

A FISCAL POLICY FRAMEWORK TO SAFEGUARD PUBLIC INVESTMENT

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1. Introduction

There has been, and continues to be, a lively debate concerning whether and how public investment should be safeguarded in the face of limited budgetary resources and competing spending needs. This debate has its roots in one stylized fact and two beliefs. The stylized fact is that fiscal adjustment has forced governments to compress public investment, which consequently has fallen as a share of GDP over the last two decades, especially in Latin America but also in other parts of the world. The two beliefs are: first, that falling public investment has a significant cost in terms of lower growth, unless the private sector steps in to take up the slack; and second, that public investment in infrastructure is more meritorious than other government spending, since it produces assets that generate returns to offset the borrowing that pays for it, and therefore leaves government net worth unchanged.

Based on these beliefs, it is argued that declining public investment is to be partly blamed for the lackluster growth performance of a number of countries; or, following on from this, it appears that higher public investment spending is a precondition for boosting these countries' growth potential over the medium term. To this end, public investment should be freed from the constraints imposed by the "traditional" fiscal policy framework which focuses on liquidity and debt sustainability. This framework is biased against public investment, because it inevitably has a negative effect on liquidity in the short term (given large upfront costs and long pay-off periods) and adverse consequences for debt sustainability if the beneficial growth effects of public investment are not taken into account.

This paper seeks to present a number of perspectives on the public investment debate. More specifically, it discusses proposals to modify the traditional fiscal policy framework by looking at fiscal indicators and targets that may be better suited to safeguarding public investment, and to avoiding procyclical spending behavior resulting from public investment cuts in bad times and current spending increases in good times. But safeguarding public investment goes beyond the appropriate choice of fiscal indicators and targets. It also requires consideration of how to enhance budget flexibility with a view to avoiding undue cuts in public investment in the face of resource shortfalls or additional spending pressures, select and execute sound

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The views expressed are those of the authors and do not necessarily reflect the views of the IMF or IMF policy.

public investment projects, and create an environment that promotes private participation in infrastructure investment.

The main conclusion is that there is no magic bullet when it comes to safeguarding public investment. Irrespective of the accounting principles applied and the fiscal balances targeted, public investment needs to be financed from public resources, and it contributes to demand pressures just like any other government spending. This means that public investment cannot be looked at in isolation, independently of its impact on the government's borrowing requirements and debt. There may be scope, however, to prioritize and protect infrastructure projects that relieve bottlenecks and otherwise clearly contribute to a country's growth potential, even when the fiscal position provides little room for additional borrowing. The paper offers some suggestions on a fiscal policy framework to help achieve this.

2. Has public investment declined over the last two decades?

Latin American leaders have been most forceful in voicing concerns about declining public investment in their countries. Thus Brazil's President Lula da Silva last year called on the IMF to allow infrastructure spending to be excluded from fiscal targets under IMF-supported programs, while President Vincente Fox of Mexico made a similar proposal in 2003 at the G8 summit in Evian, France. Their calls have been echoed by a number of researchers and observers (for example, Calderón and Servén, 2003, for Latin America, and Blanchard and Giavazzi, 2003, for the euro area).

