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Abstract

Potential output growth around the world slowed over the past two decades. This slowdown is expected to continue in the remainder of the 2020s: global potential growth is projected to average 2.2 percent per year in 2022-30, 0.4 percentage point below its 2011-21 average. Emerging market and developing economies (EMDEs) will face an even steeper slowdown, of about 1.0 percentage point to 4.0 percent per year on average during 2022-30. The slowdown will be widespread, affecting most EMDEs and countries accounting for 70 percent of global GDP. Global potential growth over the remainder of this decade could be even slower than projected in the baseline scenario—by another 0.2-0.9 percentage point a year—if investment growth, improvements in health and education outcomes, or developments in labor markets disappoint, or if adverse events materialize. A menu of policy options is available to help reverse the trend of weakening economic growth, including policies to enhance physical and human capital accumulation; to encourage labor force participation by women and older adults; to improve the efficiency of public spending; and to mitigate and adapt to climate change, including infrastructure investment to facilitate the green transition.

JEL Classification: E30, E32, E37, O20

Keywords: N/A

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Potential Growth Prospects: Risks, Rewards, and Policies

Sinem Kilic Celik, M. Ayhan Kose, and Franziska Ohnsorge[1]

April 2023

Abstract. Potential output growth around the world slowed over the past two decades. This slowdown is expected to continue in the remainder of the 2020s: global potential growth is projected to average 2.2 percent per year in 2022-30, 0.4 percentage point below its 2011-21 average. Emerging market and developing economies (EMDEs) will face an even steeper slowdown, of about 1.0 percentage point to 4.0 percent per year on average during 2022-30. The slowdown will be widespread, affecting most EMDEs and countries accounting for 70 percent of global GDP. Global potential growth over the remainder of this decade could be even slower than projected in the baseline scenario—by another 0.2-0.9 percentage point a year—if investment growth, improvements in health and education outcomes, or developments in labor markets disappoint, or if adverse events materialize. A menu of policy options is available to help reverse the trend of weakening economic growth, including policies to enhance physical and human capital accumulation; to encourage labor force participation by women and older adults; to improve the efficiency of public spending; and to mitigate and adapt to climate change, including infrastructure investment to facilitate the green transition.

Keywords: production function; growth expectations; emerging markets; developing economies.
JEL Classification: E30, E32, E37; O20

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I. Introduction

Over the period 2011-21, global potential output growth declined 0.9 percentage point per year below its 2000-10 average, to 2.6 percent a year on average (Kilic Celik et al. 2023). The weakening of growth was widespread, occurring in both advanced economies and emerging market and developing economies (EMDEs). The trend decline raises concerns about the underlying strength of the recovery from the pandemic over the next several years. In addition, climate change is expected to increase the frequency of natural disasters, which could further weaken global potential growth unless policy action is taken.

Potential output refers to the output an economy could sustain at full capacity utilization and full employment. The growth rate of potential output is a critical determinant of a wide range of macroeconomic and development outcomes, including sustained improvements in living standards and poverty reduction.[2] In some EMDEs, especially commodity-exporting economies in Europe and Central Asia (ECA) and the Middle East and North Africa (MNA), the slowdown in potential growth could set back per capita income convergence with advanced economies by more than a decade (figure 1). The possibility of a continuation of the trend decline in potential growth is a major concern for future growth and convergence prospects in EMDEs and a formidable challenge for the international community's ability to meet its broader development goals.

This study addresses three questions. First, what are the prospects for potential output growth? Second, what are the main risks that could lower future potential growth? Third, what policy options are available to lift potential growth?

To help answer these questions, this study utilizes estimates of potential growth in a large sample of countries from the comprehensive database presented in Kilic Celik et al. (2023). For clarity, and in keeping with a longer-term focus, this study uses the production function approach, whereas other measures of potential growth often incorporate short-term impacts of supply shocks.

This study makes three major contributions to the literature on potential growth.

Prospects for potential growth. The study presents the first comprehensive set of projections of potential output growth for the largest sample of countries for which data are available—83 countries (30 advanced economies and 53 EMDEs) accounting for 95 percent of global GDP. The use of potential growth estimates based on the production function approach permits a detailed

[2] Research suggests that two-thirds of cross-country differences in income growth for the poorest households are accounted for by differences in average income growth (Barro 2000; Dollar, Kleineberg, and Kraay 2013). Sustained growth can also help reduce inequality, including by raising the demand for agricultural output which helps poor land holders (Christiaensen, Demery, and Kuhl 2011; Pham and Riedel 2019; Ravallion and Datt 2002), and by expanding urbanization which disproportionately lifts wages for poorer workers (d'Costa and Overman 2014; Gould 2007; Yankow 2006).

analysis of the structural drivers of potential growth, which in broad terms are total factor productivity (TFP) growth, labor supply growth, and the growth of human and physical capital.[3] Since data for many EMDEs before 1998 are inadequate for application of the production function approach, the sample period begins in 2000.

