing assumptions behind the underlying Cholesky identification scheme, which are less compelling for annual-frequency data, this approach is agonistic about anticipation effects of fiscal spending.

A second approach, by Kraay (2012, 2014), is to instrument government shocks with predicted disbursements from approved loans from official creditors—such as the World Bank and other multilateral and bilateral aid agencies—as exogenous sources of fluctuations in government spending. This approach is difficult to replicate, as it requires a calculation of “predicted” disbursements for each loan, which can then be considered as exogenous spending shocks.

A third approach is the “natural experiment” approach proposed by Barro (1981) and further developed by Ramey in subsequent papers (Ramey and Shapiro 1998, Ramey and Zubairy 2018). This framework uses fluctuations in military expenditures to identify government spending shocks. This approach, however, would not work well for

EMDEs, as the military spending variable does not change much from one year to the next.

Finally, in more recent empirical research, Auerbach and Gorodnichenko (2012a, 2012b) use forecast errors to examine how the fiscal multiplier varies with the business cycle in Organisation for Economic Co-operation and Development (OECD) economies. This measure of government shocks is computed as the difference between the actual public spending and the public spending expected previously by professional forecasters. Using forecast error-based shocks, Abiad, Furceri, and Topalova (2016) identify the causal impact of higher public investment on output, private investment, unemployment, and public debt ratios. The authors argue that this methodology overcomes the obstacles that often confound the causal estimation of the effect of fiscal policy on economic performance. The Auerbach and Gorodnichenko (AG) approach was utilized also in Honda, Miyamoto, and Taniguchi (2020); Miyamoto et al. (2020); and Furceri et al. (2022). This methodology has the advantage of overcoming the problem of “fiscal foresight” (Forni and Gambetti 2010; Leeper, Richter, and Walker 2012; Leeper, Walker, and Yang 2013; and Zeev and Pappa 2017).

Public (and private) spending shocks based on cyclically adjusted public variables. In this paper we build on the work of Alesina and Ardagna (2010) and others that assess the effects of changes in cyclically adjusted (fiscal) variables on growth. What is new in our approach is the way in which we identify spending shocks for public (and private) investment. The shock identification framework involves several steps.

First, we estimate output elasticities of both public and private investment for each country by regressing the log of real public and private investment on the log of real GDP.

Estimates are done by ordinary least squares (OLS) for all countries with at least 20 continuous observations of both variables.³ Summary statistics for the elasticities are shown in Appendix Table A1.

Second, we obtain measures of potential output GDP^{pot} via a Hodrick-Prescott (HP) filter as the baseline estimate.⁴

Third, we compute cyclically adjusted real public investment (CAPI):

$$CAPubI = PubI \left(\frac{GDP^{pot}}{real\ GDP} \right)^{\varepsilon_{PubI}} \quad (1a)$$

$$CAPriI = PriI \left(\frac{GDP^{pot}}{real\ GDP} \right)^{\varepsilon_{PriI}} \quad (1b)$$

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

Fourth, we determine whether or not a change in public and private investment stripped of business cycle influences is large enough to be included in the sample used for the econometric analysis, and to this end, define public and private investment shocks ($PubIS$ and $PriIS$, respectively) as a measure taking the value of one when a country's first difference of $CAPubI$ or $CAPriI$ exceeds its country-specific mean by one standard deviation for each country i :

$$PubIS = 1 \text{ if } \Delta CAPubI_{it} > \overline{\Delta CAPubI_i} + SDCAPubI_i, 0 \text{ otherwise} \quad (2a)$$

$$PriIS = 1 \text{ if } \Delta CAPriI_{it} > \overline{\Delta CAPriI_i} + SDCAPriI_i, 0 \text{ otherwise} \quad (2b)$$

³ Countries with less than 20 continuous observations were not included in the sample going forward.

⁴ We also use Baxter-King, Christiano-Fitzgerald Random Walk, and the Hamilton (2018) and other statistical filters as a robustness check.

The focus on large shocks (greater than a standard deviation) is in the spirit of Alesina and Ardagna (2010), who argue that, looking specifically to the fiscal context at relatively large fiscal adjustments helps identify changes in fiscal variables that are policy-induced, rather influenced by the business cycle. This 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 public and private investment are excluded from the econometric analysis. In addition to this binary shock variable, we use two versions of *continuous* shocks based on CAPubl and CAPril as a robustness check: shocks based on the growth rate of the CAPubl and CAPril and shocks based on the yearly changes in the CAPubl and CAPril expressed in percent of GDP (winsorized to account for outliers).

3.2. Methodological framework

The main hypothesis to be tested is whether public and private investment shocks lead to higher real GDP. To estimate the response of real GDP to major public and private investment shocks, we follow the local projections method proposed by Jordà (2005) to estimate impulse-response functions. This approach has been advocated by Auerbach and Gorodnichenko (2013) and Romer and Romer (2019) as a flexible alternative to vector autoregressions (VAR) for estimation purposes while being on similar footing with regards to identification.⁵

Given the panel data setting, we adopt the local projections method over VAR estimation for the following reasons. First, the investment shocks from both public and private sectors we're employing have been adjusted to be independent of current and

⁵ See Plagborg-Møller and Wolf (2021) for a discussion on the trade-offs between VARs and local projections.

expected future macroeconomic conditions. Consequently, there's no need for additional identification via constraints typical in VAR models. Second, our analysis involves a large panel dataset with various fixed effects, which makes the straightforward implementation of conventional VAR models complex.⁶ In addition, the local projections approach eliminates the necessity to estimate equations for any dependent variables other than the variable of interest, substantially reducing the amount of parameters required. Holding other things constant, local projections usually offer more accurate estimates for impulse responses over shorter timeframes, which suits our analysis. Third, the local projections method is particularly suited to estimating nonlinearities, as its application is much more straightforward compared to non-linear structural VAR models, such as Markov-switching or threshold-VAR models.⁷ In fact, local projections tend to be easier to implement relative to VARs when a specified nonlinearity would make the inversion of the VAR form into the VMA form difficult (Plagborg-Møller and Wolf 2021). Lastly, the error term in these panel estimations is likely to be correlated across countries, which is easier to handle in the local projections method by either clustering standard errors or using the Driscoll-Kraay (1998) standard errors that take account of arbitrary correlations of the errors across countries and time. Against this background, the baseline specification we estimate takes the following form:

$$y_{i,t+k} - y_{i,t-1} = \alpha_i + \tau_t + \beta_k shocks_{i,t} + \theta X_{i,t} + \varepsilon_{i,t} \quad (3)$$

⁶ If one wishes to introduce country fixed effects in a VAR in a panel environment that is also possible, for instance, by demeaning each model variable over time for each country before including them in VAR.

