LAPSE OF TIME

SM/20/90

April 15, 2020

To: Members of the Executive Board

From: The Secretary

Subject: **April 2020 Fiscal Monitor—Chapter 2**

Board Action:	Further to the Executive Board discussion on April 7, 2020, this analytical chapter of the Fiscal Monitor is being circulated for **Executive Directors' comments** in advance of publication.
Deadline to Provide Comments:	**Tuesday, April 28, 2020** **12:00 (noon)**
Publication:	Proposed, after Thursday, April 30, 2020
Questions:	Mr. Mauro, FAD (ext. 37718) Ms. Pattillo, FAD (ext. 37319) Mr. Lam, FAD (ext. 36963) Mr. Raissi, FAD (ext. 36465)
Additional Information:	The paper will be revised for publication in light of the comments from Executive Directors. If Executive Directors have comments, they should notify Mr. Mauro (ext. 37718), Ms. Pattillo (ext. 37319), Mr. Lam (ext. 36963), and Mr. Raissi (ext. 36465) by **12:00 p.m. on Tuesday, April 28, 2020.**

CHAPTER 2

IDEAS TO RESPOND TO WEAKER GROWTH

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EXECUTIVE SUMMARY

This chapter outlines a framework for policymakers to reinvigorate economic growth and counter adverse macroeconomic shocks with IDEAS—*I*nvest for the future—in health systems, infrastructure, low carbon technologies, education, and research—thereby boosting productivity growth; adopt well-planned *D*iscretionary policies; and *E*nhance *A*utomatic *S*tabilizers (including features of the tax and benefit system that stabilize incomes and consumption, such as progressive taxation and unemployment assistance). This framework can inform policies to respond to downturns or weak demand. At the current juncture, governments are actively enhancing the automatic stabilizers by expanding social safety nets to support people during the COVID-19 pandemic. It is also important to prepare investment plans and discretionary policies more generally, to be deployed as shutdowns end, and fiscal stimulus becomes effective and, depending on fiscal space, appropriate.

Low interest rates present an opportunity for high return public investment—a priority in most countries. Over the past decade, a moderation of capital accumulation has slowed economic growth. Modernizing the aging infrastructure in *advanced economies* and addressing infrastructure needs and other sustainable development goals in *emerging market and developing economies* are important. In all countries, combating climate change requires investment in mitigation and adaptation. These additional investment needs are likely to exceed $20 trillion, globally at current prices, over the next two decades.

For *advanced economies* with fiscal space, a greater set of investment projects is worth undertaking because the value of the resulting assets will likely exceed the liabilities incurred, thus improving the public sector's net worth. Where fiscal space is limited, it is appropriate to reorient revenues and expenditures to increase investment in health systems, infrastructure, and people. In *emerging markets and developing economies*, high debt levels and rising interest expenditures call for financing development in a fiscally responsible way. In *low-income developing countries*, raising tax revenues would be crucial over the long term. Improving investment management is critical for all countries: one-third of funds for public infrastructure is lost worldwide to inefficiencies.

Discretionary fiscal support during previous downturns often came too late and was not well targeted. To reduce implementation lags and guide expectations, policymakers should act swiftly to establish a pipeline of appraised investment projects now, to be implemented when the health crisis abates; and plan discretionary measures that can be deployed quickly.

Enhancing automatic stabilizers, especially improving unemployment benefit systems and social safety nets, can protect household incomes from adverse shocks and strengthen resilience against epidemics. For example, if *Estonia* or the *United States* upgraded their benefit systems to the median Organisation of Economic Co-operation and Development country level, net incomes of workers who lose their jobs during recessions would fall by one third less. Timely extension of the coverage and benefits of social safety nets (a priority during the pandemic) would support consumption of vulnerable households. A good example is a guaranteed minimum income scheme that is selective, conditional, and means-tested. While many countries are providing greater social assistance to households to fight COVID-19, a premium should be placed on measures that improve tax-benefit systems more lastingly.

Introduction

Low growth and investment, adverse shocks, and low inflation and interest rates during the past few years put fiscal policy at the forefront. The COVID-19 pandemic of 2020 has strengthened the case for fiscal policy action and heightened its urgency. In the past few years, growth has been subdued in advanced economies, reflecting various factors including a moderation in capital accumulation (Box 2.1). Sustained high, inclusive growth is critically needed for development in emerging market and developing economies. Inflation has trended down since the 1980s and is currently below targets in two-thirds of inflation-targeting countries. In advanced economies, inflation expectations are anchored at low levels. Nominal interest rates are at historical lows, shifting the balance of cyclical demand support toward fiscal policy. This is because the natural rate of interest—the interest rate that keeps the economy at full employment with stable inflation—is estimated to have fallen significantly and is now below zero in some economies (Rachel and Summers 2019). Consequently, the effective lower bound on policy rates binds more frequently. Moreover, the nominal interest rate on new government borrowing, although at times volatile, is currently negative in many advanced economies (something historically unprecedented). These patterns have been exacerbated by the COVID-19 pandemic (Chapter 1), resulting in a global recession this year, and are likely to persist during the post-shutdown recovery.

This chapter explores how fiscal policies can respond to weak growth with IDEAS: (1) Investing for the future—in infrastructure, low-carbon technologies, health care, education, and research; (2) enacting Discretionary measures that can be deployed contingent upon a particular state of the economy (Chapter 2 of the April 2020 *World Economic Outlook*); and (3) Enhancing Automatic Stabilizers—particularly by improving unemployment benefits and social safety nets—that are key fiscal tools used by countries in response to the pandemic. In discussing the IDEAS approach, the chapter will emphasize maximizing the benefits from sustainable, resilient public investment and improving social safety nets (that is, noncontributory transfer programs financed by general government revenue) (Figure 2.1).

Figure 2.1. A Road Map for Fiscal Policies

Response to Weaker Growth

- **Investment in the Future**
- **Discretionary Measures**
- **Enhancing Automatic Stabilizers (taxes, unemployment benefits, and social safety nets)**

Source: IMF staff.

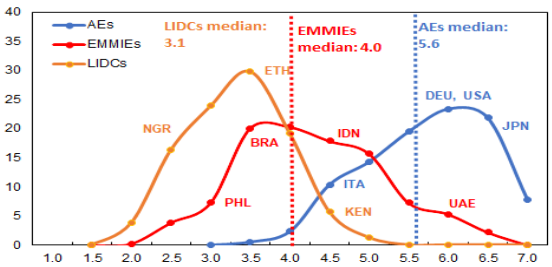
Low-for-long interest rates present an opportunity for quality public investment across the world to boost growth. Discretionary fiscal policies can have larger fiscal multipliers when policy rates are at the effective lower bounds and economic slack and fiscal space exist, because the policies can lead to a virtuous cycle that spurs private consumption and investment through higher inflation expectations and lower real interest rates (Christiano, Eichenbaum, and Rebelo 2011; Eggertsson 2011; Woodford 2011; Auerbach and Gorodnichenko 2012 and 2013; Correia and others 2013; Farhi and Werning 2016). With significant supply disruptions, the size of fiscal multipliers is more uncertain during pandemics and before the recovery phase. High levels of public debt, however, remain a vulnerability and impose constraints on the use of countercyclical fiscal policies in downturns (Romer and Romer 2019; April 2018 *Fiscal Monitor*). Moreover, when public debt is high, the multiplier effects of discretionary fiscal policies are lower (Bi, Shen, and Yang 2016). At high debt levels, automatic stabilizers can still be effective at reducing

macroeconomic fluctuations. To that end, strengthening social safety nets can be highly effective; it is an urgent priority to tailor the safety nets to the special situation of the pandemic.[1]

*I*nvestment for Growth

The slowdown in global growth has been linked, in part, to a moderation of capital accumulation. In advanced economies, total investment per person (public and private) was essentially unchanged for a decade: at $9,867 in 2007 and $9,991 in 2017, in constant 2017 US dollars (IMF Investment and Capital Database). In a range of countries, high-return public investment could act as a bridge to sustainable, resilient, and inclusive economic growth, including by lifting productivity, creating jobs, and spurring private sector investment. It can also improve public sector net worth because the value of the resulting assets will likely exceed the liabilities incurred (October 2018 Fiscal Monitor). In many emerging market and developing countries, infrastructure bottlenecks are impediments to long-term development (Chapter 3 of the October 2014 *World Economic Outlook*; Figure 2.2).

Figure 2.2. Distribution of Overall Infrastructure Quality, by Income Group
(Frequency in percent, 2007–17 average)
Infrastructure quality varies across countries.



Source: World Bank.
Note: Based on the scoring of infrastructure quality for more than 150 countries across the world. Scoring of overall infrastructure quality ranges from 1 (lowest) to 7 (highest). Data labels use International Organization for Standardization (ISO) country codes. AEs = advanced economies; EMMIEs = emerging market and middle-income economies; LIDCs = low-income developing countries.

Investment inefficiencies and other structural rigidities, especially in emerging market and developing economies, could reduce expected returns on public capital and raise debt-to-GDP ratios following a scale-up of public investment. Decisions, including whether and how much to scale up quality public investment, will depend on the needs in specific sectors and their returns, prospects for sustainable financing (debt financed versus budget neutral), and the efficiency of public investment. A sizable increase in public investment—particularly if undertaken in a range of countries—could affect inflation and interest rates, which are especially relevant in the current macroeconomic juncture for many advanced economies. For emerging market and developing countries, while investment needs are large and inefficiencies higher, a critical challenge is to finance development in a fiscally responsible way given high, and in many cases, still rising public debt (Schwartz and others 2020).

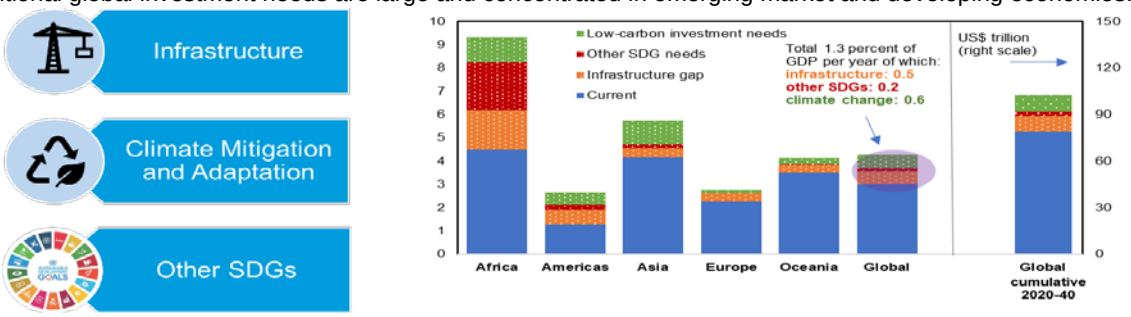
- *Sustainable investment areas:* Public investment is particularly desirable in sectors that have large positive externalities and could crowd in private sector investment (Acemoglu, Aghion, and Zilibotti 2006). Investment in health and emergency services will improve living standards, enhance resilience, and help mitigate risks from future epidemics. Key priorities include infrastructure, low-carbon technologies, and progress toward other Sustainable Development Goals. Additional investment needs are estimated at 1.3 percent of global GDP per year (Figure 2.3) or, on a cumulative basis,

[1] The merits of improving tax-benefit systems go well beyond stabilization. Reducing tax distortions and providing incentives to encourage labor supply and investment, along with well-designed benefit systems, could contribute to supply potential and long-term growth. A strong safety net and unemployment insurance can reduce inequality and the need for precautionary savings (underlying causes of prolonged demand weaknesses), particularly for emerging markets and developing economies (Di Maggio and Kermani 2016; Hsu, Matsa, and Melzer 2018). At the same time, if the burden of structural reforms and the cost of deleveraging fall on low-income households and small businesses, a well-designed safety net can alleviate such costs.

exceeding $20 trillion (measured in current USD terms) over the next two decades, although these estimates are subject to considerable uncertainty. Investment needs consist of the following:

Figure 2.3. Global Investment Needs on Infrastructure, Climate, and Other SDGs
(Percent of annual regional GDP; trillions of US dollars, right scale)

Additional global investment needs are large and concentrated in emerging market and developing economies.