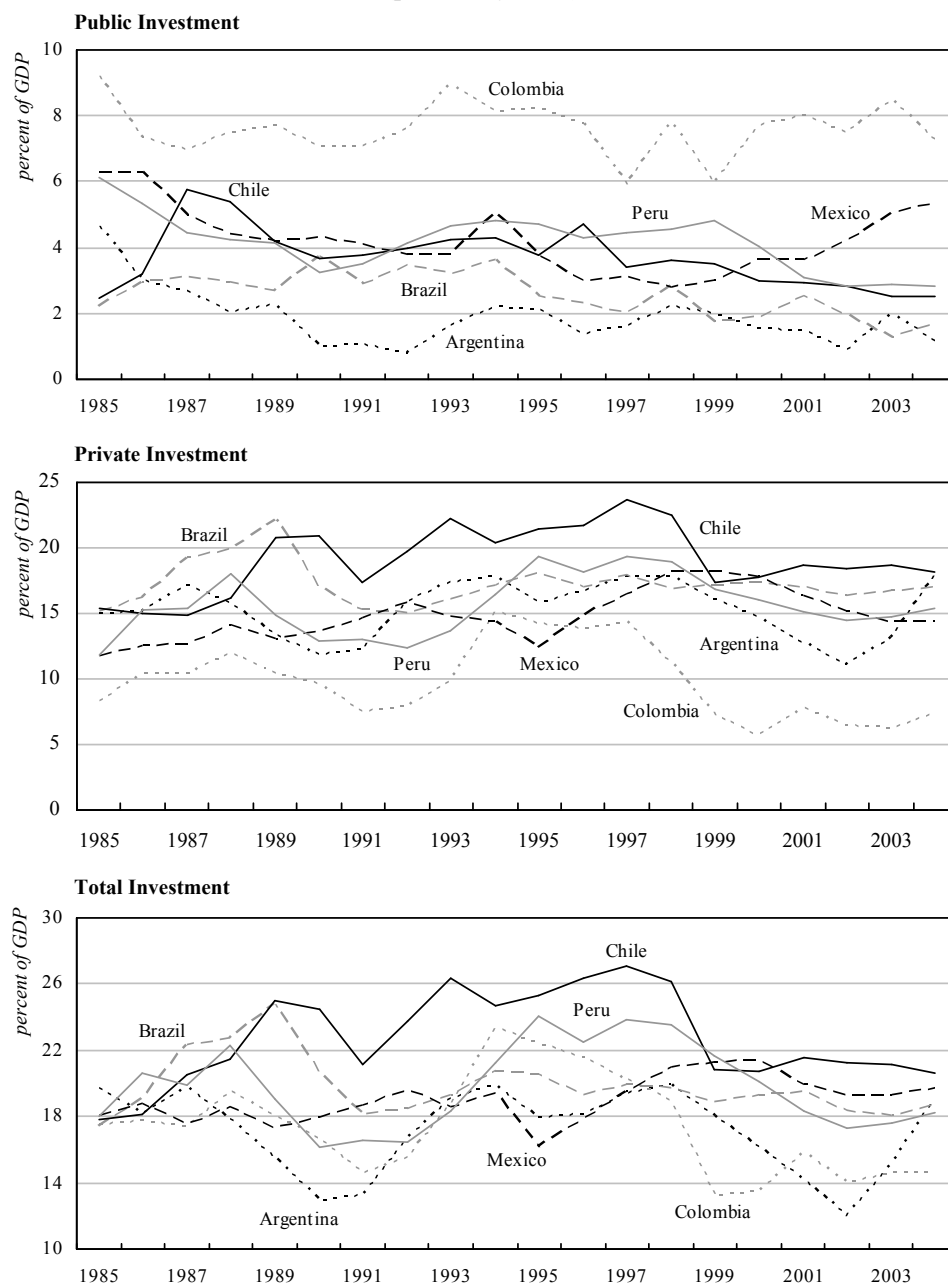
Public investment has indeed declined as a share of GDP in many countries; it has also been very volatile, most notably in Latin America, possibly reflecting the stop-go pattern of investment spending in countries that have gone through periods of fiscal adjustment, and this has probably had important efficiency implications (Figures 1 and 2). As a result of lower public investment and insufficient private sector involvement in infrastructure, significant infrastructure gaps have emerged, hurting economic growth in a number of countries (Calderón and Servén, 2003).

Why has public investment borne the brunt of fiscal adjustment? This may reflect political economy constraints – since public investment benefits mainly future generations, today's politicians have no incentive to protect investment. The situation is different for current spending, which benefits the current generation of voters. It may also be the result of public investment being less rigid than current spending; the heavy weight of entitlement programs, wages, and interest payments means that current spending has a large nondiscretionary component.

Declining public investment is not always and necessarily worrisome, however. Public investment depends, among other things, on the level of development of a country and the role of the government in the economy. Public investment should naturally decline over time as the public capital stock is built up, and this trend will be more pronounced when a general preference for smaller government gets reflected in privatization and other forms of private sector