⁷ See Choi and Shin (2023) and Miyamoto et al. (2020) for the recent application of local projections to the estimation of nonlinearities and interaction effects of exogenous shocks using a large international panel dataset—an approach similar to ours.

in which y is the dependent key economic variable of interest; β_k denotes the (cumulative) response of the variable of interest in each k year after the public and private investment shocks; α_i, τ_i are country and time fixed effects, included to account for cross-country heterogeneity and global factors (such as the world business cycle or oil price movements)⁸; $shocks_{i,t}$ denotes the public or private investment shocks PubIS or PriIS ; $X_{i,t}$ is a set a of control variables including—as in Abiad, Furceri, and Topalova (2016) and Furceri et al. (2022)—two lags of the shocks and two lags of real GDP growth. In the robustness section, to address potential omitted variable bias, we add two lags of CPI inflation and trade openness (the sum of exports and imports as a share of GDP).⁹

Equation 3 is estimated using ordinary least squares (OLS).¹⁰ We calculate Spatial Correlation Consistent (SCC) standard errors as proposed by Driscoll and Kraay (1998). Impulse response functions (IRFs) are then obtained by plotting the estimated β_k for $k=0,1,...,5$ with 90% confidence bands computed using the standard deviations associated with the estimated coefficients β_k based on robust standard errors clustered at the

⁸ The inclusion of τ_t controls for cross-sectional dependence that arises from common sources of variation in the panel, it may also potentially affect the coefficient interpretation by conditioning out the common factor component of the shock series and its effect on GDP growth in equation 3. With the inclusion of the τ_t term, the estimated impulse responses can thus be interpreted as responses to country-specific shocks *relative* to the global.

⁹ The dynamics of GDP growth differ across countries, so that the lagged coefficients differ across countries. We acknowledge that here they are being estimated as if they were homogeneous across countries. This could lead to the classic problem of latent heterogeneity in lagged dependent variables with the implication that the OLS consistency conditions are violated (Pesaran and Smith 1995). We work under the assumption that dynamics for the shock variables are indeed exogenous and in such a case, the coefficients will converge to the average value among countries and the OLS conditions for consistency of the estimators will be met.

¹⁰ The local projection approach has an additional benefit over autoregressive distributed lag models and vector autoregressions in that it does not require asymptotic approximations or Monte Carlo simulations for the estimation of confidence bands. Confidence bands, on the other hand, are often bigger at longer horizons than those estimated in vector autoregression specifications.

country level. We also employ, as a robustness check, a comparison with the alternative approach of identifying fiscal shocks using forecast errors.¹¹

Other variables used in the analysis come from the World Economic Outlook (WEO) of the International Monetary Fund (IMF) and the World Bank's World Development Indicators (WDI) databases.

4. Stylized Facts

In this section, we review major trends in public investment. We observe that for EMDEs and Asian economies, public investment-to-GDP ratio has been relatively stable over time, with a median around 5% of GDP Figure 1. There are, nonetheless, quite a degree of heterogeneity as indicated by the wide top and bottom quartiles of the distribution. This is clearer in Figure 2 where we zoom into Asia and the Pacific and observe large public investment ratios in the PRC or Maldives and low ratios in Brunei Darussalam or Pakistan. While there are variations across countries and regions, some common trends can be observed:

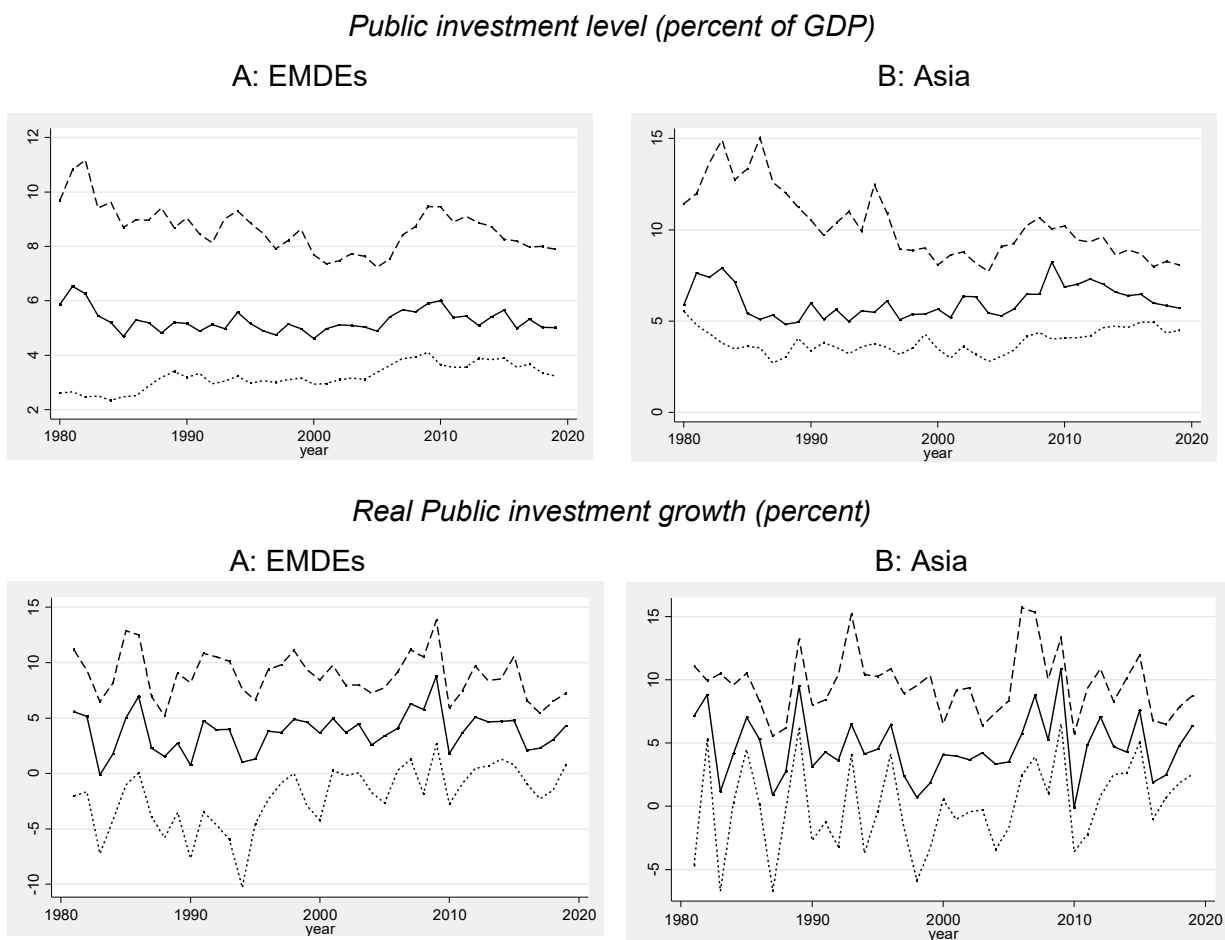
- **Post-1980s decline and subsequent recovery.** Many EMDEs experienced a decline in public investment as a percentage of GDP during the 1980s and 1990s. This trend was partly due to structural adjustment programs and fiscal consolidation efforts encouraged by international financial institutions, which often led to reduced public spending on infrastructure. However, since the early 2000s, there has been a noticeable recovery in public investment levels, driven by improved fiscal positions,