Sources: Global Infrastructure Hub; Oxford Economics; and IMF staff estimates.
Note: The blue bars show the current investment levels across regions as of the end of 2017. Additional global investment needs are estimated, on average, at 1.3 percent of global GDP per year during 2020–40 (exceeding US$20 trillion in current US dollars), comprising infrastructure (0.5 percent of GDP), other SDGs (0.2 percent of GDP), and low-carbon investment (0.6 percent of GDP). The right panel shows the cumulative investment needs in trillions of US dollars (constant 2019 prices and exchange rates) over the next two decades. SDGs = Sustainable Development Goals.

- *Infrastructure:* According to the G20-initiative on the global infrastructure outlook, an additional investment of 0.5 percent of global GDP per year is needed over the next two decades to cover infrastructure gaps, mostly for transportation.[2] In addition, investment needs for upgrading health infrastructure (medical facilities and equipment) are large.
- *Climate change:* An additional investment of 0.6 percent of global GDP per year is needed for adaptation to climate change as well as the transition to cleaner energy systems—to limit the rise in global temperatures to below 2 degrees Celsius in this century compared with pre-industrial levels *(October 2019 Fiscal Monitor)*.[3]
- *Other Sustainable Development Goals:* Meeting these goals (for access to clean water, sanitation, and affordable electricity) requires an additional 0.2 percent of global GDP in investment per year up to the year 2030, according to the G20-initiative on global investment outlook. These additional investment needs are over and above infrastructure needs described in the first bullet and are mostly concentrated in sub-Saharan Africa and other low-income developing countries, amounting to 5 percent of regional GDP per year in Africa.[4]

- *Investment management:* Scaling up public investment too much and too fast, going beyond a country's absorptive capacity, risks waste rather than sustained output growth (Presbitero 2016). Across countries, losses and waste in public investment are prevalent. On average, over one-third of funds for public infrastructure are estimated to be lost owing to inefficiencies (IMF 2015a; Baum, Mogues,

[2] The size of infrastructure needs in energy, telecommunications, transportation (airport, ports, rail, and road), and water sectors for each of the 50 countries is calculated based on trend investment projections relative to best performers (that is, the 75th percentile) among countries of similar income levels. Missing data from remaining countries are scaled by their relative GDP weights to arrive at regional and global infrastructure needs. Additional Sustainable Development Goals investment needs for access to clean water, sanitation, and electricity are over and above those infrastructure needs indicated above.

[3] Investment needs for climate adaptation are estimated at $1.8 trillion globally cumulatively over 2020–30, or 0.2 percent of global GDP per year (Global Commission on Adaptation 2019). Key areas include early warning systems, climate-resilient infrastructure, dryland agriculture crop production, mangrove protection, and water resource management.

[4] Including health and education investment toward the Sustainable Development Goals could add an additional 0.2 percent of global GDP per year to the global investment needs (Gaspar and others 2019).

and Verdier 2020). Weaknesses in infrastructure governance, such as optimism bias in project appraisal, limited interagency coordination, corruption, and weak budget processes, are critical factors behind such inefficiencies and poor investment outcomes, particularly in the allocation and implementation of public investment (Schwartz and others 2020; April 2019 *Fiscal Monitor*). In countries where subnational governments are critical in executing public investment, the fragmentation of public infrastructure delivery, local capacity constraints (Germany, Italy), or unclear delineation of land rights (India) could emerge as obstacles to large public investment. For example, in Germany, where two-thirds of public investment is executed by local governments (states and municipalities), earmarked deferral funds for investment are underutilized. That is largely because of capacity constraints in some localities and price pressures in the construction industry, even though local municipalities have backlogs of investment needs. India's budget allocations for capital expenditure are not fully executed, particularly at the state level. Bolivia experiences weak intergovernmental coordination.

To increase the long-term output gains from increased public investment, investment efficiency needs to be improved. Sound institutional processes, including careful project selection, management, and evaluation, as well as a clear delineation of responsibilities and mechanism to ensure coordination between central and subnational governments, should be in place to ensure productive investment (IMF 2015a). Improving public investment management (to the 90th percentile of best performers in each income group) could halve the size of investment inefficiencies across countries (Baum, Mogues, and Verdier 2020). Improving investment efficiency is by no means limited to emerging market and developing economies. Advanced economies can improve public investment processes. For example, policymakers can establish a central register of infrastructure projects, tighten financial rules on public-private partnerships, and disclose more ex post reviews and audits of capital projects. Policymakers can also strengthen the links among the national planning framework, the long-term capital plan, and the budgeting process (*Ireland*) (IMF 2017). Most countries should also accelerate their decision-making processes and strengthen implementation capacity (*Italy, Germany*).

- *Sustainable financing:* While government borrowing costs in many advanced economies have declined to unprecedently low levels, the rates of return on private capital have largely held up (Farhi and Gourio 2018). Considering weak private investment, to the extent that the risk-adjusted social return on new public investment is higher than government financing costs, a greater set of public investment projects is worth undertaking (Blanchard 2019). In this environment, public investment is less likely to crowd out private activity. In contrast, public investment in electricity networks could encourage, for example, private investment in low-carbon technologies (October 2019 *Fiscal Monitor*). However, in some countries—including several advanced economies—with high debt-to-GDP ratios, adverse market reactions to large public investment scale-up could emerge, resulting in higher financing costs and further increases in debt vulnerabilities. In such cases, a budget-neutral increase in investment would deliver better outcomes (that is, higher output and lower debt ratios).
- In most emerging market and developing economies, meeting large investment needs in a fiscally responsible way is challenging (*October 2019 Regional Economic Outlook: Sub-Saharan Africa*). Over the past decade, large emerging market economies, such as China, have played an important role in financing infrastructure investment in many emerging and developing economies, such as *Cambodia, Ethiopia,* and *Venezuela* (IMF 2019a; Scissors 2019; Figure 2.4). Loans from China accounted for 17 percent of total public external debt of low-income developing countries in 2018—a fourfold increase from the 2008 levels (IMF 2019b). Governments have relied on public-private partnerships to encourage private sector participation in infrastructure projects. Given the sizable investment needs, direct private investment and financing are critical and could be facilitated by structural reforms, such

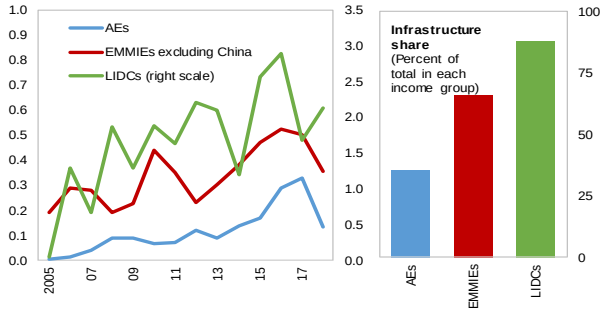
as improving the business environment. Furthermore, supranational coordinated investment projects could play a role in regional infrastructure development or when the depth of challenges surpass individual countries (for example, cross-country renewable energy networks). The rise of multinational state-owned enterprises globally has also contributed significantly to cross-border investment flows, including in infrastructure (Chapter 3).

Countries need to balance the risks to debt sustainability against the benefits of additional public investment. This would call for stronger governance and institutions, better capture of the returns to investment, management of fiscal risks arising from public-private partnerships (Irwin, Mazraani, and Saxena 2018), greater debt transparency, and improved coordination with creditors to ensure debt sustainability. Based on current trends, meeting the Sustainable Development Goals in low-income developing countries would likely imply new borrowings on nonconcessional terms and could lead to a substantial increase in average interest rates by 110 basis points (IMF 2019b). Increasing tax-to-GDP ratios (Figure 2.5), seeking concessional financing, and involving the private sector are critical.

Figure 2.4. Overseas Investment by China

(Percent of recipients' GDP and infrastructure share of total overseas investment by China in the region, 2005–18)

China plays an important role in infrastructure investment in emerging market and developing economies, accounting for more than half of China's overseas investments in the regions.

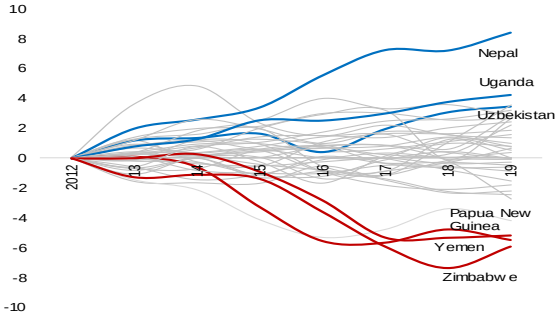


Sources: China Global Investment Tracker database; Scissors (2019); and IMF staff estimates.
Note: Based on more than 3,000 individual transactions during 2005–18 for 150 economies. Data include both private and public investment projects. Infrastructure share indicates the percentage of infrastructure investment (construction, energy, transportation, and utilities sectors) in total overseas investment financed by China in each income group. AEs = advanced economies; EMMIEs = emerging market and middle-income economies; LIDCs = low-income developing countries.

Figure 2.5. Low-Income Developing Countries: Change in Tax Revenues

(Percent of GDP, 2012–19)

Progress in tax collection is mixed.



Source: IMF, World Economic Outlook database.
Note: The lines show the cumulative changes in tax-revenue-to-GDP ratios of individual countries since 2012.

What would be the macroeconomic effects of higher public investment to meet the estimated needs in Figure 2.3? Can such scaling up of investment "move the needle" on growth, inflation, and real interest rates? A general equilibrium model can help quantify (1) the growth and debt implications of meeting global investment needs, and in a separate scenario, of addressing Europe's green investment (which is specified in the Sustainable Europe Investment Plan) and infrastructure needs; and (2) estimated effects

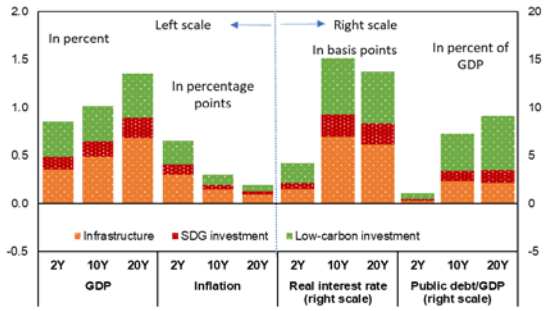
on inflation and interest rates, illustrating the extent to which fiscal policy can support monetary authorities in achieving inflation targets (model description is provided in Annex 1.1).[5]

Figure 2.6. Simulated Macroeconomic Effects of a Public Investment Push

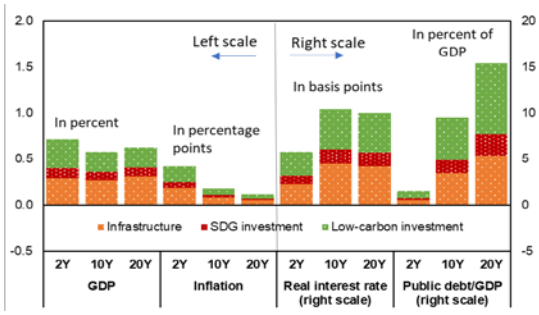
(Average annual deviations from the path without a public investment push for GDP, inflation, and real interest rates; cumulative change in percent of GDP over time horizon for public debt)

High-quality efficient public investment, if persistent, can lift growth, inflation, and interest rates; if investment is inefficient, the macro impact will only be modest, but public debt will surge.