Figure 1

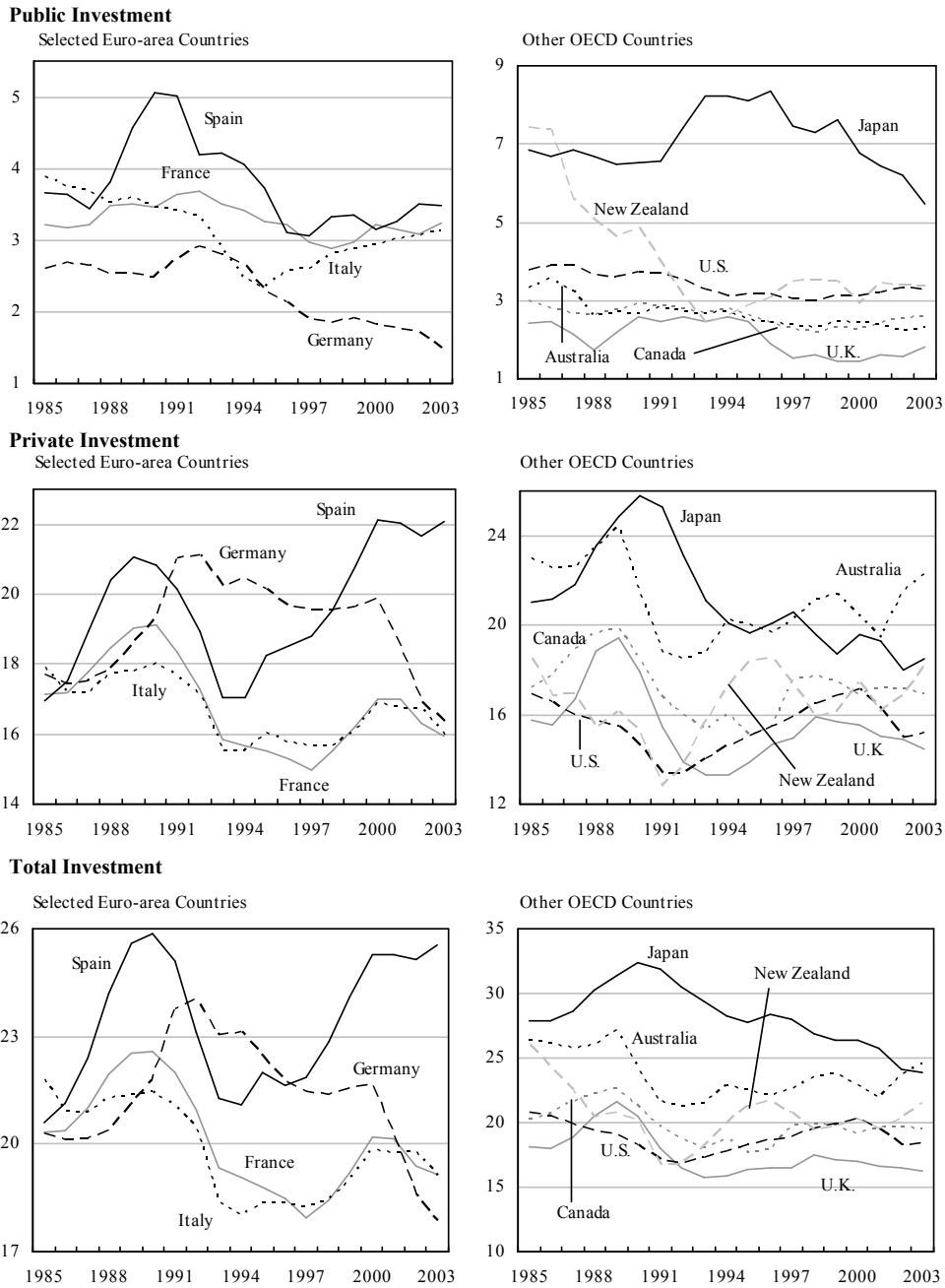
Investment Trends in Selected Latin American Countries, 1985-2004
(percent of GDP)



Source: World Economic Outlook.

Figure 2

Investment Trends in Selected OECD Countries, 1985-2004
(percent of GDP)



Source: OECD.

involvement. In the last few decades, there has also been more scope for the private sector, driven by technological advances that have allowed natural monopolies to be broken up (for example, in electricity generation and telecommunications) and capital market developments that have facilitated better risk management. In addition, to the extent that the investment deflator has fallen relative to the GDP deflator (as in Europe), a falling public investment-to-GDP ratio would not imply a decline in the volume of investment.