Climate change and potential growth. This study analyzes the possible impacts of climate disasters, which are expected to become more frequent because of climate change. It also examines the possible effects on potential growth of investment to alleviate the effects of climate change. Several studies—reviewed in Shabnam (2014), Klomp and Valckx (2014), and Botzen, Deschenes, and Sanders (2019)—have found mixed evidence for both short-term and long-term impacts of natural disasters on incomes and output growth, with possibly larger and more lasting impacts in low-income countries (LICs). Broadly consistent with this literature, our study documents small, but statistically significant, damage to short-term growth, which dissipates quickly. The study goes on to estimate the impact on potential growth of investment to mitigate or reduce the damage from climate change, drawing on the estimated investment needs presented in Stamm and Vorisek (2023).

Policies to promote potential growth. This study explores, in a consistent framework, policy options to lift potential output growth. A large literature has considered the impact of different policies and institutional settings on growth, including human capital improvements (World Bank 2018b), governance improvements (World Bank 2017a), trade and global value chain integration (World Bank 2020b), new technologies (World Bank 2016; 2019b), and labor market changes (World Bank 2013). In contrast to these and other earlier studies, the discussion of growth-enhancing policy options in this study is directly derived from the empirical framework provided by the production function approach, which is used to link policy options to their impacts on growth prospects.[4]

Our study presents several findings.

Weaker potential growth prospects. The slowdown in potential growth in the past two decades, described in Kilic Celik et al. (2023), is projected in the baseline to extend into the remainder of this decade. Trends in the fundamental drivers of growth suggest that global potential output

[3] Much of the previous literature has focused on examining past trends but not prospects (ADB 2016; Dabla-Norris et al. 2015; IMF 2015a; OECD 2014). For European and OECD countries, respectively, the European Commission and the OECD have prepared long-term growth forecasts based on production function approaches (European Commission 2021; OECD 2014). For individual EMDEs or EMDE regions, the World Bank has estimated potential growth prospects (World Bank 2022, World Bank 2021a, World Bank 2021b, World Bank 2020a, World Bank 2018a, World Bank 2019a). Other studies have used a statistical approach to assess long-term growth prospects for a handful of countries (Modis 2013).

[4] Several studies have investigated the link between the growth of output or productivity and structural reforms, focusing on the near-term benefits (Prati, Onorato, and Papageorgiou 2013) or productivity effects (Adler et al. 2017; Dabla-Norris, Ho, and Kyobe 2015). In some such studies, the sample has consisted mostly of advanced economies (Banerji et al. 2017; IMF 2015a, 2016b; de Haan and Wiese 2022).

growth will slow further, by 0.4 percentage point a year on average, to 2.2 percent a year during 2022-30. Just under half of this slowdown is due to demographic factors, including slowing working-age population growth and declining labor force participation as populations age. EMDE potential growth is projected to weaken considerably more, by about 1.0 percentage point a year, to 4.0 percent a year during 2022-30. In advanced economies, potential growth is expected to slow by 0.2 percentage point a year, to 1.2 percent a year, on average, during 2022-30.

The slowdown will be internationally widespread: Most EMDEs, and economies accounting for 70 percent of global GDP, are projected to experience a slowdown in potential growth between 2011-21 and 2022-30. Among EMDE regions, the slowdown will be most pronounced in East Asia and the Pacific (EAP) and ECA because of slowing labor supply, investment, and TFP growth, and least pronounced in Sub-Saharan Africa (SSA), where the multiple adverse shocks of the past decade are assumed to dissipate. Potential growth in Latin America and the Caribbean (LAC), MNA, and South Asia (SAR) is expected to be broadly steady, with slowing population growth offset by strengthening productivity growth. Global potential growth over the remainder of this decade could be even slower than projected in this baseline scenario—by another 0.2-0.9 percentage point a year—if investment growth, improvements in health and education outcomes, or developments in labor markets disappoint, or if adverse events materialize.