¹¹ While the presence of a lagged dependent variable and country fixed effects may, in principle, bias the estimates in small samples (Nickell 1981), the length of the time dimension mitigates this concern. The finite sample bias is in the order of $1/T$, where T in our sample is 40. For robustness, we also examine a specification without the lagged dependent variables, which yields similar results.

increased access to international capital markets, and a renewed focus on infrastructure development as a means of stimulating economic growth.

- **Impact of global financial conditions.** The global financial environment has had a significant impact on public investment trends in EMDEs. Periods of low global interest rates and high liquidity have often facilitated increased public investment through easier access to international borrowing. Conversely, financial crises and tightening conditions have led to reduced investment due to capital outflows and increased borrowing costs.

Figure 1: Public Investment Level (percent of GDP) and Growth (percent), 1980–2019



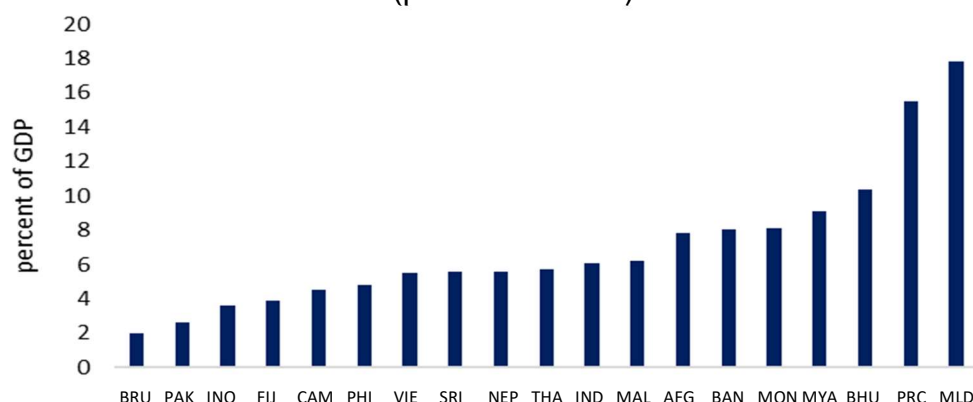
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EMDEs = emerging market and developing economies, GDP = gross domestic product.

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

Sources: International Monetary Fund Investment and Capital Stock Dataset; World Bank's World Development Indicators.

Figure 2: Public Investment in Asia and the Pacific, by country, 2019
(percent of GDP)



AFG = Afghanistan, BAN = Bangladesh, BHU = Bhutan, BRU = Brunei Darussalam, CAM = Cambodia, FIJ = Fiji, GDP = gross domestic product, IND = India, INO = Indonesia, MAL = Malaysia, MLD = Maldives, MON = Mongolia, MYA = Myanmar, NEP = Nepal, PAK = Pakistan, PHI = Philippines, PRC = People's Republic of China, SRI = Sri Lanka, THA = Thailand, VIE = Viet Nam.

Note: The Asian Development Bank's regular operations in Myanmar and Afghanistan have been on hold since February and August 2021, respectively.

Source: International Monetary Fund Investment and Capital Stock Dataset; World Bank's World Development Indicators.

5. Empirical Results

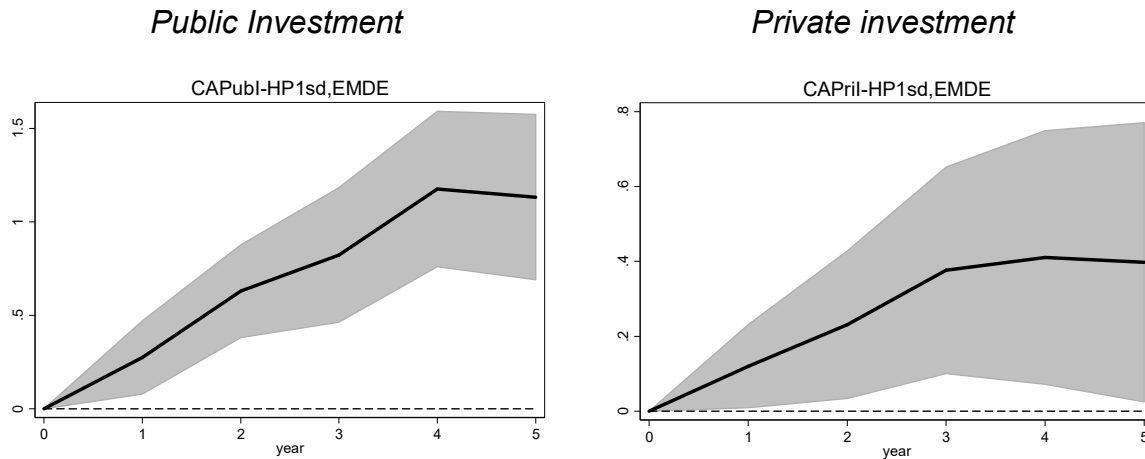
5.1. Baseline Estimation Results

The starting point of the analysis is the estimation of the baseline equation 3 for the EMDE sample spanning the period 1980–2021 that will underpin the computation of the impulse response functions. Sub-samples of this group as well as regional breakdowns are also examined. The estimated coefficients for the binary shocks to public and private investment identified in line with the methodology outlined in Section 3 are then scaled by the average ratio of public (private) investment to GDP of the shock sample to provide a scale in the IRFs and a more direct interpretation. The impulse responses can then be

interpreted as the effect of a one-percent-of-GDP unanticipated increase in public (private) investment in year 0 on real GDP growth over the horizon of 5 years. In interpreting these results, it is important to note that as far as public investment shocks are concerned, they cover *shocks* occurring during both recessions and expansions, and thus cannot be used to judge whether countercyclical fiscal policies are effective or not.