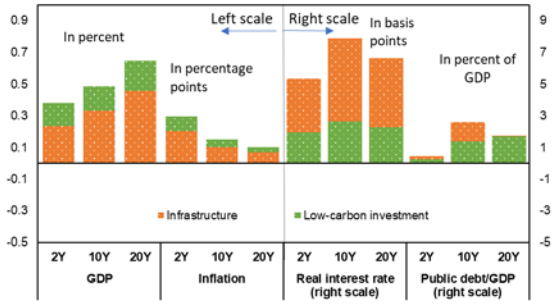
1. Global Level: Productive Public Investment



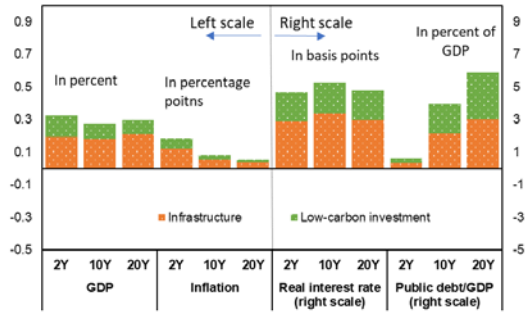
2. Global Level: Low-Efficiency Public Investment (Supply-Side Rigidities)



3. European Union Level: Productive Public Investment



4. European Union Level: Low-Efficiency Public Investment (Supply-Side Rigidities)



Source: IMF staff estimates based on a revised version of the model developed in Traum and Yang (2015).
Note: In panels 1 and 2, additional global investment needs are estimated at 1.3 percent of global GDP initially and are assumed to decline gradually over time. Those needs are composed of infrastructure (0.5 percent of GDP), low-carbon energy investment (0.6 percent of GDP), and investment in other SDGs (0.2 percent of GDP). The supply-side rigidities scenario assumes efficiency of additional public investment at almost one-half that in the productive scenario. In panels 3 and 4, additional investment needs for the European Union are estimated at 0.6 percent of regional GDP initially and are assumed to decline gradually over time. Those needs are composed of infrastructure (0.35 percent of GDP) and low-carbon investment (0.25 percent of GDP). Model assumptions are outlined in Online Annex 1.1. SDG = Sustainable Development Goal.

- When public investment is efficient (that is, assuming demand inadequacy but not supply constraints), a sustained increase in public investment across the world (1.3 percent of global GDP initially, then declining very gradually) could increase (1) global GDP by an estimated 1.4 percent per year, on average, over a 20-year horizon;[6] (2) inflation by 66 basis points per year initially; and (3) the real

[5] The model does not distinguish between different types of capital and thus does not capture the complementarity or substitutability of green investment with existing capital. If countries levy higher carbon taxes to mitigate climate change, parts of the existing capital (for example, brown assets from coal mines to oil fields) will be replaced by new "green" capital if carbon pricing is combined with supporting policies to encourage private investment in low-carbon technologies. Further research is needed to study these effects.

[6] The cumulative public investment injection over 20 years is 18 percent of global GDP and the increase in GDP is estimated to be 28 percent (assuming efficient investment). Thus, the cumulative multiplier is above one in both simulation exercises.

interest rate by 14 basis points over the 20-year horizon. The impact on the public debt-to-GDP ratio would be limited. In a separate exercise for the European Union (EU), a sustained public investment increase of 0.6 percent of EU GDP on infrastructure and decarbonization would increase EU output by 0.7 percent per year, on average, over a 20-year horizon. For illustrative purposes, the green investment needs of 0.25 percent of EU GDP are assumed to be new financing rather than from rebalanced EU budget expenditure. A public investment increase would also add to inflation initially, raise long-term interest rates modestly, and result in a modest rise in the public debt-to-GDP ratio (Figure 2.6.1 and 2.6.3).

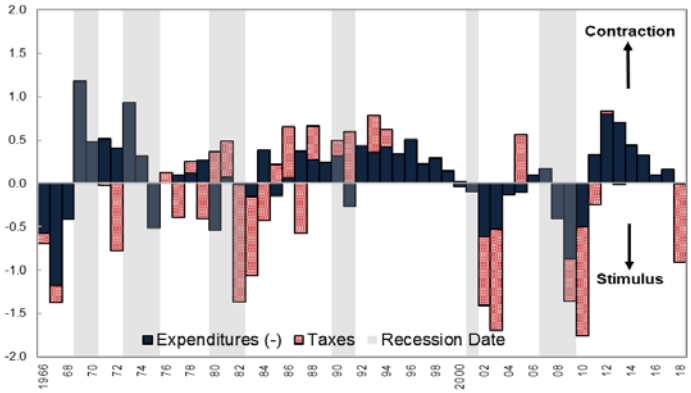
- However, when supply-side bottlenecks and absorptive capacity constraints are binding (in skills, institutions, and management), investment efficiency would be lower (Shen, Yang, and Zanna 2018; Berg and others 2019). In that case, scaling up public investment would have smaller effects on growth and inflation (with little support for monetary policy in achieving inflation target) while leading to a large rise in debt-to-GDP ratios (Figure 2.6.4 and 2.6.4).

Discretionary Measures

Given the information, decision, and implementation lags in enacting discretionary measures, policymakers should identify high-quality measures that can be deployed quickly when downside risks materialize. In previous recessions, discretionary measures were usually undertaken too late and were, at times, not effective. For example, discretionary measures in the *United States* came late in half of previous recessions (Figure 2.7). US county-level data also show that the discretionary stimulus from the American Recovery and Reinvestment Act during the Great Recession was not well targeted to areas where the recession was more severe (Crucini and Vu 2017).

Figure 2.7. Breakdown of Discretionary Expenditure and Revenue Measures in the United States
(Percent of GDP)

Discretionary fiscal support in previous recessions often occurred too late.



Sources: Congressional Budget Office (2013); Romer and Romer (2010); and IMF staff.
Note: Gray-shaded areas indicate recession periods. Negative (positive) numbers refer to stimulus (contractions).

Well-prepared countercyclical discretionary measures can be effective, as fiscal multipliers tend to be larger in downturns than under normal circumstances. Such measures are particularly appropriate in response to deep and prolonged downturns, where support is not sufficient through existing automatic stabilizers and social safety nets. To improve the timeliness of discretionary stimulus, an option is to enact discretionary measures that will be automatically activated—that is, a rules-based fiscal stimulus (Chapter 2 of the April 2020 *World Economic Outlook*)—when economic conditions deteriorate (for example, a decline in job creation below a certain threshold or a large increase in the unemployment rate above a certain level or duration) (Solow 2005; Blanchard, Dell'Ariccia, and Mauro 2010; Boushey, Nunn, and Shambaugh 2019; Eichenbaum 2019; Blanchard and Summers 2020). The rules-based fiscal stimulus should be designed in ways that prevent a continued debt buildup over the long term. On the revenue side, examples include temporary value-added tax cuts or tax policies targeted at low-income households (such as a flat, refundable tax rebate) or tax policies affecting firms (such as

cyclical investment tax credits). On the expenditure side, measures include temporary extensions of the coverage and duration of unemployment benefits (for example, emergency unemployment compensation programs in the *United States*) or well-targeted transfers to low-income or liquidity constrained households, as they are more vulnerable to shocks and have a higher marginal propensity to consume (Landais and Spinnerwijn 2019). These policies can also be tailored to respond to the ongoing health crisis (Chapter 1).

To avoid policy lags when stimulus is most needed, a pipeline of appraised projects (especially those involving upgrades, maintenance, and repairs) can be identified for timely implementation when needed. At the current juncture, the scope for large public investment is limited considering supply disruptions (lockdowns and quarantines). Since public investment has a long lead time, however, efforts should start now in reviewing the pipeline, identifying bottlenecks, and preparing a set of ready-to-implement projects that can be deployed. Maintenance and repairs can be quickly scaled up as part of broad-based stimulus when supply disruptions ease. Some governments (*Australia, Ireland*, *New Zealand,* and *Norway*) have a rolling pipeline of public infrastructure projects within a budget constraint over the long term, which provides details on the timing, sequencing, and the scale of future public investment at different levels of government. In downturns, project implementation can be accelerated.

Enhancing Automatic Stabilizers

Enhancing automatic stabilizers by improving their design is another promising route to reducing macroeconomic volatility and building resilience against downturns (Baunsgaard and Symansky 2009; Blanchard, Dell'Ariccia, and Mauro 2010; Spilimbergo and others 2010; Oh and Reis, 2012; McKay and Reis 2016). The pandemic highlighted the importance of automatic stabilizers in protecting people from losing jobs and incomes (Chapter 1). Automatic stabilizers are mechanisms built into government budgets that raise (reduce) spending or reduce (increase) taxes when the economy slows (expands). They include primarily, on the revenue side, progressive income taxes and, on the spending side, unemployment benefits and various social safety nets. Automatic stabilizers can attenuate a business cycle or limit the loss of incomes during a pandemic through channels, such as[7]

- *Disposable income*: Under a progressive income taxation, household income (after accounting for taxes paid and transfers received) does not increase as much during upswings and does not fall as drastically during slowdowns, thereby stabilizing aggregate demand.
- *Social insurance and redistribution:* This would insure incomes upon unemployment and protect poor households that consume most of their incomes relative to high-income families, thereby stabilizing aggregate demand in recessions.

In downturns, automatic stabilizers support aggregate demand promptly, reach those affected by downturns, and come to an end when conditions improve. They account for more than one-half of overall fiscal stabilization—measured as the sensitivity of the overall budget balance to the output gap—in two-thirds of advanced economies, and for 30 percent of total fiscal stabilization in emerging market and developing economies, although the extent of stabilization varies greatly across countries (April 2015 Fiscal Monitor). Automatic stabilizers provided a sizable boost to output during the Great Recession—about 2 percent of GDP in the United States and slightly less than that in the euro area, reflecting the difference in severity of the shock (Figure 2.8). Several studies suggest that automatic stabilizers can absorb one-third of income shocks and 40 percent of unemployment shocks in major advanced

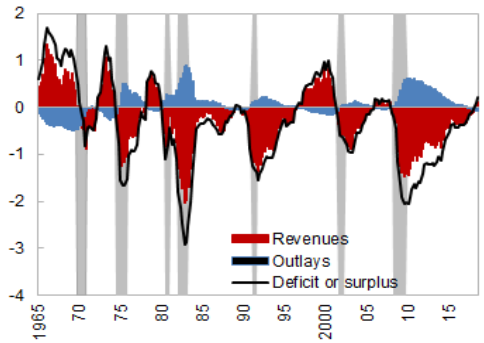
[7] While progressive taxation (for example, on labor and capital income) can reduce inequality and the volatility of disposable income, it can also make it more likely that the wealthy individuals will seek to avoid taxation, and lower firms' willingness to invest domestically (Pisani-Ferry 2019; Saez and Zucman 2019).

economies (Gali 1994; Auerbach and Feenberg 2000; Fatas and Mihov 2001; Debrun, Pisani-Ferry, and Sapir 2008; Debrun and Kapoor 2010; Dolls, Fuest, and Peichl 2012). Their aggregate demand stabilization impact would be more effective (beyond smoothing disposable income through taxes) if unemployment benefits and social safety nets were strengthened. This is because a higher share of liquidity-constrained households will be able to smooth their consumption more effectively when facing income shocks (McKay and Reis 2016; Hellwig, forthcoming).