Sizable impact of climate change on potential output growth. Natural disasters, which are expected to increase in frequency because of climate change, could reduce potential growth below the baseline projection. Over the past two decades, the average natural disaster has lowered potential growth in the affected country by 0.1 percentage point in the year of the disaster. However, increased infrastructure investment to alleviate the effects of climate change could more than offset this damage. For example, Stamm and Vorisek (2023) summarize estimates of climate-related investment needs averaging 2.3 percentage points of GDP per year; for EMDEs, this is equivalent to about one-third of the investment boost if they repeated their best ten-year investment performance. Such additional investment over the remainder of this decade could raise global potential growth by 0.1 percentage point and EMDE potential growth by 0.3 percentage point a year.

Policies supporting potential growth. A number of policies could help reverse the projected further weakening of global potential growth and return it to its 2011-21 average rate. Reforms associated with higher physical capital investment, enhanced human capital, and faster labor supply growth could raise potential growth by 0.7 percentage point a year in 2022-30, globally and in EMDEs. This would offset the 0.4 percentage point decline in global potential growth between 2011-21 and 2022-30 projected in the baseline scenario and most of the 1.0 percentage point slowdown projected for EMDEs. The policy options considered here could raise potential growth even more in EAP, ECA, and SSA, where large investment needs remain or where countries have strong track records of boosting investment.

The next section II examines potential growth prospects, followed by section III discussing risks to potential growth prospects, including from climate change. Section IV reviews a wide range of

policy options to raise potential growth. The concluding section V provides a summary and suggests avenues for future research.

II. Prospects for potential growth

Factors weighing on potential growth over the last decade are likely to persist in the remainder of the current decade. Potential growth prospects are estimated for a sample of 29 advanced economies and 53 EMDEs, unless otherwise specified (table 1). Demographic trends are expected to remain unfavorable, weighing on potential growth even while trend improvements in human capital investment and female labor force participation are expected to continue. Although growth of fixed investment in advanced economies is expected to pick up slightly from its pre-pandemic rates, it is unlikely to return to the rates seen in 2000-10, and in EMDEs it is expected to remain weak. Short of possible surges in productivity growth not assumed in the projections—which could occur as a result of technological breakthroughs or the exit of unproductive firms following the disruptions of the pandemic—these trends imply an outlook of mediocre potential growth.[5]

II.1 Design of the baseline projections

The baseline projections presented here apply the production function approach to assumed paths for capital, population, and education and health outcomes. Projections for population-related variables (including age and gender structures of the population, fertility, and life expectancy) are based on UN Population Projections under the assumptions of median fertility, normal mortality, and "normal" (i.e., trend) migration. Cohort effects are assumed to remain at their latest (2021) levels.[6]

Projections assume that education and health outcomes follow their long-term average trends. For example, gender-specific secondary and tertiary *enrollment* rates are assumed to continue rising through the forecast period at the average rates of the past two decades. Economy-wide averages are calculated as the population-weighted averages of these gender-specific rates. Similarly, gender-specific and age-specific secondary and tertiary education *completion* rates are assumed to rise at the average rates over the past two decades. Again, economy-wide averages are calculated as the population-weighted averages of these gender- and age-specific rates. These trends in education and health outcomes drive the projected growth of both TFP and labor supply.

Investment growth in the forecast period, 2022-30, is assumed to match the latest (October

[5] Some studies for individual advanced economies have suggested that the pandemic could have raised aggregate productivity through exit of unproductive firms (Kozeniauskas, Moreira and Santos 2022 and Van den Bosch and Vanormelingen 2022).

[6] Cohort effects refer to systematically different labor market participation rates between different cohorts of workers over their life cycles (Balleer, Gomez-Salvador, and Turunen 2014; Kudlyak 2013).

2022) consensus forecasts for each economy for which they are available. For economies for which consensus forecasts are unavailable, investment growth in 2022 is assumed to equal economy-specific long-term average investment growth, while for 2023-30, it is assumed for each economy to be the same as the average for the group—advanced economies or EMDEs—to which it belongs.

II.2 Evolution of drivers of global potential growth

In the baseline projections, the contributions to potential output growth of its broad, fundamental drivers—capital accumulation, labor supply growth and TFP growth—weaken further, except for the contribution of capital accumulation in advanced economies (figure 2). In the seven largest advanced economies (G7; Canada, France, Germany, Italy, Japan, United Kingdom, United States), capital accumulation is expected to tick up over the remainder of the decade as major government investment plans get underway. In other advanced economies, capital accumulation is anticipated to remain stable and somewhat higher than in G7 countries.

Globally, slower capital accumulation in EMDEs, especially in China, is expected to be offset by faster capital accumulation in advanced economies. In China, the policy-promoted shift away from investment-driven growth is assumed to continue. In EMDEs other than China, the pace of capital accumulation is projected to remain broadly steady.