3. Does public investment promote growth?

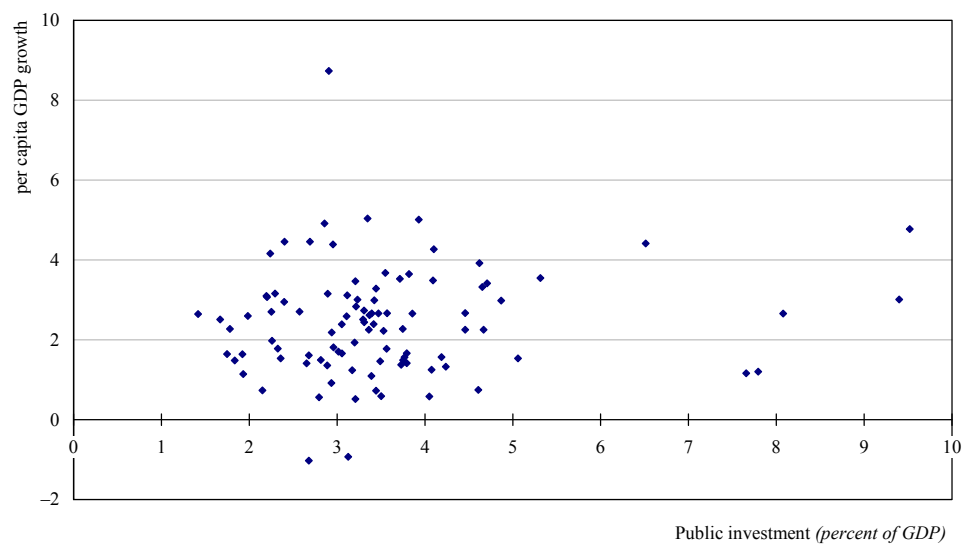
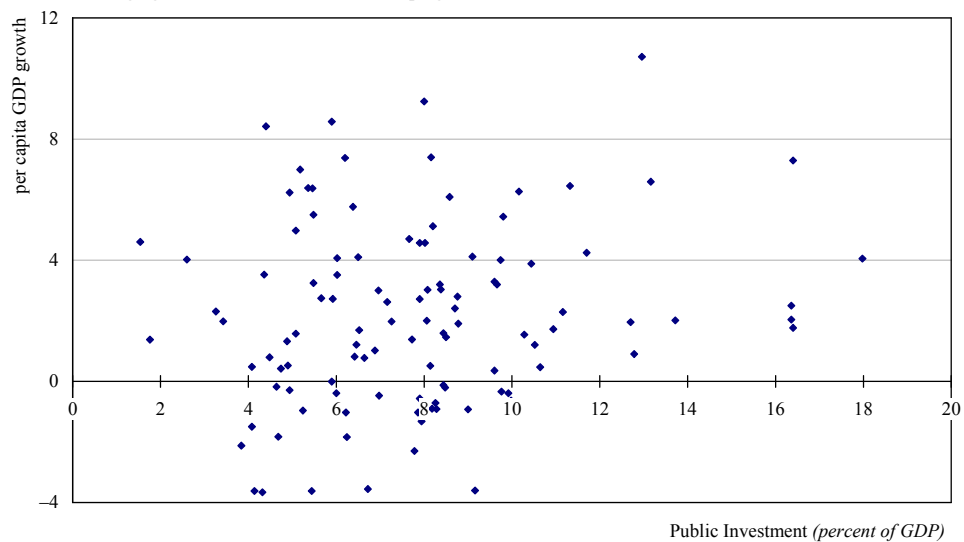
Measurement problems make establishing a robust relationship between public investment and growth challenging. First, public investment is only one of the factors that affect growth over the longer term, and it is difficult to control for the others. Second, a sizable portion of public investment is directed to supporting broad functions of government, including redistribution and the provision of social services, maintaining law and order, and administration, which do not directly boost productive potential. Finally, most infrastructure investment is lumpy in nature, implying that the full impact of investment in roads, telecommunications, and other infrastructure on growth can only be realized with considerable lags, once effective networks have been established.¹

It is therefore not surprising that the empirical evidence on the links between public investment and growth has so far been inconclusive, with studies reporting contrasting results (a review of the literature is provided in the Appendix).² The difficulty of pinning down the relationship between public investment and growth is illustrated in Figure 3, where observations on public investment-to-GDP and per capita GDP growth do not display a clear pattern. Empirical work is also complicated by data comparability problems, since the definition and coverage of public investment varies across countries. Moreover, data on the public capital stock, either in financial terms or physical terms (e.g., miles of power lines and roads, number of telephone connections, etc.), would be better for most analytical purposes, but they are less readily available and used in only a few studies (including those that give the strongest positive results).

¹ There is little evidence on relative rates of return on public and private investment. However, a study for advanced OECD countries shows that the short- to medium-term rates of return on public and private investment in infrastructure are similar, but long-term rates of return for public investment are significantly higher (Demetriades and Mamuneas, 2000).

² Appendix 1 does not cover the literature on whether higher public investment can raise growth rates in the short term. Generally speaking, fiscal multipliers are quite low; as launching new public investment projects or even expanding existing projects involve lags, increases in current spending and tax cuts tend to be a more effective means of boosting aggregate demand in the short term. However, since investment projects can be halted more quickly than they can be started, the costs of cutting public investment in terms of foregone output may be felt quite quickly. Hemming, Kell and Mahfouz (2002) review the literature on fiscal multipliers.

Figure 3

Public Investment and Growth, 1970-2000⁽¹⁾Advanced OECD Countries⁽²⁾Selected Emerging Market Economies and Developing Countries⁽³⁾

(1) Five-year within period averages.

(2) Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Ireland, Italy, Japan, Norway, Portugal, Spain, Sweden, United Kingdom and United States.

(3) Argentina, Bolivia, Brazil, Chile, Colombia, Ecuador, Mexico, Peru, Venezuela; Cote d'Ivoire, Kenya, Madagascar, Malawi; China, India, Indonesia, Korea, Malaysia, Philippines, Thailand, Morocco, Tunisia.

Source: WEO Database, International Finance Corporation, and OECD.