Figure 2.8. Automatic Stabilizers in the United States and the Euro Area
(Percent of GDP)

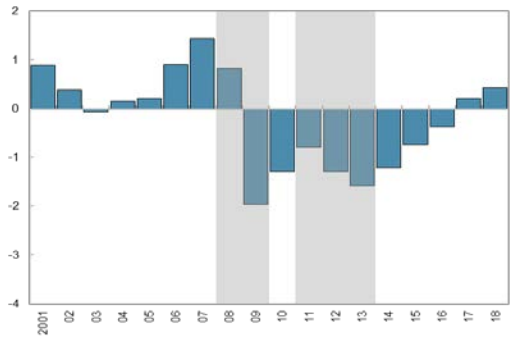
Automatic stabilizers provide a large and timely response to cyclical downturns.

1. United States



Source: Congressional Budget Office 2013.
Note: Shaded areas indicate National Bureau of Economic Research recession periods.

2. Euro Area



Source: European Commission.
Note: Shaded areas indicate Center for Economic and Policy Research recession periods.

Practical measures to improve automatic stabilizers on the revenue side, including tax measures with desirable stabilization properties, are discussed in Box 2.2. On the expenditure side, automatic stabilizers can be enhanced by strengthening social safety nets and introducing two-pillar unemployment benefit systems: the first pillar is unemployment insurance financed from contributions, and the second pillar is unemployment assistance financed from government revenues for those who have either not contributed or have exhausted their insurance benefits.[8] Increasing the generosity of unemployment benefits plays an important role in macroeconomic stabilization (Kekre 2019). Similarly, increasing the take-up of transfer programs, raising benefit levels and their duration based on predefined formulas, and easing eligibility criteria during recessions could boost aggregate demand. Nonetheless, to increase their effectiveness, the design of safety net programs should be improved to strike a balance between demand support and work disincentives (Landais, Michaillat, and Saez 2018; McKay and Reis 2019). An option includes gradually removing benefits as employment incomes increase. Although extending unemployment benefits can adversely affect workers' job search efforts, an extension's impact on macroeconomic outcomes is not settled in the literature (Chodorow-Reich, Coglianese, and Karabarbounis 2019; Hagedorn and others 2016). During the pandemic, extending unemployment benefits and enhancing social safety nets would likely have limited effects on work incentives.

How to Enhance Spending-Side Automatic Stabilizers? Some Considerations

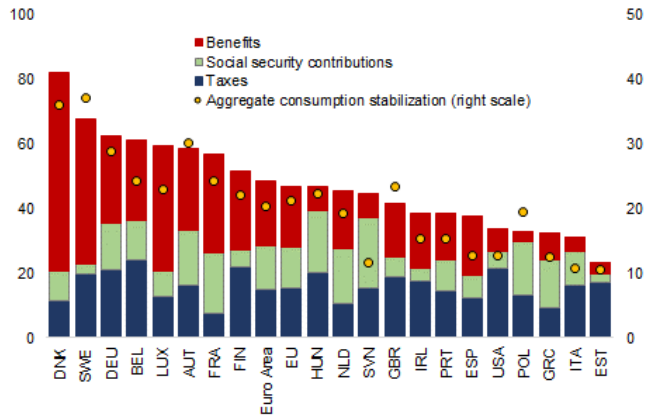
Strengthening unemployment benefit systems and social safety nets promotes two complementary objectives: (1) reinforcing spending-side automatic stabilizers and (2) protecting households with adequate income support in difficult times. Evidence suggests that cushioning personal incomes from

[8] For example, a one standard deviation increase in the generosity of US unemployment insurance would attenuate the effect of adverse shocks on employment growth by 7 percent (Di Maggio and Kermani 2016).

shocks through automatic stabilizers does not necessarily translate one to one to aggregate consumption stabilization (Auerbach and Feenberg 2000; Dolls, Fuest, and Peichl 2012). This is because progressive taxes contribute more to automatic income stabilization of high-income households, compared with unemployment benefits and social safety nets. The opposite is true for low-income households, whose consumption depends more closely on income support. At the aggregate level, the impact of automatic stabilizers on consumption depends on the extent to which each group (high and low income) saves the additional income (from lower taxes or higher benefits) and the relative size of each group in the country's aggregate income (Figure 2.9). Recent research shows that well-designed unemployment benefit systems and social safety nets can play a large role in the stabilization of aggregate demand because such payments are directly tied to consumption of low-income households (McKay and Reis 2016; Dolls, Fuest, and Peichl 2012).

Figure 2.9. Automatic Income and Demand Stabilization, by Fiscal Instrument
(Percent of gross in-work earnings, left scale; percent of aggregate consumption loss restored, right scale)

Social safety nets are an important automatic stabilizer of incomes and aggregate demand after unemployment shocks.



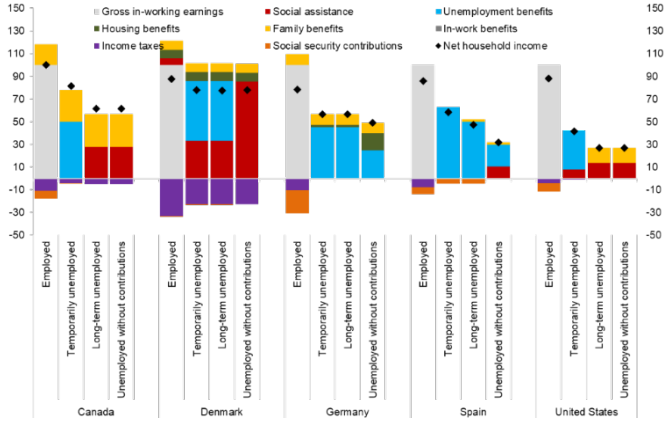
Sources: Dolls, Fuest, and Peichl 2012; and IMF staff calculations.
Note: Yellow dots show the extent to which the loss in aggregate consumption after an unemployment shock is restored by countries' tax-benefit systems. For example, if aggregate consumption falls by 1 percent, the tax-benefit system in Denmark restores one-third of this loss. Fiscal instruments include taxes, social security contributions, and benefits. Data labels use International Organization for Standardization (ISO) country codes.

Unemployment benefits and social safety nets are important features of the tax-benefit systems in Organisation for Economic Co-operation and Development (OECD) countries, stabilizing households' incomes in a typical recession. In most OECD countries, the first line of defense for a typical household is unemployment insurance. On average, the household receives insurance and other benefits of 70 percent of its last employment income. However, a long unemployment spell would eventually exhaust the insurance benefits. Some countries provide unemployment assistance (as part of labor market regulations), which, if combined with other benefits, would present a replacement rate of 60 percent of previous employment incomes. The fall in net incomes is sharper in countries without unemployment assistance (*United States*). In some cases, in lieu of unemployment assistance, other income-support schemes, such as guaranteed minimum income programs, are in place (*Denmark*). In several countries, the household that becomes unemployed without prior insurance contributions could face hardship in recessions owing to a lack of unemployment assistance or an adequately funded and covered guaranteed minimum income program (*Spain, United States*). In addition to tax design (Box 2.2), the variation of income stabilization across countries depends on policy instruments for income support as well as design features of benefit entitlements. The size of income stabilization by the tax-benefit systems varies from

95 percent in *Denmark*, given its generous social safety net, to below 20 percent in the *United States* (Figure 2.10).

Figure 2.10. Simulated Results on Average Working Income after Tax Liabilities and Benefit Entitlements during Typical Downturns
(Percent of gross in-work earnings)

Benefit entitlements and duration vary across countries and result in different levels of income stabilization.

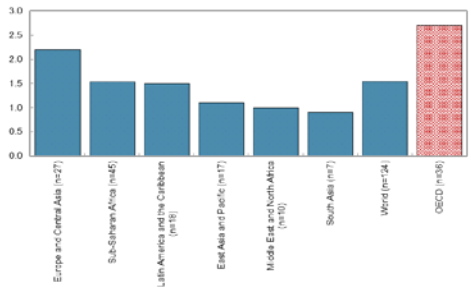


Source: Organisation for Economic Co-operation and Development, tax-benefit web calculator.
Note: The focus is on a representative household of four (with two children and one working adult) and its net income under four scenarios: (1) baseline in which the working adult earns an average income; (2) unemployed for three months after nine years of unemployment insurance contributions; (3) long-term unemployed for more than one year with the same nine years of unemployment insurance contributions; and (4) becoming unemployed without previous unemployment insurance contributions.

Social safety nets are noncontributory transfer programs aimed at low-income households or the vulnerable (World Bank 2018; IMF 2019c). They are financed from government revenues and typically include (1) cash transfers, food stamps, child allowances, and social pensions; (2) in-kind transfers; (3) income-support schemes for low-income households, conditional on education or health; (4) public works; and (5) fee waivers including for health care. These programs have contributed to a reduction of poverty gaps—the distance between the poverty line and the average income of poor households—by 45 percent worldwide, on average (World Bank 2018). The size of social safety nets varies across countries, averaging 2.7 percent of GDP in OECD countries and 1.5 percent of GDP at the global level (Figure

Figure 2.11. Social Safety Net Spending
(Percent of GDP)

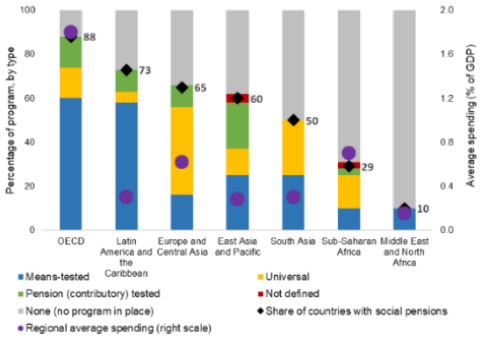
Spending on social safety nets is relatively low in the South Asia and Middle East and North Africa regions.



Source: World Bank, ASPIRE database.
Note: Simple average across regions. The number of countries in each region is in parentheses. OECD = Organisation for Economic Co-operation and Development.

Figure 2.12. Social Pensions, by Region
(Percent of program, left scale; percent of GDP, right scale)

Many countries provide social pensions.



