BOX 3.2 Macroeconomic impacts of public investment: A literature review

Public investment is viewed by some policy makers as a powerful policy tool that can help promote economic growth. However, empirical evidence on the impact of public investment on growth is mixed. The empirical work to date suggests that the impact of public investment on growth tends to be greater in countries with better government spending efficiency, larger fiscal space, greater trade openness, lower economic informality, greater financial and economic development, as well as during recessions and periods of elevated uncertainty.

Introduction

Public investment is often viewed as one of the important policy tools that can accelerate growth, as well as address pressing infrastructure needs. At the same time, sceptics argue that public spending in general is inefficient, especially in emerging market and developing economies (EMDEs) with greater institutional challenges, and public investment therefore is wasteful. The literature on the subject matter has been rapidly evolving, and the evidence presented to date is rather sporadic with the size of the public investment multipliers—the change in output in response to a unit-increase in public investment—varying significantly across studies. This box synthesizes the growing literature on the topic and explores the following questions:

- What are the implications of public investment for output growth?
- What factors and country characteristics influence the impact of public investment on growth?

Theoretical foundations

The early literature examined the effects of government investment on economic growth in the context of the endogenous growth model, in which public capital enters the production function as one of the productive inputs (Aschauer 1989a,b; Barro 1990; Barro and Sala-i-Martin 1992; Futagami, Morita, and Shibata 1993; Glomm and Ravikumar 1994; Turnovsky 1997). Subsequent studies built on this framework, incorporating features such as aid-funded public investment, infrastructure networks, and public debt accumulation to facilitate a more nuanced analysis of the transmission channels of public investment to growth (Adam and Bevan 2006; Berg et al. 2010; Chatterjee and Turnovsky 2007; Agenor 2010; Berg et al. 2012). More recently, Chakraborty and Dabla-Norris (2011) studied the quality of public investment and distortionary effects of corruption within a general equilibrium growth model.

Empirical estimates of public investment multipliers

While the empirical work on total public spending multiplier across a broad range of countries is voluminous, the subset of the literature that distinguishes public investment multipliers is limited and primarily focuses on advanced economies. In general, there is an emerging consensus that public investment tends to have a positive growth impact in the medium term (Auerbach and Gorodnichenko 2013; Eden and Kraay 2014; Furceri and Li 2017; Izquierdo et al. 2019; Ilzetzki, Mendoza, and Végh 2013; Leduc and Wilson 2012). However, there remains considerable variation in the estimates of output elasticity to public investment; in a meta-analysis of 68 studies, Bom and Ligthart (2014b), report that the range is -1.7 to 2.0. In reviews of the literature, Gechert and Rannenberg (2018) and Vagliasindi and Gorgulu (2021) also report that public investment multiplier estimates range widely with an average of about 1.5. Table B3.2.1 provides a comprehensive review of public investment multipliers in the literature over the past two decades.

Empirical work focusing on EMDEs has been especially scarce, given data constraints and methodological challenges in identifying public investment shocks (see annex 3.1 for a discussion of existing identification frameworks). Nevertheless, limited research on EMDEs also documents important growth impacts of public investment. For instance, Miyamoto et al. (2020) report an increase in output by 0.4 percent over four years for a sample of 39 EMDEs. Ilzetzki, Mendoza, and Végh (2013) estimate a public investment multiplier of 0.6 on impact, increasing to 1.6 in the longer run, for a panel of 24 developing countries. Furceri and Li (2017) report smaller magnitudes for a sample of 79 EMDEs: a 10-percent increase in public investment induces

BOX 3.2 Macroeconomic impacts of public investment: A literature review *(continued)*

growth of 0.4 percent over four years. Smaller effects are reported in Warner (2014) using a sample of 124 EMDEs: a change in public investment equivalent to one percent of GDP is found to spur only meagre output growth in the short run (0.1 percent) with no significant effect in the long run. The observed wide range of estimates of multipliers has prompted additional inquiry into the factors that may explain these differences.