Subdued investment growth in China and reduced room for "catchup" productivity growth in EMDEs as per capita income differentials narrow, will sap EMDE productivity growth (figure 3). EMDEs excluding China start the period 2022-30 with per capita incomes averaging 14 percent of those in advanced economies, about 1 percentage point higher than in 2009. On the other hand, recoveries in TFP growth are assumed for those EMDEs, especially in LAC and SSA, that were hardest hit by adverse shocks, such as debt crises or natural disasters, in the past decade. These shocks reduced TFP growth to nil or even negative rates but, as they dissipate, TFP growth should recover. On balance, EMDE potential TFP growth is projected to be about 0.2 percentage point per year lower over 2022-30 than over 2011-21.

Even if education and health outcomes continue to improve in line with their long-term trends, as assumed, slowing working-age population growth combined with withdrawal from the labor market of older cohorts of workers could reduce both global and EMDE potential growth by another 0.2 percentage point a year on average in 2022-30 relative to 2011-21 (figure 4).

II.3 Global potential growth prospects

Absent unexpectedly favorable or adverse developments—such as significant productivity breakthroughs or natural disasters related to climate change—global potential growth in 2022-30 is projected in the baseline to weaken by 0.4 percentage point a year relative to 2011-21, to 2.2 percent a year (figure 5). Globally and among advanced economies, potential growth is projected to slow in almost one-half and more than one-third of economies, respectively,

accounting for 70 percent of global GDP and 66 percent of advanced-economy GDP. More than one-half of the sample's EMDEs, accounting for 77 percent of EMDE output, are expected to experience slower potential growth in the remainder of the current decade than in 2011-21. The economies where potential growth is projected to increase include smaller metal and energy commodity exporters, which are expected to benefit from increased investment growth.

Potential output growth in advanced economies is expected to slow by 0.2 percentage point to 1.2 percent a year in 2022-30. Further weakening of both TFP growth and, because of population aging, labor supply growth is expected to be partly offset by a slight pick-up in the pace of capital accumulation. The same applies to the G7 countries, where potential growth is also expected to be 0.2 percentage points per year slower in 2022-30 than in 2011-21.

EMDE potential growth is projected to slow by about 1.0 percentage point a year in 2022-30, relative to 2011-21, to 4.0 percent a year. This slowdown mostly reflects demographic developments across most EMDEs and weaker capital accumulation, especially in China, as China's policy-guided decline in investment growth continues. In other EMDEs, capital accumulation is expected to slow only modestly. While China will account for 0.8 percentage point of the 1.0-percentage-point decline in EMDE potential growth, slower growth is projected for most of the EMDEs in the sample, with significant slowdowns expected for some other large EMDEs. These could generate adverse spillovers to other EMDEs that the production function approach does not explicitly account for.[7]

II.4. Regional potential growth prospects

Potential output growth is expected to be slower in 2022-30 than in 2011-21 in three of the six EMDE regions and slower than in 2000-10 in all regions (figure 6). In EAP, ECA, and LAC, working-age shares of the population are expected to shrink. In MNA, SAR, and SSA, working-age shares of the population are expected to rise, but with a shift toward older cohorts with weaker labor market attachment.

In *EAP*, potential growth is expected to slow as policies in China continue to shift growth away from investment toward more sustainable engines, and the growth of the region's working-age population and TFP slows. China's potential growth is expected to slow to just under 5 percent per year on average in 2022-30, well below the average during 2000-21 that was well in excess of 7 percent and within the range of recent long-term growth forecasts.[8] Elsewhere in EAP, potential growth is expected to decline only marginally between 2011-21 and 2022-30 and

[7] For example, a 1-percentage-point decline in growth in the seven largest EMDEs has been estimated to slow growth in other EMDEs by 0.9 percentage point a year over the following three years. A similar-sized decline in G7 growth could have a one-half to three times larger impact than an EM7 slowdown (Huidrom, Kose, and Ohnsorge 2017).

[8] October 2022 consensus forecasts are for 4.1 percent per year GDP growth in China on average over 2022-30. Rajah and Leng (2022) project growth slowing to the range of 2-3 percent by 2030; WEF (2021) forecasts growth of about 5 percent on average over 2022-30.

remain over 4 percent a year. In *ECA*, demographic trends and an expected further decline in investment growth are projected to shave off 0.6 percentage point a year from potential output growth between 2011-21 and 2022-30.