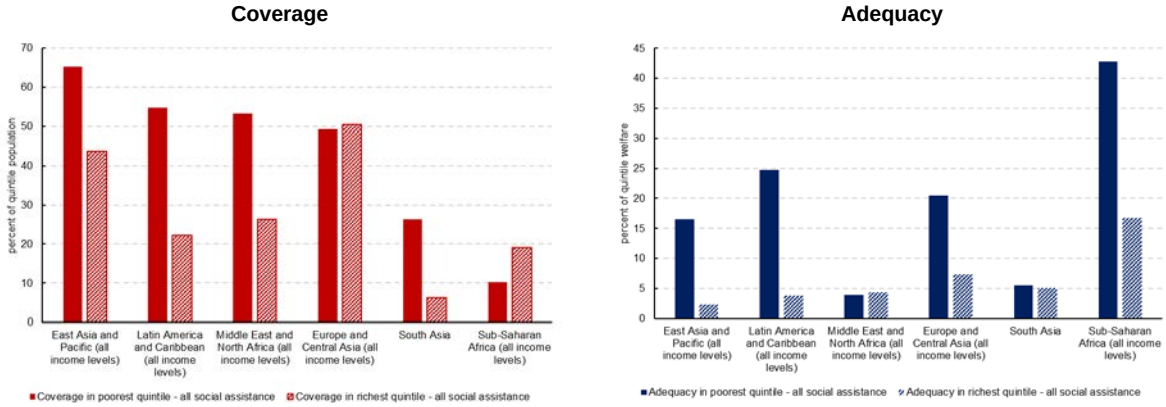
Sources: World Bank 2018.
Note: Data are as of 2014. OECD = Organisation for Economic Co-operation and Development.

2.11). Within the safety nets, old-age social pension programs have grown rapidly across many emerging market and developing economies because of demographics, among other reasons (Figure 2.12).

The choice of instruments, coverage of the poor, adequacy of benefits, and implementation of social safety net programs varies significantly across emerging market and developing countries. For example, in terms of coverage of the poorest quintile of households, the following programs stand out: unconditional cash transfers in *Malaysia*; conditional cash transfers in *Uruguay*; and social pensions in *Georgia*, *Mauritius,* and *South Africa*, covering between 60 percent and 100 percent of the poorest quintile of households. Unconditional cash transfer programs in *Georgia* and *Rwanda* are effective in poverty alleviation, and those in *Malawi* have a large impact on households' consumption (World Bank 2018). A strong safety net is also important for countries that plan to raise revenues by introducing a value-added tax or to reduce energy subsidies. For example, *Egypt* scaled up its means-tested cash transfer program to support energy price increases. *Bolivia* has made significant progress in poverty reduction from expanding the safety net programs. In sub-Saharan Africa, while the social safety nets cover a small share of the poorest quintile of the population, the adequacy of benefits for this group is relatively high (Figure 2.13).

Figure 2.13. Coverage and Adequacy of Social Safety Nets, by Region
(Percent of quintile population or welfare)

The coverage and adequacy of social safety nets vary greatly across regions.



Sources: Francese and Prady 2018; and World Bank, ASPIRE database.
Note: Welfare is usually estimated by total expenditure as self-declared in household surveys.

A good social safety net usually exhibits four attributes (Grosh and others 2008). First, it provides broad coverage and adequate benefits to vulnerable groups in a progressive way within the overall tax-benefit system (IMF 2019c)—that is, more generous benefits to the poorest beneficiaries. Second, it strives to be cost effective by avoiding program fragmentation and beneficiary overlaps. Third, it tries to preserve work incentives and enhance human capital by linking transfers to required or voluntary programs such as public works, obtaining health care, and attending education and training. Fourth, it is financially sustainable within the overall expenditure envelope and consistent with other social protection programs.[9]

Against these yardsticks, social safety nets in emerging market and developing countries have significant gaps in terms of coverage of lower income groups and benefit levels (generosity). They cover less than one-fifth of the poorest quintile of households, on average, and the average transfer accounts for only 13 percent of the consumption of the bottom 20 percent of the income distribution (World Bank 2018). Programs are often fragmented (*Mexico*), involve beneficiary overlaps, and lack appropriate incentive features. Moreover, the burden of income support is placed on social safety nets, as very few of the poor

[9] Social safety nets in this chapter are a part of social protection and do not cover pension, health and unemployment insurance.

are covered by unemployment insurance. In these countries, social safety nets can be improved by using instruments that are effective in reaching individuals most in need. These instruments include mobile money, in-kind provision of goods and services (especially health, water and transportation services), using existing social registries where applicable, and community-based methods to identify those in need. In Middle-East and North African countries, cash transfers to households (ideally targeted) could be more progressive than subsidies. The example of Aadhaar in India— the largest biometric program in the world with 1.2 billion residents enrolled over several years—could be emulated in economies that have the means and centralized information to map individual bank account information with unique identification number, to implement direct cash transfers, provided that privacy and security concerns are appropriately addressed.

For most advanced economies with better-developed safety nets, concerns relate to improving the outcomes of existing programs, extending coverage based on enhanced means testing, and better preserving work incentives (by reducing implicit labor tax wedges that arise from benefits being quickly withdrawn as earnings increase). In advanced economies, strengthening existing two-pillar unemployment benefit systems or improving the design features of guaranteed minimum income programs could improve income stabilization in the event of a recession.

Table 2.1. Typical Features of Guaranteed Minimum Income Programs

Coverage	Able-bodied working-age individuals in poverty and their households receive a guaranteed minimum income. The government's ability to verify households' income and assets, based on a means test, is important to determine eligibility and benefit levels. Yet verification may not be feasible in countries with large informal sectors and limited administrative capacity, especially low-income developing countries. The appropriate mix of universal and targeted transfers depends on country preferences and circumstances, including administrative, financing, social, and political constraints (IMF 2019c).
Benefit levels	The guaranteed minimum income (or the benefit level) should reflect basic needs without causing welfare dependence. The state tops up the beneficiary's income to the guaranteed limit, which is calibrated in relation to the relative poverty line. Most countries provide additional housing allowances and health care.
Incentives	Program design should include features that incentivize work. Generous benefit levels and high withdrawal rates (that is, the reduction in benefits once beneficiaries find jobs) could strongly disincentivize work and discourage labor force participation. To strengthen incentives, successful guaranteed minimum income programs incorporate conditional in-work tax credits (including for secondary earners) as well as a variety of "out of work" benefits, such as (marginal) income disregard for part-time and casual work, gradual benefit phaseouts, and back-to-work bonuses.
Conditionality	Participation in active labor market programs is essential for receiving the benefits, if implementation capacity exists. This would further reduce disincentives to work and control the fiscal cost. Conditioning on job training or placement, education, and so on, would help households return to work. Active labor market programs would be less effective if there were a high degree of welfare dependence.

Source: IMF 2019d.

- A two-pillar unemployment benefit system provides both income insurance and assistance to households in recessions, thereby stabilizing consumption. It is an effective automatic stabilizer for two reasons. First, more people receive unemployment insurance when they lose their jobs without any action from policymakers. And, second, beneficiaries of unemployment assistance are more likely than average to spend their benefits, thereby stabilizing demand. *Australia*, *Austria*, *Germany*, *Finland*, *Ireland*, *New Zealand* and the *United Kingdom* have implemented two-pillar systems (Immervoll 2010).

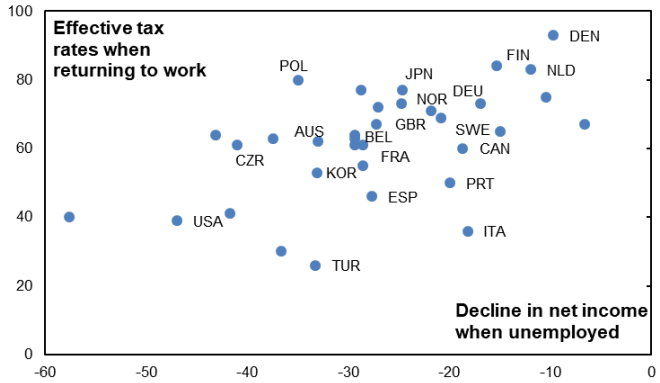
- A guaranteed minimum income program is, typically, selective, conditional, and means tested (Table 2.1).[10] It is *selective* because it focuses on low-income households; *conditional* because recipients must prove their commitment to finding a job or participating in active labor market programs (for example, employment and training); and *means tested* because the entitlement depends upon households' income and wealth. Almost all countries in the OECD have centralized minimum-income programs for working-age individuals. *Italy,* where the government introduced a citizenship income program in the 2019 budget, is the latest addition to this list.

Practical measures to enhance spending-side automatic stabilizers while preserving work incentives include subsidizing reduced working hours (*Germany*), increasing the coverage and benefits of unemployment benefits and social safety nets (for example, by relaxing eligibility criteria and loosening work requirements in recessions). For example, in *Italy*, the income-support scheme could be improved by reducing the generosity of benefits, thereby reducing welfare-dependence risks and creating larger incentives to work. Targeting could also be improved, and adequate controls and local administrative capacity should be built for effective implementation. As another illustrative example, if *Estonia* or the *United States* were to upgrade their benefit systems to that of the median OECD country, household incomes would fall by one-third less when workers lose their jobs during recessions. Moreover, countries with strong spending-side automatic stabilizers are better positioned to attenuate the adverse effects of atypical shocks, such as pandemics.

The design of social safety net programs can be improved toward more income stabilization by increasing the progressivity of net transfers through a reduction in the benefit withdrawal rate as earnings increase. Some countries (*Denmark, Finland*) provide strong income support when households become unemployed (through unemployment insurance and assistance), but they also have a large effective tax rate of 90 percent on labor income upon recipients finding a job—which could discourage participation in the labor market. Other countries without unemployment assistance (*Turkey*, *United States*) tend to place a higher weight on work incentives and have low effective tax rates upon the return to work (Figure 2.14). Overall, spending-side automatic stabilizers can be improved while preserving work incentives (including through in-work wage subsidies, such as the earned income tax credit in the *United States*), which is critical for long-term growth.

Figure 2.14. Employment Income Replacement Rates upon Unemployment and Effective Tax Rates when Returning to Work
(Percent of GDP)

Social safety net programs should be designed to balance income stabilization and work incentives objectives.



Sources: OECD tax-benefit web calculator; and IMF staff estimates. Note: Based on OECD Tax-benefit web calculator for a typical four-person household with two children and one working adult earning average employment income. Data labels use International Organization for Standardization (ISO) country codes. OECD= Organisation for Economic Co-operation and Development.

[10] A guaranteed minimum income program is different from a universal basic income scheme. The latter applies to all citizens, regardless of their socioeconomic status or their needs, is unconditional (granted to individuals without a need to meet any requirements), and is not means tested.