Figure 3 indicates that for the EMDE sample, public investment shocks, on average, lead to higher real output growth than private investment shocks. The results also suggest that both types of investment shocks lead to growth responses that are highly statistically significant throughout the IRF horizon. A public investment shock (equivalent to 1% of GDP) increases real GDP by about 1.2% over the horizon of 5 years. This is expected as public investment raises output through supply-side effects, thereby boosting potential output, in addition to its short-run demand stimulus. In turn, a private investment shock yields one-third of that growth increase, reaching 0.4% over the same horizon. A range of robustness checks with alternative shock definitions, sensitivity checks for model parametrization and sample composition, and possible bias associated with the mutual impacts of public and private investment, are discussed in Section 5.4, and confirm the baseline results.

Figure 3: Growth Effects of Public and Private Investment Shocks in Emerging Market and Developing Economies



EMDEs = emerging market and developing economies.

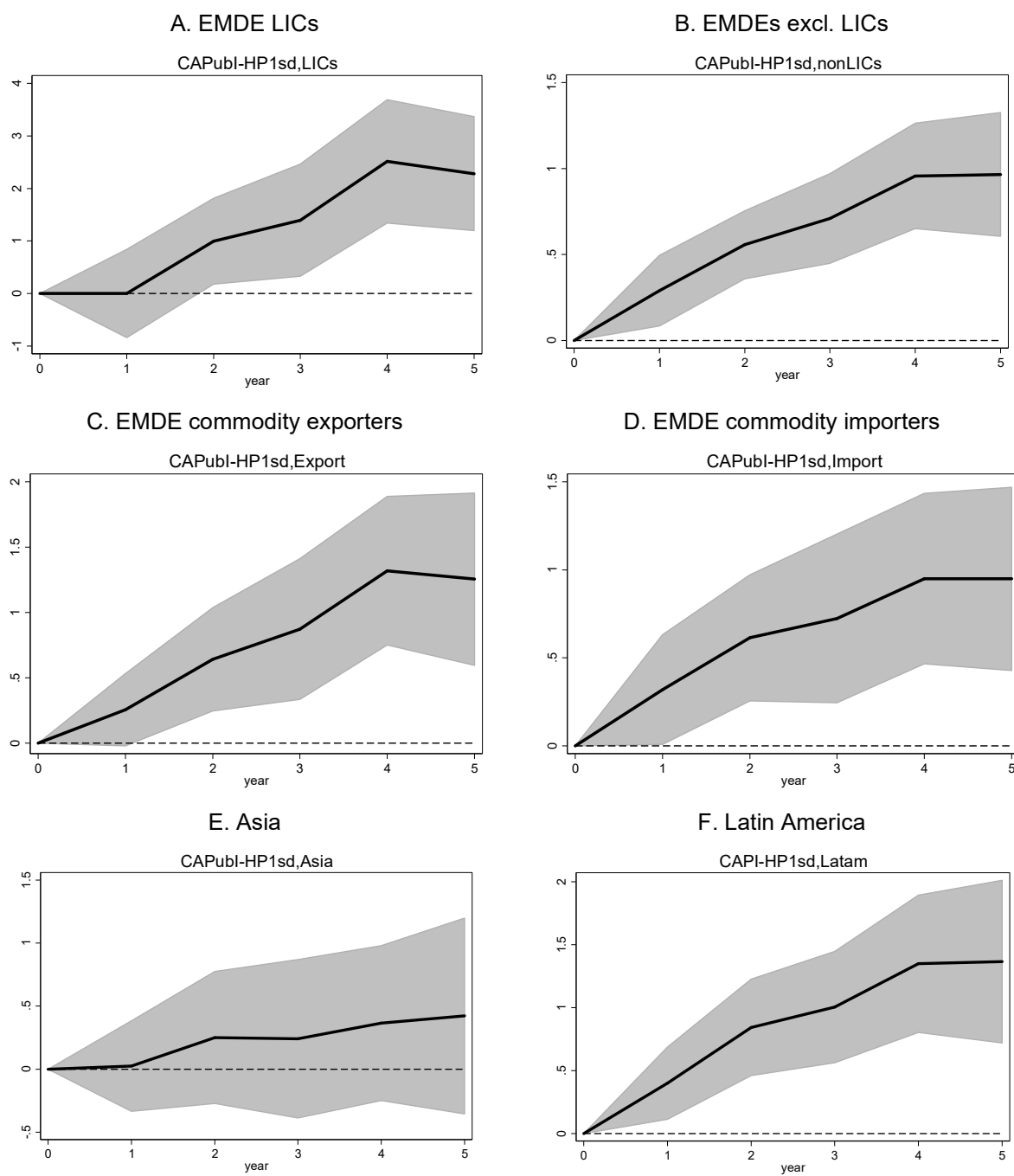
Note: “CAPubl-HP1sd” and “CAPriI-HP1sd” denote the binary-created public investment and private investment shocks using the HP filter to cyclically adjust respective variables – see main text for further details. $t=0$ is the year of the government investment shock; $t=1$ is the first year of impact. Solid black lines denote the response to a government investment shock. Shaded areas denote 90% confidence bands, based on standard errors clustered at the country level.

Source: Authors’ calculations.

In Figures 4a and 4b we zoom-in into the EMDE sub-groupings and regional breakdowns. Low-income countries (LICs) seem to be where the potency of public investment is the largest, even though statistical significance starts only from year 2 and not immediately as in the case of emerging markets. Commodity exporters benefit more from public investment shocks compared to commodity importers, but the difference is likely not to be statistically different from one another. Regionally, Asia does not seem to capitalize from public investment in terms of growth impact as the response is, on average, zero. This is in contrast with the Latin American region, which more closely mimics that of Figure 3. Turning to private investment—Figure 4.b—we see that yet again, the largest growth impact is found in the LIC sub-group compared to emerging markets (where the response is on average zero). Most of the other results discussed for public

investment are *mutatis mutandis*, equivalent for private investment shocks, though with generally smaller magnitudes.