In *SSA*, slower labor supply growth and capital accumulation in 2022-30 are expected to be partly offset by a modest pick-up in TFP growth reflecting accelerated per capita income catchup after the setbacks caused by multiple adverse shocks over the past decade, including the COVID-19 pandemic. The projected decline in potential growth in SSA is therefore milder than in EAP and ECA. It is mainly accounted for by South Africa and, in particular, by population aging and weak investment growth in that country: elsewhere in SSA potential growth is expected to remain broadly steady, at 4.6 percent a year.

Potential growth in *LAC*, *MNA* and *SAR* in 2022-30 is expected to be little changed, at the relatively weak rates of just over 2 percent per year in LAC and MNA and at a robust pace of more than 6 percent a year in SAR. TFP growth in LAC and MNA is expected to pick up, reflecting recoveries from the effects of the currency and debt crises of the past decade in some countries and modestly stronger investment growth in others, but this boost is expected to be offset by diminishing demographic dividends. The contribution of capital accumulation to potential growth in LAC and MNA is expected to be broadly unchanged, assuming no major intensification of geopolitical risks and uncertainty. In SAR, a slowdown in labor supply growth is expected to be largely offset by a pick-up in TFP growth related to the expected gains in educational attainment and agricultural productivity as well as still robust growth of investment.

III. Risks to potential growth prospects: Downside scenario

Several adverse developments could deepen the slowdown in potential growth that is proiected in the baseline scenario. The investment growth forecasts underlying the baseline scenario could turn out to be overly optimistic. Natural disasters could increase in frequency and cause repeated shocks to output and productivity. A global recession in the near term could cause lasting setbacks to potential growth, in line with historical experience. Policy-induced improvements in such areas as education, healthcare, and female labor force participation could disappoint. This section examines the implications of each of these downside risks in turn.

If one of these risks materializes, potential growth could turn out lower than projected in the baseline, by 0.2-0.9 percentage point per year globally and 0.1-0.7 percentage point per year in EMDEs. This would be in keeping with the record of past long-term growth forecasts, which have had a significant optimism bias (Ho and Mauro 2016; Juhn and Loungani 2002; World Bank 2018c).

III.1 Investment disappointments

The baseline scenario assumes that investment growth over 2022-30 will match the latest (October 2022) one- to nine-year-ahead consensus forecasts. However, during 2010-22, consensus forecasts overestimated global investment growth over the subsequent ten years, on average, by 2.4 percentage points per year (figure 7).[9] For EMDEs, consensus forecasts in this period overestimated investment growth, on average, by 1.4 percentage points per year, with average forecast errors for LAC and ECA more than twice as large as those for EAP and SAR. Some of the forecast overoptimism reflected a failure to anticipate the global recessions of 2009 and 2020. But even excluding these two global recessions and their subsequent rebounds, consensus forecasts overpredicted global investment growth, on average, by 1.0 percentage point per year and EMDE investment growth by 1.4 percentage points per year over the subsequent ten-year period.

To take account of the possibility of forecast optimism in the baseline scenario for 2022-30, a risk scenario was constructed in which investment growth in every year of the forecast period is reduced from the baseline by the average forecast bias in 2010-22 for each respective forecast horizon. In this scenario, potential output growth in 2022-30 is 0.1 percentage point a year lower in EMDEs and 0.3 percentage point a year lower globally than in the baseline.

III.2 Climate disasters

Climate change has become an increasingly urgent policy challenge as the frequency and impact of adverse climate events have increased (IPCC 2022). On average over 2000-18, the number of climate disasters—droughts, floods, and storms—per year was more than two-thirds higher than in the previous two decades (1980-1999). Storms disrupted economic activity most severely in EAP and LAC, where there are many particularly vulnerable small island states. In LAC, floods also caused notable disruptions of activity in mining and agriculture. Droughts had their most severe effects in ECA and SSA.

The effects of climate disasters on TFP growth estimated by Dieppe, Kilic Celik, and Okou (2020) were used to construct a scenario representing the increased frequency of climate disasters relative to the baseline. The estimates were derived from a sample of 2,812 climate disasters over 1950-2018, of which 43 percent were floods, 30 percent storms, and 9 percent droughts, in 35 advanced economies and 89 EMDEs. Almost half of the disasters occurred in three EMDE regions—292 in 8 EAP countries, 479 in 28 SSA countries, and 636 in 20 LAC countries. Each climate disaster was estimated to have reduced TFP growth, on average, by 0.1 percentage point in the year of the disaster.