Factors affecting the size of public investment multipliers

Macroeconomic conditions. In a synthesis review, Izquierdo et al. (2019) note that a position of economy in the business cycle, the degree of exchange rate flexibility, debt levels, and the monetary policy stance are important determinants of the size of multipliers. In this regard, the literature indicates that multipliers tend to be larger during recessions (Auerbach and Gorodnichenko 2012 and 2013; Honda et al. 2020; Riera-Crichton, Vegh, and Vuletin 2015). Ramey (2019) notes that these results may not be fully robust given their sensitivity to the sample composition and the methodology. Further, the output effects tend to be larger in supply-driven recessions compared with those in demand-driven recessions (Ghassibe and Zanetti 2022). The multipliers are found to be larger during periods of monetary policy easing and elevated macroeconomic uncertainty, particularly, when nominal interest rates are at very low levels and reach the "zero lower bound" (Christiano, Eichenbaum, and Rebelo 2011; Gbohoui 2021).

Country structural characteristics. Multipliers tend to be greater in countries with a fixed exchange rate regime, low levels of debt, greater trade openness, and lower economic informality (Colombo et al. 2022; Honda, Miyamoto, and Taniguchi 2020; Huidrom et al. 2020; Ilzetzki, Mendoza, and Végh 2013). Financial development and economic development are also positively associated with the size of spending multipliers (Ilzetzki, Mendoza, and Végh 2013; Koh 2017).

Initial stock of public capital. Public investment multipliers are greater in countries with a lower level of initial public capital stock (Izquierdo et al. 2019). Excessive levels of public capital stock and investment may be detrimental for growth if resources are diverted away from more productive uses or crowd out private investment (Canning and Pedroni 2008; Devarajan, Swaroop, and Zou 1996). Contrary to these studies, Honda, Miyamoto, and Taniguchi (2020) find that, in a sample of low-income countries (LICs), output effects of public investment are greater in economies with higher initial capital stock, and conjecture that in LICs the private sector may not be responsive to fiscal policy shocks when initial capital stock is too low.

Public investment efficiency. The quality of the public investment management process is important to reap the positive macroeconomic effects of public capital. The public investment management process encompasses multiple aspects, including project development, implementation, monitoring, and evaluation (Dabla-Norris et al. 2012). Gupta et al. (2014) compute "efficiency adjusted" public capital stocks and find that the growth effects of efficient public investment are higher. Positive impacts of higher efficiency of public investment are also documented in other empirical studies (Berg, Portillo, and Yang 2013; Cavallo and Daude 2011; Furceri and Li 2017; Izquierdo et al. 2018; Leduc and Wilson 2012; Leeper, Walker, and Yang 2010; Miyamoto et al. 2020).

Conclusion

The literature is generally in agreement that public investment tends to have positive impacts on economic growth, particularly in the longer run. The wide dispersion of the estimated magnitudes of public investment multipliers, however, motivated research that sought to reconcile the heterogeneity. Findings suggest that country-level characteristics—including public investment efficiency, debt levels, capital scarcity—and prevailing macroeconomic conditions at the time of public investment shocks impact the size of the multiplier. Methodological and sample differences may also explain some variation in results across studies. That said, the evidence on the impact of public investment on output in EMDEs is limited to date, owing in large part to associated data constraints. This important topic warrants further research to better inform the policies to stimulate economic growth and mobilize private investment.

BOX 3.2 Macroeconomic impacts of public investment: A literature review (*continued*)