Figure 4a: Growth Effects of Public Investment Shocks, by Emerging Market and Developing Economies Country Group

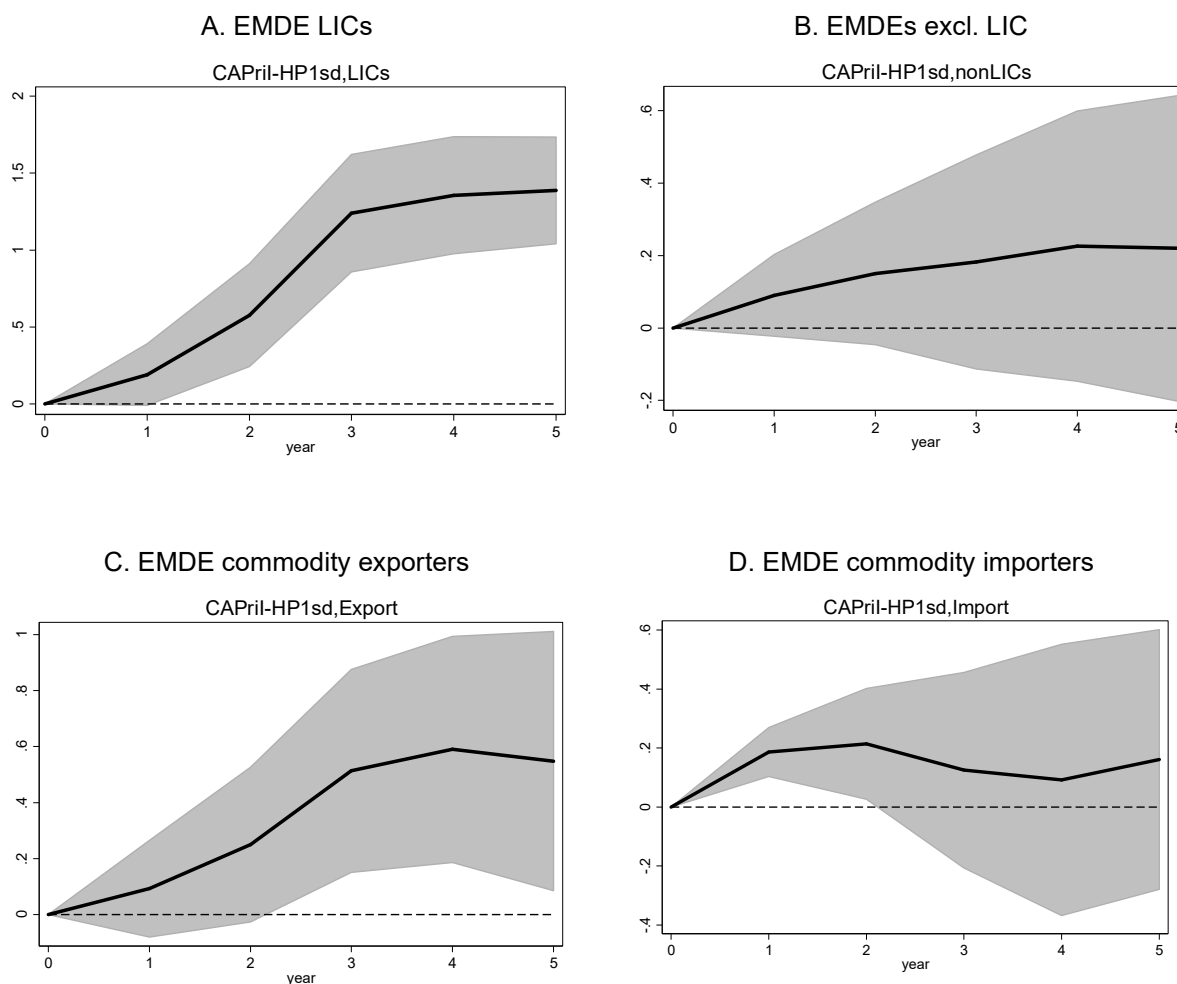


EMDEs = emerging market and developing economies.

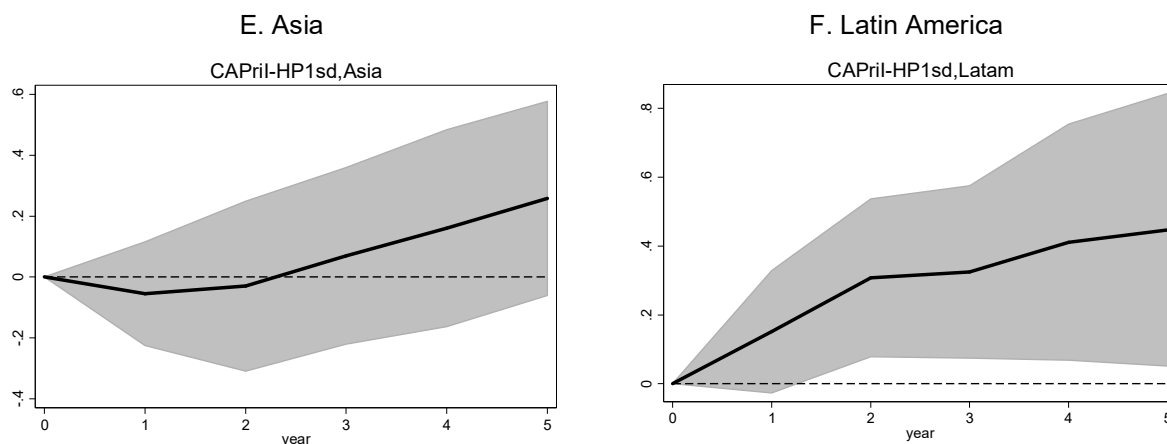
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Note: “CAPubl-HP1sd” and “CAPrll-HP1sd” denote the binary-created public investment and private investment shocks using the HP filter to cyclically adjust respective variables – see main text for further details. $t=0$ is the year of the government investment shock; $t=1$ is the first year of impact. Solid black lines denote the response to a government investment shock. Shaded areas denote 90% confidence bands, based on standard errors clustered at the country level.
Source: Authors’ calculations.

Figure 4b: Growth Effects of Private Investment Shocks, by Emerging Market and Developing Economies Country Group



Continued on the next page



EMDEs = emerging market and developing economies.

Note: “CAPubl-HP1sd” and “CAPriI-HP1sd” denote the binary-created public investment and private investment shocks using the HP filter to cyclically adjust respective variables – see main text for further details. $t=0$ is the year of the government investment shock; $t=1$ is the first year of impact. Solid black lines denote the response to a government investment shock. Shaded areas denote 90-percent confidence bands, based on standard errors clustered at the country level.

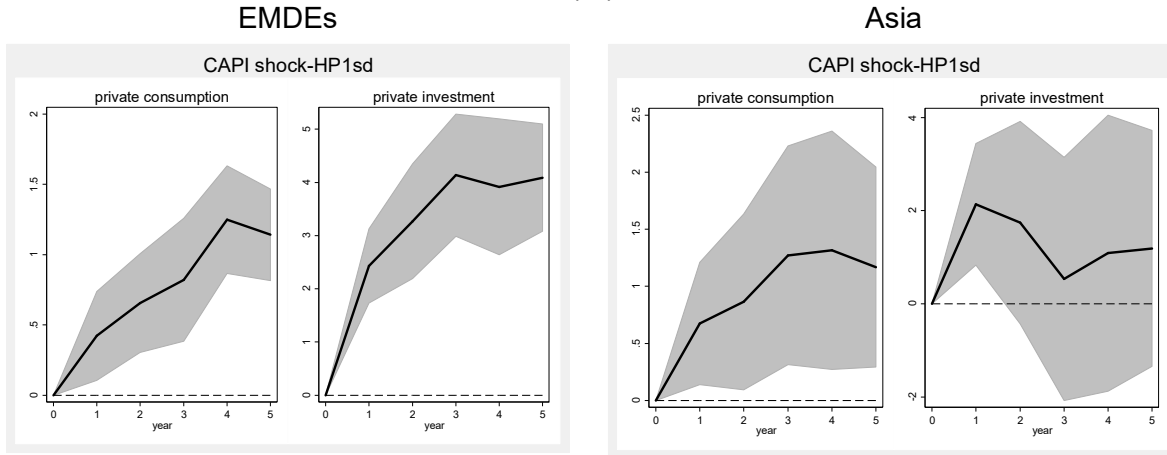
Source: Authors’ calculations.