It should also be noted that it is total investment and the national stock of capital that matter most for growth. Hence a related question is whether public and private investment are complements or substitutes; in other words, does public investment crowd in private investment by increasing its productivity, or crowd it out, either directly because the government undertakes projects that the private sector would be willing to take on, or indirectly via pressures on interest rates and the exchange rate. The evidence points to only modest crowding out (Hemming, Kell and Mahfouz, 2002).

4. Is public investment different?

Advocates of protecting public investment argue that it is different from current spending. First, by creating productive assets, public investment pays for itself over the long term, either because it contributes to raising tax revenue as growth responds and/or user fees are levied. Second, while the benefits of current spending fall mainly in the current period, benefits from capital spending extend to future generations; principles of intergenerational equity would then justify spreading the costs of public investment across generations of beneficiaries.³ Finally, while current spending diminishes government net worth, in principle investment generates an asset equivalent to the value of the expenditure; hence net worth remains unchanged. On these counts, public investment is therefore “superior” to current spending, and merits being safeguarded.

However, there is no guarantee that public investment will be productive in the sense that projects yield dividends for the budget that cover the government’s borrowing costs. Moreover, the payoff from private investment, good quality current spending, or cuts in distortionary taxes may be higher. In particular, increasing maintenance spending to help preserve the existing stock of capital may be a better choice than embarking in new projects while the status of existing ones deteriorates. Current spending that adds to human rather than physical capital may also pay for itself over the longer term.

5. How should public investment be safeguarded?

Advocates of higher public investment claim that the traditional approach to fiscal policy, by focusing on the overall budget balance and gross debt, provides no built-in incentive to give priority to public investment over current spending or tax cuts. But as stressed above, there is no guarantee that public investment is especially meritorious or productive. Consequently, attention must be paid to fiscal policy in its entirety, that is to the level and composition of spending, taxation, and financing. Indeed, fiscal constraints are not on public investment *per se*, but on fiscal

³ Strictly speaking, future generations should pay for public investment (through taxation) in proportion to the benefits they receive from it.

imbalances. It should in principle always be possible to rearrange the composition of expenditure or raise additional revenue to meet the budget constraint while allowing for higher public investment.

Independently of whether the traditional approach to fiscal policy provides no incentive to public investment or actually discriminates against it, the question then arises as to whether fiscal policy can be framed and implemented in a way that could help safeguard public investment.

5.1 *Broadening the set of fiscal indicators and targets*

A more flexible and “public investment-friendly” approach to fiscal policy could focus on broadening the usual set of fiscal indicators and targets, but without losing sight of the traditional overall balance and gross debt. Targeting the current balance, which excludes public investment, rather than the overall balance, would allow public investment to be treated differently from current spending; as a corollary, borrowing to finance infrastructure would not be counted against deficit and debt targets. A variant of this approach is the so-called *golden rule*, which requires governments to run a current balance or surplus. A number of countries follow some form of golden rule at the central and subnational levels (e.g., Germany, the United Kingdom, and the United States). A golden rule approach has also been suggested as a possible option for reforming the Stability and Growth Pact (SGP), given the need to step up infrastructure investment in many of the current euro area member countries and in most of the new EU member states.⁴

There are a number of arguments in favor of focusing on and targeting the current fiscal balance:

- such an approach would acknowledge that productive public investment adds to the stock of public (physical) capital. If its financial returns match (or exceed) the cost of borrowing, the net worth of the government is not affected (increases);
- if public investment, through higher growth, contributes to higher tax revenue or user fees are levied, productive public investment can pay for itself over the longer term, at least partially;
- spreading the costs of public investment over time promotes intergenerational equity. By financing public investment through borrowing, rather than through current savings, governments can shift part of the cost of investment to future beneficiaries by having them service the resulting debt;
- a balanced current budget is consistent with a positive steady-state public debt ratio. More specifically, it results in a steady-state ratio of public debt to GDP which is linked to the steady-state ratio of the public capital stock to GDP. In case of an overall balanced budget, the ratio of public debt to GDP is eventually driven to zero – an unlikely desired outcome in theory or practice.

⁴ See Blanchard and Giavazzi (2003), Buiter and Grafe (2002), and Galí and Perotti (2003).