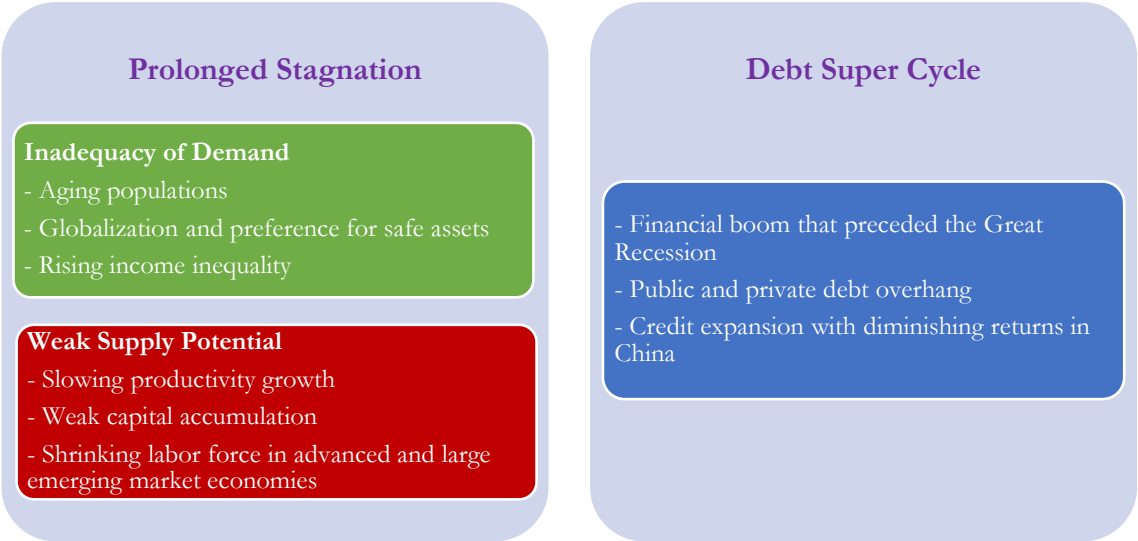
Box 2.1. Factors Underlying Low Growth and Low Interest Rates

The underlying determinants of low levels of growth, investment, interest rates, and inflation have been variously attributed to inadequacy of demand (Rachel and Summers 2019), weak supply potential (Gordon 2015), and the debt supercycle (Lo and Rogoff 2015). *Debt supercycle* refers to a persistent and rapid increase in debt throughout the economy by consumers, businesses, and governments.

- Plausible explanations for inadequacy of aggregate demand include rising income inequality, aging populations, globalization, and greater demand for safe assets—partly from financial (re-)regulation and higher demand for reserves by emerging market and developing economies (Caballero, Farhi, and Gourinchas 2016; Gourinchas and Rey 2016, 2019).
- Reasons for weak supply potential include lower productivity growth, for example, from slowing innovation and rising market power (Philippon 2019), a trend decline in public-investment-to-GDP ratios in advanced economies and the growth rate of investment per capita in emerging market and developing economies, and plateauing education attainments and labor participation rates, as well as a shrinking labor force in advanced economies and some emerging markets.
- Drivers of the debt supercycle include the financial boom that preceded the global financial crisis and subsequently left advanced economies with an overhang of debt (governments, households, corporates) and lower growth (Chudik and others 2017), and continued credit expansions with diminishing returns on investment in China (Maliszewski and others 2016).

Figure 2.1.1. Drivers of Subdued Growth, Low Inflation and Interest Rates, and High Debt

Different theories conceptualize the underlying drivers of current global trends.



Sources: Gordon 2015; Lo and Rogoff 2015; Rachel and Summers 2019; and IMF staff summary.

Although it is hard to disentangle the effects of weak aggregate demand from weak supply potential or a debt supercycle (Figure 2.1.1), there is a broad consensus among these competing theories on the need for more high-return investment (public and private) to foster long-term growth.

- If aggregate demand remains weak for a lengthy period because of a debt overhang, pessimistic expectations (Benigno and Fornaro 2018), rising inequality, or aging, then the real return on private investment would stay low. High-return public investment, in a low interest rate environment, could spur private sector activity.

- If growth weaknesses are supply driven, investing in physical and human capital as well as research and development can propel an economy over the longer term by bringing about innovation and technological change. This argument applies to all economies across income groups that have experienced a sharp productivity slowdown in recent years owing to the moderation of capital accumulation. Evidence shows that high-return investment, particularly if complemented with structural reforms such as those that foster competition and innovation, can durably raise long-term growth (IMF 2015b; Bakker 2019).

Box 2.2. Tax Policy and Automatic Stabilizers

This box discusses how the design of the tax system can help stabilize the economy, with an emphasis on specific desirable features in countries that have adopted them.

The design of a country's tax system—which reflects economic considerations as well as political factors and societal attitudes toward redistribution—affects how the economy responds to economic shocks and, thus, the volatility of output and employment. For example, a progressive tax system, in which the tax rate on high incomes is larger than that on low incomes, helps stabilize the economy because taxpayers pay lower taxes in a recession than in a boom, so that their consumption and investment—and thus aggregate demand—will fluctuate less.[11] Moreover, the impact of a recession on net wages is cushioned, so that people are less likely to drop out of the labor force or to work fewer hours. Through these mechanisms, the tax system therefore acts as a so-called automatic stabilizer because the stabilization effect is embedded in the design of the system. By obviating the need for further action on the part of policymakers when the shock occurs, automatic stabilizers prevent the lags between shocks and policy responses that stem from policymaking and legislative processes. Among Organisation for Economic Co-operation and Development countries, income taxes can automatically stabilize between 20 percent and 50 percent of income shocks (OECD 2019).

Among various taxes, those on income respond the most to the economic cycle, reflecting the progressive rate structure for personal income taxes and the close link to profitability for corporate income taxes (Baunsgaard and Symansky 2009). Likewise, taxes on goods and services (particularly if consumption is less volatile than income), as well as payroll taxes and social security contributions (particularly if capped at a nominal level), move with the cycle, though to a lesser extent than progressive income taxes.[12] Taxes on capital gains, financial transactions, and immobile property also respond to developments in asset prices. On the whole, progressive income taxes are the most effective for output stabilization.

Some tax-related automatic adjustments contribute little, if at all, to stabilizing output. For example, tax deductions (such as mortgage interest payments or certain types of investment), the earmarking of proceeds from particular taxes, nontax revenues loosely related to nominal GDP, specific taxes that are infrequently indexed (such as excises), and taxes collected with delays do not have strong stabilization properties.

Furthermore, tax-related automatic stabilizers may not be sufficient to deliver an adequate fiscal response to large output shocks. Raising the progressivity of personal income taxes would, in principle, enhance automatic stabilizers. This increase, though, is likely to have a moderate additional impact on stabilizing output and needs to be balanced against disincentives to labor supply (McKay and Reis 2016). In addition, broadening the revenue base (for direct or indirect taxes) could also foster income stabilization (Amaglobeli and others 2019). Expenditure-side automatic stabilizers, such as unemployment benefits and social transfers (discussed in the main text), can complement revenue-side stabilizers.

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[11] In the United States, Auerbach and Feenberg (2000) finds that reduced income and payroll tax collection offset 8 percent of the loss of output. The Congressional Budget Office (2013) estimates that, through increased transfer payments and reduced taxes, automatic stabilizers supported activity during and in the aftermath of the global financial crisis.

[12] Taxpayer compliance may also deteriorate during sharp recessions, leading to additional revenue loss (Brondolo 2009). Although noncompliance would reinforce automatic stabilizers, it can easily become entrenched. Tax administrations should thus counter the recession-related deterioration in compliance.

Several tax-related instruments can strengthen automatic stabilizers (Baunsgaard and Symansky 2009) and can be tailored to respond to the ongoing pandemic. *Bonus depreciation* allows firms to automatically deduct a substantial portion of their new investment from taxable profits as depreciation during recessions. This measure seems to have boosted investment in the United States during the global financial crisis, especially by providing breathing space to the most liquidity-constrained firms (Zwick and Mahon 2017). Accelerated depreciation or super-deductions can encourage investment in health or hygiene products that are undersupplied during the pandemic.

Automatically allowing deduction of current corporate losses against past tax payments (*cyclical loss-carry backward*) can provide struggling companies with immediate tax refunds during recessions. This feature has been applied in several advanced economies in previous recessions (*Canada*, *France*, *Germany*, the *United Kingdom*, and the *United States*), as well as during the current pandemic.

Governments can link *property taxes* more closely to the real estate cycle, by assessing property values annually (for example, the *United States*). This smooths the cycle by increasing tax collections during property booms and reducing taxes during slumps.

Tax credits are preferable to deductions as a way of encouraging socially valuable activities (such as education and charitable contributions) while smoothing the cycle. The impact of tax credits on disposable income is fixed, whereas the impact of deductions declines during downturns as disposable income falls. *Uniform personal income tax credits* (that is, an equal credit for all individuals) are recommended because, under a deduction-based system, higher-income individuals would receive higher effective tax relief (Batchelder and Goldberg 2008). This proposed measure applies when the personal income tax is progressive. *Investment tax credits* are stabilizing because they reduce the cost of capital and stimulate investment when it tends to fall during recessions—that is, at a time when the stabilization is most needed (Blanchard, Dell'Ariccia, and Mauro 2010). These instruments are relevant in the current conjuncture. For instance, in *Sweden*, cyclical investment tax credits through the Swedish Investment Fund successfully served as countercyclical fiscal measures between the mid-1950s and the mid-1970s (Taylor, Baily, and Fischer 1982). During normal times, firms could deduct up to 40 percent of their taxable profit, allocate it to an investment fund, and draw on this fund freely for investment during downturns.

Corporate income tax collections based on current-year estimated income—as opposed to a corporate income tax based on actual income of the previous year—allow tax collections to be linked more closely to the current state of the economy. In this way, the tax could make stabilization timelier because tax collections would fall during downturns and reverse during a recovery.

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Online Annex 2.1. The Macroeconomic Effects of Public Investment: A Model-based Analysis

Global growth remains fragile, inflation rates are below targets in many economies, government borrowing costs are at historical lows, and the global economy is awash with debt (public and private). Is it time for an efficient public investment push? How large and long-lasting would such a surge in public investment need to be to "move the needle" on growth, inflation, and interest rates? A model-based analysis shows that efficient public investment, if persistent, can lift growth, inflation, and interest rates; inefficient investment, however, will only bring modest macroeconomic effects while public debt-to-GDP will surge.

This annex relies on a revised model based on Traum and Yang (2015) to quantify the macroeconomic effects of a large and long-lasting increase in public investment and to illustrate the role of investment efficiency. This closed-economy dynamic stochastic general equilibrium model of the world follows closely the New Keynesian structure of Smets and Wouters (2003, 2007) and has a detailed fiscal sector, including distorting taxation of consumption, labor, and capital income; transfers to households; productive and unproductive government spending; and endogenous public debt accumulation. In addition to standard forward-looking households with rational expectations, the model includes liquidity-constrained households to account for varying responses to fiscal policy. Monetary policy follows a Taylor principle with interest rate smoothing—that is, responding gradually to inflation—and a small response to output gaps. Simulation results from the model are also compared with those of the IMF's Global Integrated Monetary and Fiscal model (GIMF), a six-region open-economy model that captures the interlinkages across countries at the global level.

The model is used to simulate the effects of two public investment–package scenarios: an efficient investment scaling-up (baseline) and a less-efficient one. Each scenario considers three types of public investment: infrastructure, low-carbon technologies, and other UN Sustainable Development Goals (SDGs). At the global level, baseline simulations take an initial investment of 1.3 percent of global GDP (comprising 0.5 percent of GDP on infrastructure, 0.6 percent on low-carbon technologies, and 0.2 percent toward other SDGs for access to clean water, sanitation, and electricity) based on estimates from the G20 Global Infrastructure Outlook,[1] the Global Commission on Adaptation, and the October 2019 Fiscal Monitor. The investments gradually decline over time to half of their initial values by year twenty. The cumulative public investment injection over 20 years is 18 percent of global GDP. At the EU level, the simulations assume an initial public investment increase of 0.6 percent of the EU's GDP, comprising 0.35 percent on infrastructure and 0.25 percent on low-carbon technologies. For illustrative purposes, the green investment needs of 0.25 percent of EU's GDP is assumed to be new financing rather than from rebalanced EU budget expenditure. Also, the two types of investments are assumed to gradually decline over time.