Figures A1 and A2 in the Appendix plot the same for Asian regions and different types of commodity exporters, respectively. On the former, South Asia seems to yield a positive growth response from public investment shocks from year 2, 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. For Asia, the effect of private investment does not seem to matter much for growth unconditionally. On the latter, out of the four types of exporters, agriculture and metal ones seem to reap more of the benefits of a public investment shock in terms of growth.

5.2. Channels: Crowding-in/out, Labor Productivity, and Employment

To better understand the channels through which public spending has an impact on growth, we also look at the impact of public investment shocks on private consumption and investment (Figure 5). Public investment shocks in EMDE and Asian samples crowd-in private investment and private consumption. The positive effects are especially strong in the case of private investment in EMDEs while being smaller and shorter-lived for Asia.

Figure 5: Effects of Public Investment Shocks on Private Investment and Consumption (%)



EMDEs = emerging market and developing economies.

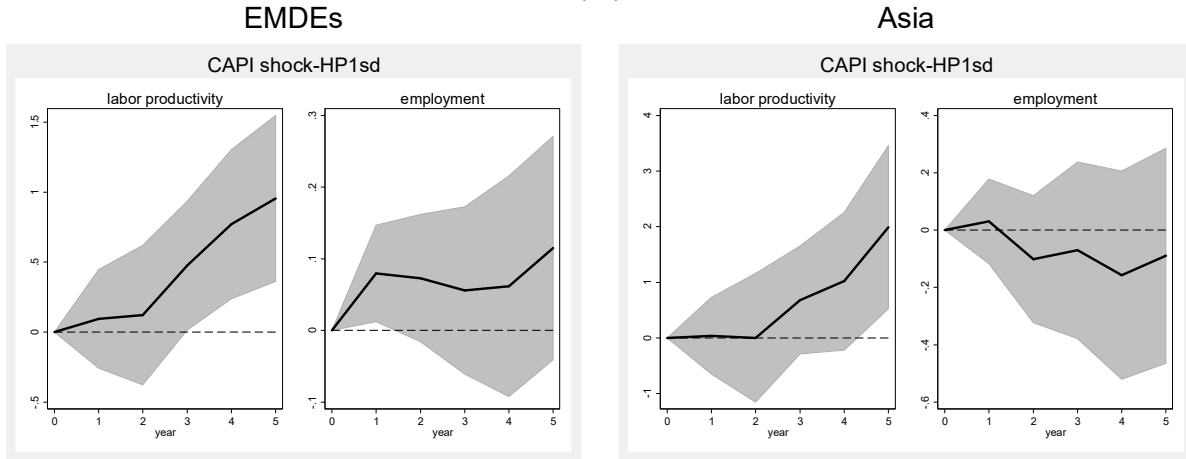
Note: $t=0$ is the year of the investment spending shock; $t=1$ is the first year of impact. Solid black lines denote the response to a government investment shock. Shaded areas denote 90% confidence bands, based on standard errors clustered at the country level.

Source: Authors' calculations.

In addition, we look at the labor market and productivity as dependent variables.

In Figure 6, we observe that in the general EMDEs, employment goes up in the very short term while productivity follows slightly later (from year 3 onwards). 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.

Figure 6: Effects of Public Investment Shocks on Labor Productivity and Employment (%)



EMDEs = emerging market and developing economies.

Note: $t=0$ is the year of the government investment shock; $t=1$ is the first year of impact. Solid black lines denote the response to a government investment shock. Shaded areas denote 90% confidence bands, based on standard errors clustered at the country level.

Source: Authors' calculations.

5.3. Robustness and Sensitivity

The empirical results were subjected to several robustness checks.

Controlling for Country-specific Time Trends

To measure the causal impact of public and private investment shocks on growth, it is imperative to control for historical growth trends that may have affected the shocks using up to two lags in the real GDP growth balance.¹² To further lessen the effect of time trend, we re-estimate equation (3) by including country-specific time trends as additional control variables. The obtained results are similar to, and not statistically different from, the baseline results (available upon request).

¹² Similar results are obtained when using alternative lag parametrizations.

Controlling for Additional Growth Short-term Drivers

A potential issue with the analysis is that the results may suffer from omitted variable bias, since public and private investment programs may be implemented in response to historical economic conditions or in conjunction with other macroeconomic policy moves impacting real GDP growth. To solve this issue, we broaden the range of controls to include additional macroeconomic variables that have been shown to influence growth. In particular, we include lagged changes of (i) real exchange rates; (ii) terms of trade; (iii) short-term interest rates—to capture monetary policy actions; (iv) general government primary budget balance—to capture fiscal policy actions; (v) the Chinn-Ito index of capital controls.¹³ The findings of this analysis are comparable to, and not statistically different from, those found in the baseline specification, suggesting that this source of omitted variable bias is likely to be minimal in our scenario (available upon request).

Controlling for GDP Growth Expectations

Another possible source of endogeneity issue is that public and private investment programs may be implemented in response to the plans for future economic growth. To overcome this, we control for the expected values in $t-1$ of future real GDP growth rates over periods t to $t+k$ —that is, the time horizon over which the impulse response functions are estimated. These are taken from the fall issue of the IMF World Economic Outlook for the year $t-1$.

¹³ The series (i)-(iv) are taken from the IMF World Economic Outlook database. The Chinn-Ito index is taken from http://web.pdx.edu/~ito/Chinn-Ito_website.htm.

6. Conclusion

This paper enhances the existing body of research by incorporating a more extensive and diverse array of EMDEs than previously analyzed, and introducing a methodological approach that future researchers can readily replicate and adapt. We also take a closer look at Asia and Latin America. Our findings largely corroborate those of prior studies. Our expansion of the country sample allows for an examination of differences among various country groups and the role of initial conditions in shaping the growth outcomes of public and private investment.