However, framing fiscal policy exclusively around the current balance and adopting it exclusively as a fiscal target would entail a number of risks:

- when financing is constrained, there is little alternative but to focus on and target the overall balance. Indeed, if gross financing requirements (including the rollover of debt coming due) are large, fiscal targets may have to be set according to total, rather than net, financing availability;
- similarly, if demand pressures arise, public investment cannot be excluded when assessing the degree of fiscal adjustment required to bring domestic absorption into line with resource availability;
- even when public investment has the potential to generate additional revenue, a country may fail to collect it, for example due to poor tax administration, or to save it, as when revenue is earmarked for additional spending;
- implicit in the current balance approach is the presumption that public investment is of high quality, as it is supposed to yield adequate returns. But reality can be quite different, especially when screening and monitoring mechanisms for projects are weak. In such cases, public investment is less likely to pay for itself; rather, borrowing undertaken to finance it could undermine debt sustainability;
- targeting the current balance could introduce a bias against productive spending on health and education, or reductions in distortionary taxes;
- delinking borrowing for public investment from overall borrowing or debt limits may also undermine debt sustainability. Even when offset by public assets, gross public debt still matters, both because high debt levels send signals to markets and because heavy debt service limits a government's room for maneuver in the face of adverse shocks. These concerns are exacerbated in emerging market economies facing high borrowing costs, volatile macroeconomic variables (growth, interest rates, and exchange rates) and uneven access to capital markets. Similar concerns apply to advanced OECD and other countries where aging populations will be source of increasing fiscal pressures;
- freeing public investment from fiscal constraints may also crowd out private involvement in infrastructure, even in circumstances where such involvement would be desirable on efficiency grounds (e.g., when there is no obvious market failure);
- separating public investment by adopting an infrastructure or capital budget can fragment the budget, which reduces flexibility;
- focusing on the current fiscal balance may create an incentive for creative accounting, so as to classify current spending as investment and thereby exclude it from fiscal targets.

Rather than replacing the traditional framework based on overall balance and gross debt, there may be scope to modify it by paying more attention to the current balance. This is consistent with the long-established view that there is no one-size-fits-all fiscal indicator that is satisfactory for all purposes; rather a range of fiscal indicators should be used (Tanzi, 1993). More precisely, targeting the overall

fiscal balance and gross debt would remain appropriate where there are concerns about macroeconomic stability and debt sustainability. However, where these are not pressing concerns for fiscal policy, a supplementary target for the current balance can limit the government's ability to utilize any scope it has for additional borrowing to finance tax cuts or increased current spending. And where financing is constrained, setting such a target can highlight the trade-off between public investment, current spending, and taxation, and prompt policies needed to accommodate a higher level of public investment. The Fund's *Government Finance Statistics Manual 2001 (GFSM 2001)* is a fiscal reporting framework that provides a basis for the calculation and analysis of the current balance (the operating balance in the *GFSM 2001* terminology) and net worth.

Finally, a word on structural or cyclically-adjusted fiscal balances. Despite their limitations and computational challenges that make them unsuitable to all countries (Balassone *et al.*, 2005), these indicators may be useful in encouraging a buildup of fiscal cushions in good times that can be used to protect public investment in bad times, and more generally help avoid procyclical spending. This will in turn contribute to reducing the volatility of public investment.

5.2 *Introducing more budgetary flexibility*

To help avoid squeezing public investment in unfavorable cyclical conditions or when other spending pressures emerge, greater flexibility in budget formulation and execution is clearly desirable. This would allow for the creation of budgetary room for an appropriate public investment program, in line with other budget priorities and consistent with a sustainable fiscal stance. This should be complemented, where necessary, by reforms to:

- 1) streamline and prioritize current spending, by modifying earmarking and entitlement programs so that current outlays are easier to contain,
- 2) mobilize revenue,
- 3) eliminate wasteful public investment, and
- 4) identify priority projects.

Implementing medium-term expenditure frameworks would provide a mechanism to better focus on priorities and trade-offs. In view of the bias against cutting current spending in the short term, public investment (along with any other spending program) should be cast in a medium-term expenditure framework to help prioritize projects – in case of adverse shocks, priority projects would then be protected. When appropriately implemented, a medium-term framework would also provide for the protection of the recurrent costs of investment projects.

5.3 Strengthening the institutional framework for public investment

Improvements in the institutional framework for formulating and undertaking public projects, where necessary, would also contribute to safeguarding public investment. This would involve strengthening project evaluation and management capacity to ensure that public investment is both productive and cost effective, by building institutions that do that, or strengthening current institutions (such as project evaluation units in economic ministries); and it would help to promote independent evaluation of projects, which is not affected by political considerations dictated by the government of the day.

5.4 Promoting private sector involvement

Infrastructure investment and the provision of infrastructure-based services can be provided under different market conditions (competitive vs. uncompetitive, with and without prices etc.) and under different arrangements (wholly government or private provision, public-private partnerships, regulated private provision). The market failure test should determine who provides infrastructure and how. At the same time, disincentives to private sector participation should be removed by overhauling inadequate, discriminatory, and unstable regulatory frameworks, liberalizing pricing policies faced by private firms, and more generally placing government at an arm's length from the private sector. The application of sound and transparent procurement laws would complement these efforts.