Over the medium-term, the impact of these disasters varied widely depending on the speed and magnitude of reconstruction efforts. For example, three years after a climate disaster, TFP

[9] Working-age population growth forecasts have also been shown to be biased (Keilman 2001).

growth was anywhere between nil and 10 percent lower than in countries and years without disasters (Dieppe, Kilic Celik, and Okou 2020). Some countries, especially small states, have suffered much larger damages than suggested by the average effect. The average small state has suffered losses and damages from climate-related disasters of 5 percent of GDP per year, on average (World Bank 2023). These losses did not occur in a predictable pattern. Instead, it was not uncommon for the damages from a single climate-related disaster to cost a substantial portion of a country's GDP, or even multiples of GDP in extreme cases.

The climate change scenario assumes that the number of climate disasters in 2022-30 will be higher than in 2011-21 in each country by the same amount as the increase between 2000-10 and 2011-21. On average, this means two disasters every three years in 2022-30, up from one every two years in 2011-21. The negative effect of the greater frequency of disasters on each country's TFP growth is then estimated by multiplying the assumed increase in the number of disasters per year by the average impact of each disaster on TFP growth, as estimated by Dieppe, Kilic Celik, and Okou (2020).[10] In this scenario, both global and EMDE potential growth over 2022-30 would be almost 0.1 percentage point a year lower than in 2011-21.

III.3 Recessions

With global output growth slowing sharply in 2022-23 amid tightening global financial conditions, there are risks of a global recession and of financial crises in EMDEs in the near term (World Bank 2023). In the past, slowing global growth and rising global financing costs have been associated with a significantly higher probability of currency crises and sovereign debt crises in EMDEs (Koh et al. 2020).

Recessions and financial crises have been associated with lasting reductions in potential output growth. Kilic Celik et al. (2023) show that national recessions between 1990 and 2021 have typically been associated with reductions of about 1.4 percentage points in potential growth even after five years.[11] Based on the econometric estimates presented in Kilic Celik et al. (2023) of the effect over different forecast horizons, recessions in EMDEs in 2023 could lower potential growth over 2022-30 by 0.7-0.9 percentage point per year globally, in EMDEs, and in advanced economies.

III.4 Disappointing policies

The baseline scenario assumes that education and health outcomes will continue to improve in 2022-30 in line with their country-specific long-term trends. However, such improvements

[10] Natural disasters have implications for output, productivity, and investment. The immediate effect might be damage to existing capital stock, followed by a rapid investment rebound in reconstruction. For the year as a whole, the net effect tends to be negligible. In contrast, output rebounds tend to be more muted than investment rebounds such that there are measurable output and TFP losses on an annual basis.

[11] See Kilic Celik et al. (2023) for a review of the related literature.

slowed over the 2010s (Dieppe 2020). An alternative scenario therefore assumes that such improvements continue, not at their historical average pace, but at the slowest ten-year pace for every country.

Hence, instead of assuming that secondary school completion rates in EMDEs improve, on average, by 12.3 percentage points between 2011-21 and 2022-30, as in the baseline scenario, the alternative scenario assumes that they improve by only 3.4 percentage points. Similarly, in the alternative scenario, tertiary completion rate in EMDEs improve by only 1.4 percentage point in 2022-30 compared with 2011-21, instead of the 4.2 percentage points in the baseline scenario. In advanced economies, secondary and tertiary school completion rates are expected to improve by 10 and 7.2 percentage points, respectively, in the baseline scenario, whereas they would only pick up around half as much in the alternative risk scenario.

The alternative, less optimistic, assumptions for education and health outcomes make a significant difference to projected labor supply and TFP growth over 2022-30. Smaller improvements in life expectancy and education outcomes would discourage labor market participation by older and prime-age workers while encouraging participation of younger workers less markedly. They would also moderately dampen TFP growth. As a result, potential growth in both advanced economies and EMDEs could be 0.4 percentage point slower than in the baseline scenario.

IV. Policies to lift potential growth: Upside scenarios

In this section, the production function framework is used to construct upside scenarios driven by the implementation of policies that improve potential growth prospects. Potential growth in each upside scenario, in which improved policies generate faster growth of physical or human capital, labor supply, or TFP, is compared with the baseline projections described earlier.

IV.1 Design of an upside scenario

The general approach used in the construction of each upside scenario is to assume for each economy over the course of 2022-30 a repetition of its best ten-year improvement in a particular policy-related variable during 2000-21, up to reasonable ceilings (figure 8). The potential growth dividend estimated in each scenario therefore depends on each country's track record as well as its room for improvement. The estimates do not take into account possible nonlinearities in reform impacts or possible synergies between different reform measures, so that they may be lower bounds of the reform impact.