TABLE B3.2.1 Output effects of public investment: Summary of the literature

Study	Public investment multiplier	Sample	Methodology	Notes
Abiad et al. (2016)	0.4 (year 0) – 1.4 (year 4)	17 OECD economies; 1985-2013	Local projections with forecast error shocks	Output growth in response to a one percent of GDP increase in public investment. Larger multipliers in low-growth episodes and in countries with high spending efficiency.
Auerbach and Gorodnichenko (2012)	2.12 (peak response over 20 quarters)	the United States; 1947-2008	SVAR with forecast error shocks	Cumulative output effect in dollars in response to a one dollar increase in public investment. Larger multipliers in recessions that in expansion.
Barry et al. (2018)	0.16 (quarter 1) – 1.10 (quarter 12)	Cameroon; 1999-2015	SVAR with Blanchard and Perotti (2002) identification	Cumulative change in output in percent, in response to a one percent increase in public investment. Statistically insignificant for most of the forecast horizon and in the longer run.
Bom and Ligthart (2014b)	0.08 (short run) – 0.12 (long run)	68 studies over 1983-2008	Meta-regression analysis	Meta-regression estimates of output elasticity of public capital based on studies utilizing a production-function approach. Impact on output growth in response to a one percent increase in public capital.
David (2017)	0.1 (quarter 0) – 2.1 (quarter 20)	Paraguay; 1998-2015	SVAR with Blanchard and Perotti (2002) identification	Output growth in percent, in response to a 1 percent increase in public investment. Larger multipliers for public investment than for public consumption.
Deleidi et al. (2020)	[0.9 – 1.2] in year 0; [1.9 – 3.4] in year 6	11 euro area countries; 1970-2016	Local projections	Output growth in response to a one percent increase in public investment. Smaller multipliers in the pre-2007 period. The ranges of individual country estimates are in parentheses.
Demetriades and Mamuneas (2000)	[0.36 – 2.06] in the short run; [0.36 – 1.97] in the long run	12 OECD countries; 1972-91	Simultaneous equations system	Output elasticities. Impact on output of a one percent increase in public capital. The ranges of individual country estimates are in parentheses.
Eden and Kraay (2014)	1.5 (year 1)	39 low-income countries (IDA borrowers)	2SLS with Kraay (2012) identification	Output increase in dollars in response to a one dollar increase in public investment. Lower multiplier using OLS estimation (0.2).
Elkhdari et al. (2018)	0.3 (year 1) – 1.2 (year 5) 0.5 (year 1) – 1.8 (year 5)	Algeria; 2008-15 9 MNA countries; 2000-15	SVAR with Blanchard and Perotti (2002) identification; location projections	Output growth in response to a one percent increase in capital expenditures. Larger multipliers during periods with negative output gaps.
Espinoza and Senhadji (2011)	0.2-0.3 in the short term; 0.6-1.1 in the long term	Gulf Cooperation Council countries; 1975-2009	Panel models	Output growth in response to a 15 percent increase in capital expenditures. Larger multipliers for public investment than for public consumption.
Furceri and Li (2017)	0.2 (year 1) – 0.4 (year 4)	79 EMDEs; 1990-2013	Local projections with forecast error shocks	Output growth in response to a 10 percent increase in public investment. Larger multipliers during economic slack, in closed economies, in countries with fixed exchange rates, lower public debt, and higher investment efficiency.
Gbohoui (2021)	0.55 (year 0) – 0.07 (year 2) 0.22 (year 0) – 0.56 (year 2)	Advanced economies; 1996-2019 EMDEs; 1990-2019	Local projections with forecast error shocks	Output growth in response to a one percent of GDP increase in public investment. Larger multipliers during heightened uncertainty.
Gechert and Rannenberg (2018)	0.6	98 empirical studies	Meta-regression analysis	Output growth in response to a one percent of GDP increase in public investment. Larger multipliers during economic downturns.
Gonzales-Garcia et al. (2013)	0.12 (year 0) – 0.44 (after 4 years)	Eastern Caribbean Currency Union; 1994-2009	SVAR with Blanchard and Perotti (2002) identification	Cumulative output growth in response to a one percent of GDP increase in public investment. Larger multipliers for public investment than for public consumption (the latter are not statistically significant).