6. Concluding comments

The issue of promoting/safeguarding public investment is not exclusively one of providing additional financing; nor does it involve adopting either legitimate accounting changes or accounting gimmicks to create room for additional financing for public investment. Ultimately, safeguarding public investment is a matter of fiscal policy choices and prioritization given limited budgetary resources and competing budgetary claims. There is no better solution to safeguarding public investment than to formulate and implement fiscal policy in a flexible, sustainable, and transparent manner. At the same time, however, more work is needed to better inform fiscal policy formulation. In particular, a better understanding of the growth effects of public investment and the government's ability to capture the dividends of higher growth is needed to reconcile increased public investment and debt sustainability.

APPENDIX STUDIES OF PUBLIC INVESTMENT AND GROWTH

Studies on the impact of public investment on longer-term growth do not give clear-cut results. This is despite the substantial research effort that took off following a series of papers by Aschauer, published in 1989, which suggested that falling public investment in the United States helped explain the post-1970 slowdown in U.S. productivity growth, and that there was a positive cross-country correlation between public investment and productivity growth. A number of subsequent studies reached similar conclusions. However, the strength and robustness of such results turn out to be sensitive to the methodology and data employed. This appendix provides further detail on this body of empirical work.

Some of the key studies are summarized in Table 1. These are grouped according to the four main methodologies that have been employed:

- aggregate production functions, which relate output to public capital stocks. Public capital is viewed either as an input in its own right, or as a factor improving the productivity of other factor inputs, such as private capital.
- cost or profit functions, to assess whether public capital lowers business costs (or increases profits).
- research focused on growth rather than the level of output, examining whether public investment – in aggregate, or broken down into components such as infrastructure – helps explain differences in cross-country or cross-regional growth.
- vector autoregressions (VARs), which are well suited to exploiting the time-series properties of public investment, output, and other variables without imposing a causal structure *a priori*.

Considering first the links between public capital and output, other studies – but not all – using Aschauer's general methodology have also found a positive association between these variables, both in the United States and elsewhere. However, pointing to the range of econometric problems arising with such studies, Gramlich (1994) and others have noted that the implied rates of return on public capital in many of these studies appear to be implausibly high.⁵ It is also notable that, while the work of Aschauer and others was motivated in part by the post-1970 slowdown in productivity growth and the role that declining public investment might have played in this, U.S. productivity growth picked up significantly during the Nineties while public investment continued to decline. Most of the studies using cost or profit functions have found that public capital lowers business costs or increases profits, although with relatively weak effects. In an application of this approach to Germany, Conrad and Seitz (1994) find that while public infrastructure

⁵ Although this may be an extreme case, Canning and Bennathan (2000) note that the implied rate of return to investment in telephone networks in an earlier study is over 10,000 per cent a year.

Table 1

The Effect of Public Investment on Output, Productivity, and Growth

Study	Data	Results
1. Production Function Approach		
Aschauer (1989a)	U.S., time series 1949-85	Positive effect of public capital on output
Aschauer (1989b)	G7, panel data, 1966-85	Positive effect of public capital on output
Merriman (1990)	Japan, panel data on 9 regions, 1954-63	Positive effect of public capital on output
Ford and Poret (1991)	11 OECD countries, time series 1960-89	Significant positive effect in Belgium, Canada, and Germany
Bajo-Rubio and Sosvilla-Rivero (1993)	Spain, time series 1964-88	Positive effect of public capital on output
Dalamagas (1995)	Greece, time series 1950-92	Ambiguous effects
Sturm and De Haan (1995)	U.S., time series 1949-85	Positive effect of public capital on output; insignificant effects using time differences
García Milá, McGuire and Porter (1996)	U.S., panel data on 48 states, 1970-83	Insignificant effect of public capital on output
Kavanagh (1997)	Ireland, time series 1958-90	Insignificant effect of public capital on output
Canning and Bennathan (2000)	90 countries, 1960-90	Specific types of infrastructure complement physical and human capital in supporting output per worker
La Ferrara and Marcellino (2000)	Italy, regional panel, 1970-94	Negative effect of public capital on output
Ligthart (2000)	Portugal, time series 1965-95	Positive effect of public capital on output
Calderón and Servén (2003)	101 countries, 1960-97	Positive effect of specific infrastructure components on output per worker
2. Cost or Profit Function Approach		
Berndt and Hansson (1991)	Sweden, time series 1960-88	Reduction in costs. Public capital in excess supply.
Lynde and Richmond (1993a)	U.K., time series 1966-90	Reduction in costs
Lynde and Richmond (1993b)	U.S., time series 1958-89	Increase in output
Conrad and Seitz (1994)	Germany, panel on 3 sectors, 1961-88	Reduction in costs. Public capital in short supply during 1961-79; in excess supply during 1980-88
Dalamagas (1995)	Greece, time series 1950-92	Reduction in costs
Seitz and Licht (1995)	Germany, panel on 11 states, 1971-88	Reduction in costs
Morrison and Schwartz (1996)	U.S., panel on 48 states, 1970-87	Infrastructure has a negative impact on costs
La Ferrara and Marcellino (2000)	Italy, regional panel, 1970-94	Insignificant effect on costs. Public capital in excess supply for Italy as a whole