Investment growth in each economy is assumed to rise over the course of 2022-30 by the most that it increased in any ten-year period during 2000-21. Such an investment surge would also help countries address needs for investment to adapt to, and mitigate, climate change.

Educational outcome indicators—secondary and tertiary enrollment and completion rates—are

assumed to rise in each country by the largest improvement seen in any ten-year period during 2000-21, except that enrollment rates are capped at 100 percent and completion rates are capped at the highest levels observed in advanced economies in 2019, the latest available data point. Life expectancy is assumed to rise in each country by the largest increase in any ten-year period during 2000-21, but not above the median advanced-economy life expectancy in 2019.

For each age group in each country, the female labor force participation rate is assumed to rise by the largest increase over any ten-year period during 2000-2021, but not to exceed the male labor force participation rate in the same age group. Separately, a social benefit reform with labor market implications is modelled. For each gender and each country, labor force participation rates for workers in age groups 55-59, 60-64, and 65 years or older are assumed to rise to the participation rates of age groups that are five years younger, i.e., those of age groups 50-54, 55-59, and 60-64 years. The increase is assumed to occur gradually over 20 years for each gender in each country.

IV.2. Raising the growth rate and efficiency of physical capital

Scaled-up fixed investment can raise potential output growth both directly through the contribution of capital accumulation and indirectly by boosting TFP growth, since TFP-enhancing technological progress tends to be embodied in new investment. Potential output can also be raised through more efficient investment spending.

Scaling up investment

To achieve the sustainable development goals, it has been estimated that global investment needs to be raised by up to 3 percent of global GDP (UNCTAD 2014). All EMDEs and EMDE regions have sizable investment needs (Stamm and Vorisek 2023). These could be filled through either public or private investment or combinations of both, including in public-private partnerships. Increasing public investment and promoting private investment can be effective policies to support aggregate demand and activity in the short term as well as to raise potential output growth in the longer term (Calderón and Servén 2010a, 2010b, 2014; World Bank 2017b).

Although the rapid increase in public debt over the past decade has constrained fiscal space in most EMDEs, there generally remains scope to shift government expenditures toward productive, growth-promoting public investment and away from less productive spending such as subsidies (World Bank 2017c). In many EMDEs, government revenue ratios relative to GDP remain low, indicating that they could be raised, including by expanding tax bases and improving the quality of tax administration (World Bank 2015).

In addition, policies can support growth-enhancing private investment. Innovation-promoting investment tends to be low in EMDE firms, partly because of limited availability of complementary inputs such as trained engineers and effective organization techniques (Cirera and Maloney 2017). Policies to expand the supply of complementary inputs and improve management skills could therefore promote private investment, as could improved protection of

intellectual property rights.

If, over the remainder of this decade, each economy raised its investment growth rate by as much as its largest increase over any ten-year interval in 2000-21, investment would rise by 5.2 percentage points of GDP globally and by 7.4 percentage points of GDP in EMDEs over the course of 2022-30.[12]

Such an investment boost would raise global potential growth during 2022-30 by 0.3 percentage point per year above its 2011-21 average, almost reversing the 0.4 percentage point slowdown from 2011-21 in the baseline scenario (figure 9). EMDE potential growth would rise by 0.4 percentage point a year, reversing almost half of the slowdown from 2011-21 in the baseline.[13] Over the course of 2022-30, these higher growth rates would cumulate to increase potential output in 2030 by 3.3 percent globally and 3.5 percent in EMDEs relative to the baseline.

A package to adapt to, and mitigate, climate change could be part of such an investment push. To limit climate change to 2°C and stay on track to achieve infrastructure-related sustainable development goals, Rozenberg and Fay (2019) estimated that EMDEs needed to raise infrastructure investment by 1.1-3.5 percent of GDP per year just to meet flood protection goals and climate goals in the area of renewable power generation. Most of this would be needed to improve renewable energy supply and energy efficiency, to adopt appropriate standards of coastal protection for cities, and to address increased risks from river floods.

Estimates of investment needs for climate change have spanned a wide range. The World Bank's *Country Climate and Development Reports* estimate the additional need for infrastructure investment for 13 countries (Argentina, China, Egypt, Ghana, Iraq, Jordan, Kazakhstan, Morocco, Peru, Philippines, South Africa, Türkiye, and Vietnam). The average of these 13 estimates is 2.3 percent of GDP per year—an estimate that is also around the average of the broader literature review shown in Stamm and Vorisek (2023). Region-specific climate needs are assumed to be distributed across six regions based on the regional distribution in Rozenberg and Fay (2019). An investment boost of this magnitude could raise global potential growth by 0.1 percentage point, EMDE potential growth by 0.2 percentage point, and potential growth in advanced economies by 0.1 percentage point (figure 10).