Global Public Investment Needs

Baseline Simulations: An Efficient Investment Scaling-Up

The model is calibrated to match the weighted average of fiscal variables at the global economy level in 2019, with an initial public debt of 84 percent of GDP and public investment of 3.8 percent of GDP per year (before the global public investment surge).[2] The slope of the Phillips curve is calibrated to match

[1] "Global Infrastructure Outlook," https://outlook.gihub.org/.

[2] The weighted average global public debt-to-GDP and public investment-to-GDP ratios are calculated from data on general government gross debt, public gross capital formation, and GDP across countries in the World Economic Outlook database. The weights are computed as a country's nominal GDP in U.S. dollars divided by the sum of all countries' GDPs.

the empirical evidence for eight major economies in Dees and others (2014). The analysis assumes that only the consumption tax rate responds to deviations of debt from its steady-state level. The magnitude of response is small but sufficient to maintain debt sustainability.

The three types of public investment differ in their effectiveness in raising the productivity of private capital and labor, leading to different cumulative output multipliers (Online Annex Table 2.1.1).[3] Infrastructure is the most productive investment with a two-year cumulative multiplier of 0.7 (twenty-year cumulative multiplier of 1.7), roughly matching the cross-country estimates in Ilzetzki and others (2013). For investment in other SDGs, the calibration yields a twenty-year cumulative multiplier of 1.4 because they have lower overall network externalities. Last, considering the considerable uncertainty around the size of green investment multipliers, the calibration assumes a twenty-year cumulative multiplier of around 1.0—the average of long-term output multipliers for general public investment in the literature (Ramey 2019).

The stacked columns in panel 1 of Online Annex Figure 2.1.1 present impulse responses of GDP, inflation, the real interest rate, and public debt over the 20-year horizon for the baseline simulations relative to the path without the investment increase. In the short term, GDP experiences an inverted hump-shaped response as the private sector activity is crowded out initially, owing to higher real interest rates. As the productive public capital gradually builds up over time, it raises the productivity of private capital and crowds in private investment. The positive GDP effects also become stronger over time as the stock of productive public capital increases.

On the nominal side, the public investment package increases inflation, as shown in panel 2. In the first year, inflation jumps by 1 percentage point. More public investment adds to aggregate demand, putting upward pressure on inflation. This positive effect on inflation diminishes over time as the monetary authorities partly respond to the inflation increase by raising the policy rate. In addition, as investment is transformed to productive public capital, it expands private production capacity, offsetting the inflationary pressure from higher demand.

There is a small positive impact on the real interest rate, as shown in panel 3. Although intuition suggests that the injection of a persistent large fiscal stimulus should significantly add to aggregate demand (boosting the real interest rate), the investment from fiscal stimulus also expands the production capacity from higher public capital, which would ease such pressures on interest rates. From the perspective of monetary policy, the response of the nominal interest rate closely follows inflation dynamics on average, which suggests the real interest rate only responds slightly in the equilibrium.

Since the scaling up of public investment is debt financed and output multipliers are less than 1.0 in the first few years, the stock of public debt increases over the short and medium terms. In the baseline simulations, public debt increases by about 9 percentage points of GDP in 20 years (shown in panel 4). The magnitude of the debt increase is half of the cumulative public investment injection.

An Alternative Scenario: Less Efficient Investment Scaling-Up

Public investment efficiency matters for fiscal multipliers (Shen, Yang, and Zanna 2018), and because of capacity constraint it is a major concern when investment is scaled up quickly and sizably. To highlight

[3] In the Traum-Yang model, public and private capital are complements. This assumption is reasonable for infrastructure and other SDG investment. However, it is not clear whether public investment in low-carbon technologies should complement existing private capital (which might be in coal, fossil fuels, and so on). Further research is needed to study the complementarity or substitutability of green investment with existing private capital. Also, carbon taxation will likely accelerate the depreciation of existing capital, raising the marginal product of new capital.

the role of investment efficiency, an alternative simulation allows the marginal public investment efficiency on new additional investment to be low.[4]

The baseline simulations assume that a $1.0 of additional investment can convert to $0.9 of public capital. The alternative simulation assumes that the marginal investment efficiency is at 0.4, matching the 25th percentile efficiency loss at the global level (IMF 2015), implying an average investment efficiency of 0.8. The black lines in the four charts of Online Annex Figure 2.1.1 are the aggregate impulse responses of the three types of investment in the alternative simulation. The last three columns of Online Annex Table 2.1.1 present the cumulative output multipliers for this alternative simulation. Relative to baseline simulations, even the twenty-year cumulative output multipliers for infrastructure investment are below 1.0. In that case, the smaller rise in GDP would be accompanied by much higher public debt, as shown by the black solid line in panel 4 of Online Annex Figure 2.1.1.

Comparison to Simulation Results using Global Integrated Monetary and Fiscal Model

To check the robustness of results to an alternative modeling approach, baseline simulations are compared to the results obtained from IMF's GIMF model.[5] Different from the closed-economy model of Traum and Yang (2015), GIMF is a multicountry structural dynamic general equilibrium model featuring six regions. Its household sector consists of forward-looking optimizing agents and liquidity-constrained households who spend all their available income every period. GIMF is based on an overlapping generations (OLG) framework, à la Blanchard-Weil-Yaari (Yarri 1965, Blanchard 1985, and Weil 1989). Furthermore, the presence of overlapping generations households breaks the Ricardian equivalence, beyond the inclusion of liquidity constrained households. The calibration of the elasticity of public capital from an increase in global infrastructure investment matches the average of elasticities from advanced countries and emerging market economies.[6]

The effects of the public investment scaling-up scenarios using GIMF match closely that of the baseline simulations. Panels 1-3 of Online Annex Figure 2.1.2 compare the GDP responses for each type of investment under the two models, and panels 4-6 compare the aggregate responses of inflation, the real interest rate, and public debt across the three types of investment. At a glance, the baseline simulations largely yield the same qualitative results as in the GIMF. In particular, the output responses of infrastructure investment are quantitatively similar between the two models' results (panel 1). In the first year, the GIMF predicts a 0.7 percent increase in output, while the baseline simulation predicts a 0.5 percent increase. Over the long term, both models predict an output increase of about 1 percent 20 years after the initial investment increase. The slight differences between the two models in the beginning years can be explained by the crowding-out effects in Traum and Yang (2015). The GIMF predicts an immediate crowding-in because the negative wealth effect from increasing government spending in a model with a finite planning horizon is much weaker than that in New Keynesian or neoclassical growth models with infinitely-lived agents.[7] Both models predict crowding-in effects in the long term as more productive public capital encourages private investment.

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[4] Berg and others (2019) show that a lower steady-state public investment efficiency does not lower the growth impact of public investment because lower steady-state efficiency implies a lower capital stock, which has a higher marginal product of capital than is the case with a higher efficiency. Thus, to capture the effect of a lower efficiency when investment is scaled up quickly and sizably, the simulation imposes a lower marginal efficiency, instead of a lower steady-state efficiency.

[5] See Kumhof and others (2010) for the model structure of the GIMF. Michal Andrle in the Research Department conducted the simulations with the GIMF model, and Rachel Zhang provided outstanding research assistance.

[6] The calibration is largely based on the meta-analysis in Ligthart and Suarez (2011) and some results are adjusted using the country public investment efficiency assessment in Gupta and others (2014).

[7] The crowding-out effects of government spending (including government consumption and public investment) are supported by several empirical papers (for example, Ramey and Shapiro 1998, Blanchard and Perotti 2002, Mountford and Uhlig 2009, and

For inflation, both models yield positive short-term responses, and the effects wane over time (panel 4). The real interest rate behaves slightly differently on impact: the baseline simulations imply an initial decline before rising, while the GIMF results in an immediate positive response (panel 5). This difference is because the baseline simulations assume a higher degree of interest smoothing than the GIMF. While both models feature Taylor-type interest rate rules, the initial nominal interest rate response is smaller in the baseline simulations because of a higher degree of interest smoothing. Also, unlike the GIMF, which has the interest rate rule respond to *future* and current inflation, the Traum-Yang model only responds to current inflation. Despite the very different initial predictions in the first year, the magnitude of the real interest rate increase for the medium and longer terms are broadly similar in the models. Finally, both models predict an increase in debt ratio over time (panel 6).

European Union Investment

The macroeconomic effects of a surge in public investment are particularly relevant in Europe. The European Commission in January 2020 proposed to mobilize and then spend €1 trillion for sustainable investment over 2021–27—assuming large national cofinancing, subsided loans from the European Investment Bank, and private sector investment. The allocation from the EU budget is about 0.25 percent of GDP per year, which is used in the following simulations. In addition, the package includes an initial increase of 0.35 percent of the EU's GDP in infrastructure, reflecting the European Commission's plan to increase public investment in general over the next decade.

To pursue the simulations for the EU, the Traum-Yang model is run separately with a calibration that matches the weighted average fiscal variables of the EU in 2019 with an initial public debt set at 84 percent of GDP. The slope of the Phillips curve and the interest rate smoothing parameter in the monetary policy rule are calibrated to those estimated in Dees and others (2014) for three euro-area economies in their sample. Again, the two areas of public investment (infrastructure and green investment) would have an initial injection of 0.6 percent of GDP, which declines gradually over time. The efficiency of investment in these two areas is assumed to be identical to those used in the global model. As a result, the implied multipliers are similar (Online Annex Table 2.1.1).

Online Annex Figure 2.1.3, panels 1-4 present the effects of a public investment increase in the EU. The stacked columns show the impulse responses under the efficient public investment assumption, and black solid lines are the aggregate responses under the lower-efficiency scenario. The results of GDP, inflation, the real interest rate, and the public debt-to-GDP ratio are qualitatively the same as those in the baseline simulations, but the magnitudes are smaller because of a smaller-scale increase in public investment. The public investment package in the EU increases inflation by 0.4 percentage points in the first year, and the effects diminish over time (panel 2). Under the efficient public investment assumption, the public debt-to-GDP ratio only increases by slightly less than 2 percent of GDP, while it increases by almost 6 percent of GDP under the low-efficiency assumption (panel 4).[8]

Ramey 2011). Also, Boehm (forthcoming) uses a panel of OECD countries to estimate specifically for public investment effects and finds that private investment responds negatively in the short term to a public investment increase.

[8] In addition to the GIMF model, the implication of the Traum-Yang model has been compared to the simulations of a government spending shock in Gros and Capolongo (2019). To make the results comparable, the size of the government spending increase is reduced to a one-quarter shock equal to 1 percent of GDP. The main conclusion of Gros and Capolongo (2019) is that fiscal stimulus is likely to be ineffective in raising inflation in the euro area. The simulation with the Traum-Yang model also generates a small inflation response: a peak inflation of about 6 basis points, compared to the mean peak responses of 4 basis points across the ten models used in Gros and Capolongo (2019). In the longer horizon, both the average responses of the ten models presented in Gros and Gapolongo (2019) and the responses of the Traum-Yang model predict that inflation returns to the targets quickly (D. Gros and A. Capolongo, "Fiscal Policy Cannot Save the ECB," *VOX* (blog), CEPR Policy Portal, December 3, 2019. https://voxeu.org/article/fiscal-policy-cannot-save-ecb).