The Effect of Public Investment on Output, Productivity, and Growth

3. Cross-section Growth Regressions		
Barro (1991)	76 countries, 1960-85	No effect of public investment on per capita GDP growth
Easterly and Rebelo (1993)	100 countries, 1970-88	Insignificant effect of public investment on per capita GDP growth, significant effect of transport and communication spending
Crinfield and Panggabean (1995)	282 U.S. metropolitan areas, 1960-77	Ambiguous or insignificant effects of local and federal public capital on per capita GDP growth
Holtz-Eakin and Schwartz (1995)	48 U.S. states, 1971-86	Insignificant effects of public capital on per capita GDP growth
Devarajan, Swaroop, and Zou (1996)	43 countries, 1970-90	Positive effect of current government spending on growth, negative effect of public capital spending and of infrastructure
Mas, Maudos, Perez, and Uriel (1996)	17 Spanish regions, 1955-91	Not always significant effects of public capital on per capita GDP growth
Khan and Kumar (1997)	95 countries, 1970-90	Positive effect of public investment on per capita growth, though declining over time and with significant regional variation
Vanhoudt, Matha and Smid (2000)	EU countries, 1960-97	Positive effect of public investment on per capita GDP levels, negative on output growth
La Ferrara and Marcellino (2000)	Italian regions, 1970-94 (panel structure)	Positive effect of public infrastructure investment on TFP growth
Clements, Bhattacharya, and Nguyen (2003)	40 low-income countries, 1970-99	Positive effect of public investment on per capita GDP growth
Milbourne, Otto, and Voss (2003)	72 countries, 1960-85	Positive effect of total public investment, and education and infrastructure components, on growth; not significant when endogeneity controlled for
Gupta, Clements, Baldacci, and Mulas-Granados (2004)	39 low-income countries, 1990-2000	Positive effect of government capital expenditure on per capita GDP growth
4. VAR Studies		
Clarida (1993)	U.S., France, Germany, U.K., time series 1964-89	Total factor productivity and public capital are cointegrated, but direction of causality is unclear
Otto and Voss (1996)	Australia, time series 1959-82	No significant relation between public capital and output
Sturm, Jacobs, and Grote (1999)	Netherlands, time series 1853-13	Public infrastructure Granger-causes output
Ligthart (2000)	Portugal, time series 1965-95	Public investment Granger-causes output

Source: Adapted from Table III.1 in European Commission (2003), with some additional references added (e.g., to more recent research) and some country-specific studies deleted (especially where the findings are similar to those of other work referred to in the table).

increases productivity and lowers business costs, there are clear indications of over-investment by the public sector during the Eighties.

In a number of studies focusing on the level and growth of output, empirical support for a positive impact of public capital has been obtained using particular components of investment – notably infrastructure – even where such evidence is lacking in the case of aggregate public investment. For example, Calderón and Servén (2003) find that quantitative measures of electricity generating capacity, road and rail lines, and telephone lines have a positive and significant impact on output per worker. Growth regressions (in the bottom group in the table) also emphasize the role of infrastructure investment. Easterly and Rebelo (1993) find that aggregate public investment does not appear to be a significant determinant of per capita GDP growth (similar to the results of Barro, 1991, and several others), but they do find a strong positive impact arising from public investment in the transportation and communications sectors. Similarly, Milbourne, Otto, and Voss (2003) find that public investment in education, as well as in transport and communications, appears to have a positive and significant effect on growth.

Since empirical analysis can be distorted by reverse causation – higher growth may create the demand for higher public investment, rather than being the result of such investment – VAR studies attempt to establish the direction of causation. However, this has produced mixed results, as have attempts to control for reverse causation in cross-sectional panel studies.⁶ Simultaneity bias can also affect the empirical work, in that a sizable public investment project may lead to a short-run spurt in output, but possibly without an enduring effect on productivity and growth (Gramlich, 1994).

⁶ The Easterly and Rebelo (1993) results referred to above continue to hold when instrumental variable methods are used – although with what the authors describe as some “disturbingly high” coefficient values. The impact of infrastructure capital on output in Calderón and Servén (2003) also remains significant when the possible endogeneity of public capital is controlled for. The Milbourne, Otto and Voss (2003) results cease to be significant when instrumental variable methods are used.

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