BOX 3.2 Macroeconomic impacts of public investment: A literature review (*continued*)

TABLE B3.2.1 Output effects of public investment: Summary of the literature

Study	Public investment multiplier	Sample	Methodology	Notes
Honda et al. (2020)	0.1 (year 1) – 0.2 (year 2)	42 low-income countries; 1995-2017	Local projections with forecast error shocks	Output growth in response to a one percent of GDP increase in public investment. Larger multipliers in recessions, under a fixed exchange rate regime, in countries with better institutions.
Ilzetzki et al. (2013)	0.4 (quarter 0) – 1.5 (quarter 20)	High income countries; 1985-2013	SVAR with Blanchard and Perotti (2002) identification	Cumulative output multipliers (ratio of cumulative increase in output and cumulative increase in public investment). Larger multipliers in countries with fixed exchange rates, closed economies, countries with low debt (not stat. significant in high-debt countries).
	0.6 (quarter 0) – 1.6 (quarter 20)	Developing countries; 1985-2013		
IMF (2014)	0.4 (year 0) – 1.5 (year 4)	Advanced economies; 1985-2013	Local projections with forecast error shocks	Output response to a one percent of GDP increase in public investment. Larger multipliers during low growth and in countries with higher spending efficiency.
	(1) 0.3 in year 0 – 0.5 in year 4; (2) 0.5 in year 0 – 0.9 in year 4	Developing economies; 1990-2013	Local projections with shocks based on Corsetti et al. (2013) and Kraay (2012)	Output response to a one percent of GDP increase in public investment. Shock identification: (1) Corsetti et al. (2013) approach based on fiscal rules; (2) Kraay (2012) methodology based on official development assistance.
Izquierdo et al. (2019)	0.2 – 1.4 after two years	31 European countries; U.S. states; Argentine provinces	Local projections with Blanchard and Perotti (2002), forecast error, and IV identification	Output growth in response to a one percent increase in public investment. Larger multipliers in countries with low public capital stock; statistically insignificant multipliers in countries with low spending efficiency.
Jong-A-Pin and de Haan (2008)	Ranging from about -2.5 to 2.5	21 OECD countries; 1960-2001	VAR	Output elasticity of public capital at the horizon of 20 years. Output growth in response to a one percent increase in public capital.
Minea and Mustea (2015)	0.53 (year 1) – 1.18 (year 10)	Mediterranean countries; 1980-2012	PVAR	Cumulative output growth in response to a one percent increase in public investment. Heterogeneous multipliers across country groups within the sample: larger in Asian, smaller in African countries.
Miyamoto et al. (2020)	0.2 (year 0) – 1.2 (year 4)	17 advanced economies	Local projections with forecast error shocks	Output growth in response to a one percent of GDP increase in public investment. Statistically insignificant in low-income countries. Larger multipliers in countries with better governance.
	0.2 (year 0) – 0.5 (year 4)	39 EMDEs		
Petrovic et al. (2021)	0.7 – 0.8 (after one year)	10 Central and Eastern European countries	Local projections and SVAR with Blanchard and Perotti (2002) identification	Cumulative output growth in percent in response to a one percent increase in public investment. Larger multipliers in low-growth periods.
Puig (2014)	1.03 over two years	Argentina; 1993-2012	SVAR	Increase in output in dollars in response to a one dollar increase in public investment. Greater impact of public investment than public consumption.
Rafiq and Zeufack (2012)	2.7 in recessions; 2.0 in expansions (year 1)	Malaysia; 1981-2004	SVAR with Blanchard and Perotti (2002) identification	Output growth in response to a one percent increase in public investment. Greater impact of public investment than public consumption.
Warner (2014)	0.14 (year 0)	124 EMDEs; 1960-2011	OLS	Output per capita growth in response to a one percent increase in public investment. Insignificant impact in the long run.

Source: World Bank.
Note: 2SLS = two-stage least squares; EMDEs = emerging market and developing economies; IDA = International Development Association; IV = instrumental variables approach; MNA = Middle East and North Africa; OECD = Organisation for Economic Co-operation and Development; OLS = ordinary least squares; PVAR = panel vector autoregression; SVAR = structural vector autoregression; VAR = vector autoregression.