From a methodological perspective, the wide range of public spending multiplier estimates found in the existing literature indicates potential sensitivity to the chosen sample of countries and the time frame of analysis. Our study sheds light on this variability, specifically within the context of EMDEs, and contributes to a deeper understanding of the factors that contribute to the differing growth impacts of public and private investment. By delving into these nuances, our research contributes to policy discussions on the macroeconomic implications of both types of investment. Our evidence highlights the critical role of fiscal health and the efficiency of public spending in enhancing the growth impact of public investments.

Our findings, derived from local projections across a worldwide dataset spanning from 1980 to 2021, indicate that public investment exerts a stronger influence on economic growth than private investment. Specifically, in EMDEs, a public (private) investment shock (equivalent to 1% of GDP) increases real GDP by about 1.2% (0.4%) over a horizon of 5 years. The growth impact of public investment is, on average, zero in Asia, in contrast to Latin America, which sees a positive impact. That said, 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 addition, we find that expansion of public and private investment yields greater benefits under certain circumstances. In particular, the effect of public investment in Asia in recessions is positive and significant. This finding strengthens the case for expanding fiscal space during upturns to secure policy flexibility in responding to downturns. Without sufficient fiscal space, countries might find themselves constrained in pursuing countercyclical fiscal policies during recessions. The expansion of debt during the coronavirus disease (COVID-19) pandemic (World Bank 2022) means that fiscal sustainability has become even more imperative.

APPENDIX

List of economies in the sample

Emerging market and developing economies (EMDEs) (98): Afghanistan, Albania, Algeria, Angola, Argentina, Armenia, Bangladesh, Barbados, Benin, Bosnia and Herzegovina, Botswana, Brazil, Bulgaria, Burkina Faso, Burundi, Cabo Verde, Cambodia, Cameroon, Central African Republic, Chad, Chile, People's Republic of China, Colombia, Comoros, Congo, Costa Rica, Croatia, Côte d'Ivoire, Democratic Republic of Congo, Djibouti, Dominican Republic, Egypt, Equatorial Guinea, Ethiopia, Gabon, Ghana, Guatemala, Guinea, Guinea-Bissau, Guyana, Haiti, Honduras, Hungary, India, Indonesia, Iran, Iraq, Kazakhstan, Kenya, Lao People's Democratic Republic, Lebanon, Macedonia, Madagascar, Malawi, Malaysia, Mali, Mauritania, Mauritius, Mexico, Mongolia, Morocco, Mozambique, Myanmar, Namibia, Nepal, Nicaragua, Niger, Nigeria, North Macedonia, Pakistan, Paraguay, Peru, Philippines, Poland, Romania, Russian Federation, Rwanda, Saudi Arabia, Senegal, Serbia, Seychelles, Sierra Leone, South Africa, Sri Lanka, São Tomé and Príncipe, Tajikistan, Tanzania, Thailand, Togo, Türkiye, Uganda, Ukraine, United Arab Emirates, Uruguay, Uzbekistan, Venezuela, Viet Nam, Yemen, Zambia.

ADB member countries (20): Afghanistan, Armenia, Bangladesh, Cambodia, People's Republic of China, India, Indonesia, Kazakhstan, Lao People's Democratic Republic, Malaysia, Mongolia, Myanmar, Nepal, Pakistan, Philippines, Sri Lanka, Tajikistan, Thailand, Uzbekistan, Viet Nam.¹⁴

Table A1: Summary Statistics for Public and Private Investment Elasticities

	Public investment elasticities	Private Investment elasticities
<i>EMDEs</i>		
Obs.	5160	5200
Mean	1.204	1.362
SD	0.939	0.835
Min	-1.391	-1.035
Max	4.812	5.84
<i>Asia</i>		
Obs.	800	760
Mean	0.875	1.325
SD	0.504	0.384
Min	-0.038	0.622
Max	2.192	2.345
<i>Latin America</i>		
Obs.	1120	1160
Mean	1.161	1.229
SD	0.856	0.568
Min	-0.071	-0.128
Max	3.422	2.281

EMDEs = emerging market and developing economies.

Sources: International Monetary Fund Investment and Capital Stock Dataset; World Bank's World Development Indicators.

¹⁴ The Asian Development Bank's regular operations in Myanmar and Afghanistan have been on hold since February and August 2021, respectively.

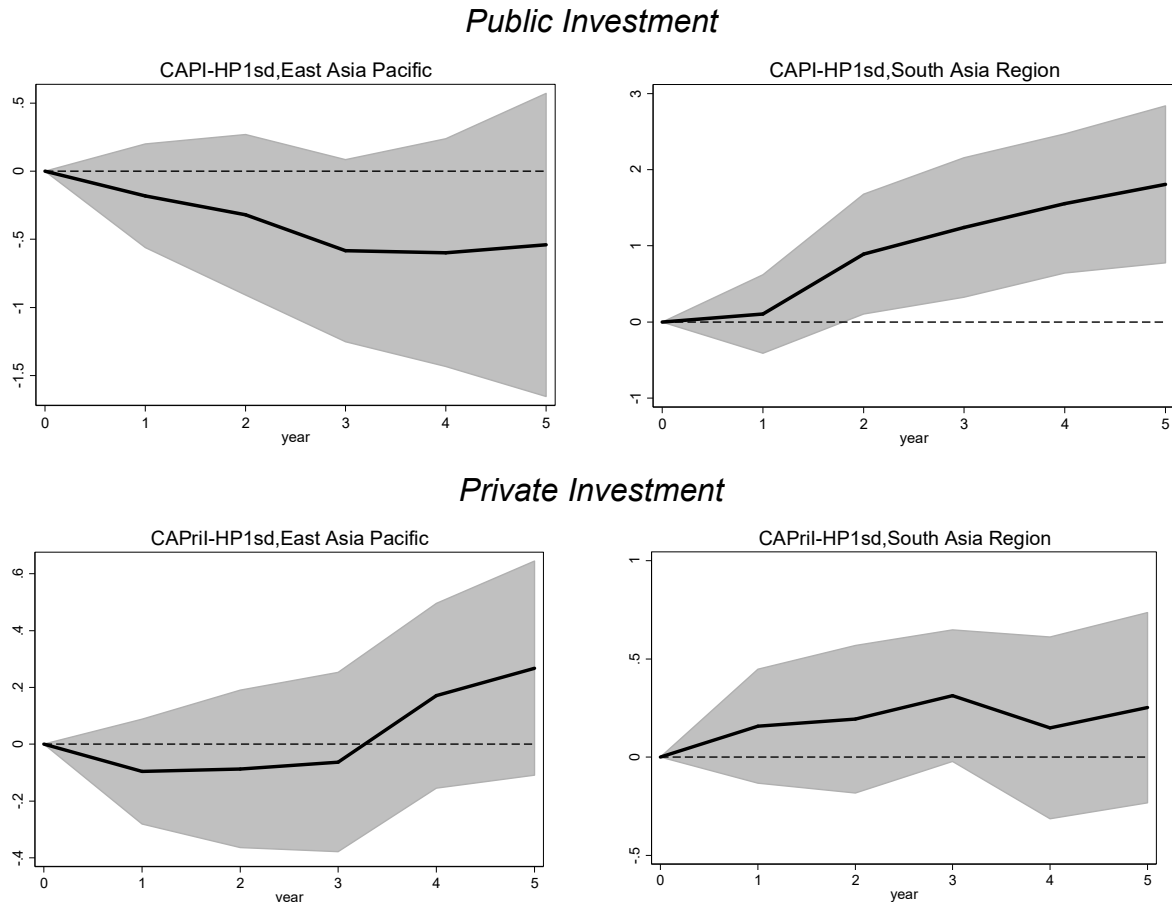
Table A2: Summary Statistics for Public Investment Shocks