Online Annex Table 2.1.1. Cumulative Output Multipliers

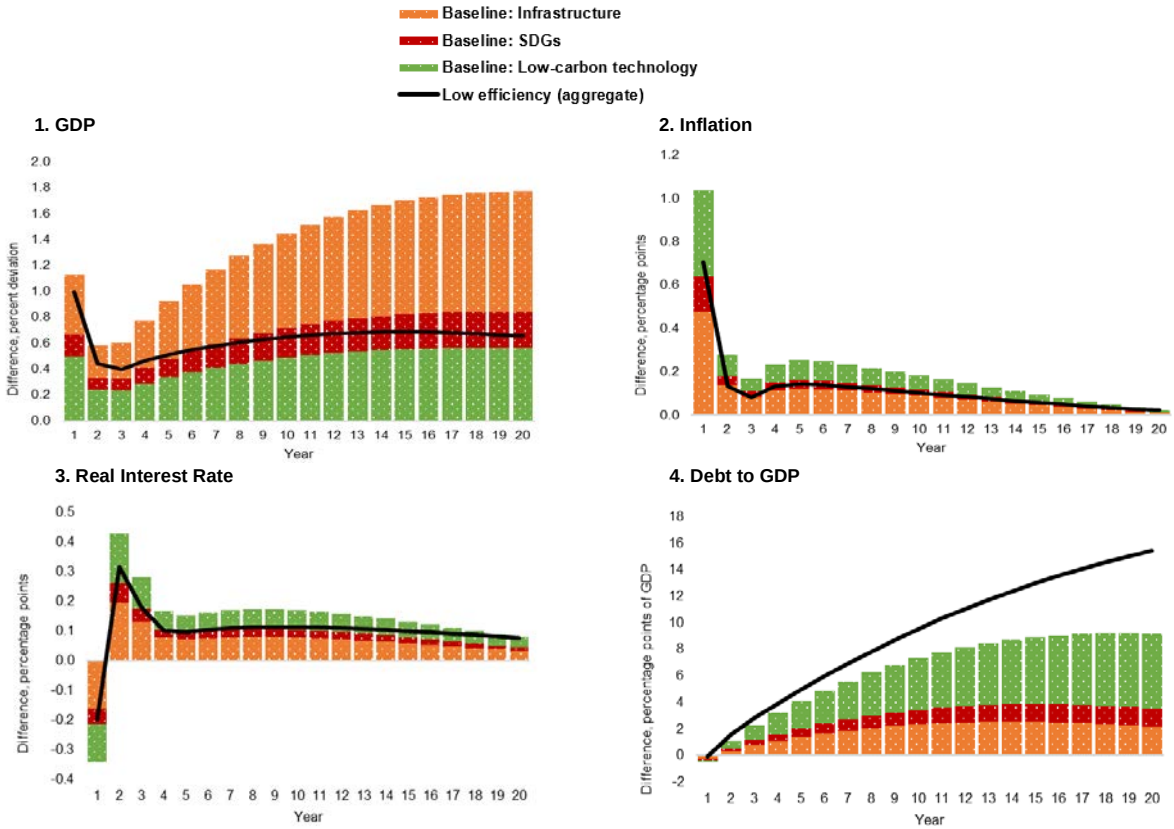
	Baseline Simulations			Low Public Investment Efficiency		
	2-year	10-year	20-year	2-year	10-year	20-year
Infrastructure	0.7	1.1	1.7	0.6	0.6	0.8
Other SDGs	0.7	0.9	1.4	0.6	0.5	0.7
Low-carbon technology	0.6	0.7	1.0	0.5	0.5	0.5

Source: IMF staff estimates.
Note: SDGs = Sustainable Development Goals.

Online Annex Figure 2.1.1. Simulated Macroeconomic Effects of a Global Public Investment Increase

(Difference in percent or percentage points relative to no public investment increase)

A large sustained public investment could lift output, inflation, and the real interest rate, and cause a mild increase in the debt-to-GDP ratio if investment is efficient.

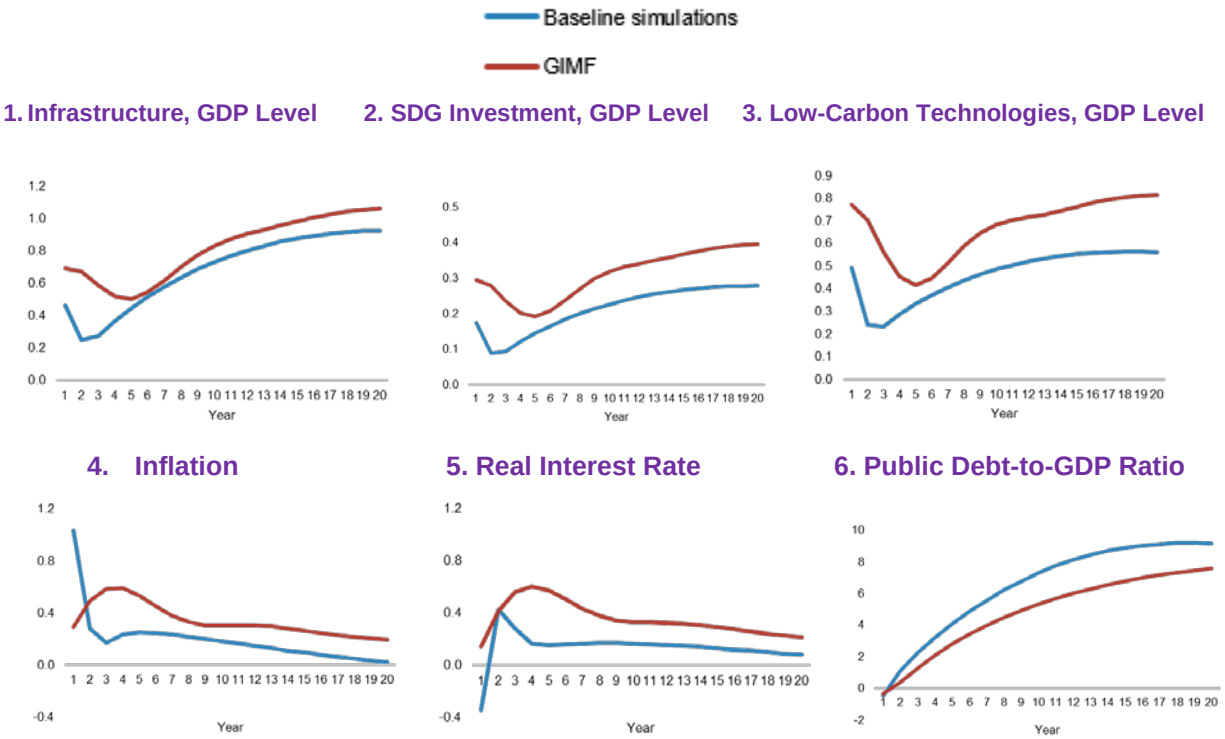


Source: IMF staff estimates based on a revised version of Traum & Yang (2015).
Note: Impulse responses to a persistent increase in three types of public investment: The initial increase is 0.5 percent of global GDP in infrastructure, 0.6 percent of global GDP in low-carbon technologies, and 0.2 percent of global GDP in other SDG investment. The investment increase gradually declines over time.

Online Annex Figure 2.1.2. Comparison of Baseline at the Global Level with GIMF Simulations

(Percent; GDP is in average annual deviation from the path without a public investment increase.)

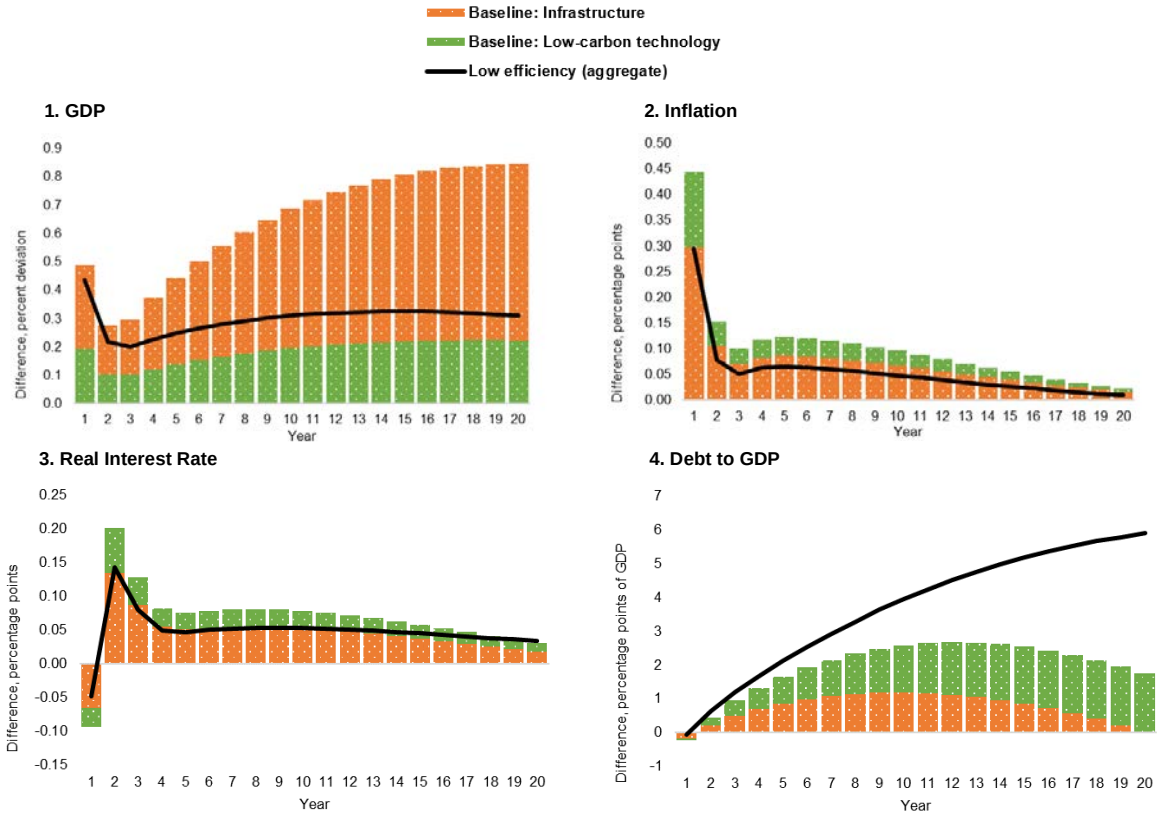
Simulation results are similar to the IMF GIMF model.



Source: IMF staff estimates based on the GIMF model and a revised model of Traum and Yang (2015).
Note: Responses are aggregated across the three types of investment. GIMF = Global Integrated Monetary and Fiscal model; SDGs = Sustainable Development Goals.

Online Annex Figure 2.1.3. Simulated Macroeconomic Effects of a European Union Public Investment Increase

(Difference in percent or percentage points relative to no public investment increase)



Source: IMF staff estimates based on a revised version of Traum and Yang (2015).
Note: Impulse responses to a persistent increase in two types of public investment: The initial increase is 0.35 percent of the euro-area GDP in infrastructure and 0.25 percent of the euro-area GDP in low-carbon technologies. The investment increase gradually declines over time. SDGs = Sustainable Development Goals.

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