Sample	Number of countries	Number of observations when shock=1	Mean value of respective variable in percent of GDP when shock=1	Mean value of real GDP growth in percent when shock=1	Mean value of real GDP growth percent when shock=0
Public investment shocks, based on CAPubl					
<i>EMDEs</i>	128	557	8.108	4.475	3.793
<i>Asia</i>	20	106	8.634	6.002	5.474
<i>Latin America</i>	28	138	6.535	4.112	2.951
Private investment shocks, based on CAPrIl					
<i>EMDEs</i>	128	544	17.94	4.713	3.761
<i>Asia</i>	19	89	17.966	6.083	5.509
<i>Latin America</i>	28	136	17.969	4.598	2.904

EMDEs = emerging market and developing economies, GDP = gross domestic product.

Sources: International Monetary Fund Investment and Capital Stock Dataset; World Bank's World Development Indicators.

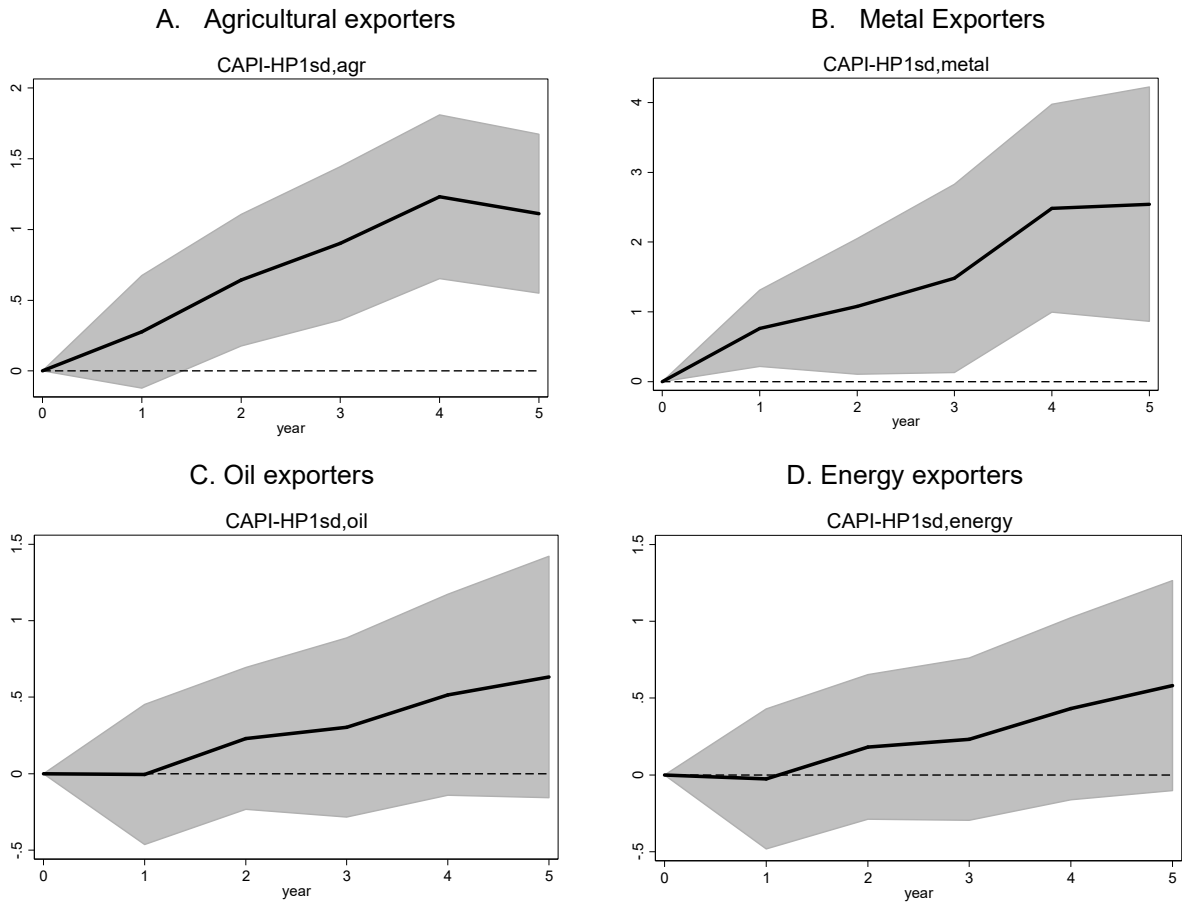
Figure A1: Growth Effects of Public and Private Investment Shocks within Asia



Note: $t=0$ is the year of the government investment shock; $t=1$ is the first year of impact. Solid black lines denote the response to a government investment shock. Shaded areas denote 90% confidence bands, based on standard errors clustered at the country level.

Source: Authors' calculations.

Figure A2: Growth Effects of Public Investment Shocks, by Type of Exporter



Note: $t=0$ is the year of the government investment shock; $t=1$ is the first year of impact. Solid black lines denote the response to a government investment shock. Shaded areas denote 90% confidence bands, based on standard errors clustered at the country level.
Source: Authors' calculations.

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Public versus Private Investment Multipliers in Emerging Market and Developing Economies

Cross-Country Analysis with a Focus on Asia

This paper introduces new measures of investment shocks based on cyclically adjusted investment data to examine the effect of public and private investment shocks on growth. Results suggest that public investment shocks play a much greater role in boosting economic growth in comparison with private investment shocks. In emerging market and developing economies including in Asia, the growth response to investment shocks is positive and much stronger during recessions compared with economic expansions. Investment shocks also stimulate private investment and private consumption.

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