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[12] Since the investment surge is assumed to cumulate gradually over the period 2022-30, the increase in annual average investment growth over 2022-30 (shown in figure 8) is less than the cumulative increase over the whole period.

[13] This impact lies within the range of other estimates. For example, China's 16 percentage points of GDP expansion of infrastructure investment between 2002 and 2016 (about three times the magnitude of the thought experiment conducted in our study) has been estimated to have raised output growth by 0.8-2.3 percentage point per year (Dinlersoz and Fu 2022). The lower bound of this range is broadly in line with the estimate derived in our study. That said, cross-country estimates yield somewhat larger impacts. For example, estimates by Abiad, Debuque-Gonzales, and Sy (2018) suggest that a 5 percentage point of GDP increase in infrastructure investment in almost 100 EMDEs during 1960-2017 was associated with up to 6 percentage point higher output after 7 years, or 0.9 percentage point per year on average.

Improving spending efficiency

Implicit in these scenarios, as well as the baseline scenario, is the premise that the additional investment will be used productively. In the context of EMDEs, particularly, there is evidence that absorptive capacity can limit the success of rapidly scaling-up public investment, although less so in lower-income and capital-scarce countries (Presbitero 2016). One study of a large number of road construction projects in almost 100 EMDEs during 1984-2008 found that unit costs were significantly higher when a project was undertaken during a major scaling-up of public investment (Gurara et al. 2021). Another found that projects undertaken while public investment was being scaled up were subject to longer delays (Espinoza and Presbitero 2021). It has also been found that investment tends to yield the greatest growth dividends when it eases bottlenecks to growth (Romp and de Haan 2007).

For climate-related infrastructure investment, in particular, the benefit in terms of potential output may be less than estimated above without complementary policies. The energy transition is likely to require major structural transformation. Government policies that delay or deter reallocation of labor and capital toward 'green' sectors may slow this transformation, reduce the productivity gains from the investment, and thus lower its growth dividends. Likewise, a failure to implement such complementary reforms as metering and the enforcement of appropriate payment for energy use could dampen incentives to take up and make the best use of climate-related new investment.

To get a sense of the potential gains from improved investment efficiency, a scenario is estimated which assumes that the efficiency of infrastructure investment is improved as follows. Countries are ranked in quartiles based on recent spending efficiency as estimated by Herrera and Ouedraogo (2018). It is assumed that countries in the first quartile, with the lowest investment efficiency, raise investment efficiency to the level of third quartile; that countries in the second quartile raise investment efficiency to the level of the fourth quartile; and that all other countries raise investment efficiency to that of the country with the highest spending efficiency. The effect of increased investment on TFP is then scaled up by the increase in spending efficiency.[14] Since the efficiency estimates refer only to infrastructure investment, the efficiency improvement is applied only to the climate-related infrastructure investment boost of 2.3 percentage points of GDP. If the improvement in the efficiency of infrastructure investment accompanied the climate investment boost, it is estimated that potential output growth in EMDEs would be raised by an additional 0.1 percentage point per year on average during 2022-30. The impact varies across countries with a range from nil to 0.3 percentage point depending on the initial level of spending efficiency and the magnitude of additional investment needs.

[14] Implicitly, the baseline exercise captures the "effectiveness" of investment associated with the average spending efficiency.

IV.3. Raising human capital

In the framework used here, human capital has two dimensions: educational attainment and health outcomes (proxied by life expectancy). Policies to enhance human capital can increase not only labor supply but also TFP. A better educated and healthier workforce is more securely attached to the labor market and more productive. A better-educated workforce may be better able to adjust to technological disruptions that reduce employment and wages for workers in certain sectors or with certain skills (Acemoglu and Restrepo 2017a).[15]

Education policies

While secondary school enrollment rates in the average EMDE are near advanced-economy levels, tertiary enrollment rates (46 percent) and secondary and tertiary completion rates (39 and 8 percent, respectively) in 2011-21 were, on average, less than two-thirds of advanced-economy averages. This indicates the scope for expanding access to education in EMDEs, but increasing the quality of education is also critical to improve education outcomes (World Bank 2018b).

Policies to improve education outcomes are especially important at the current juncture, as school closures caused by the pandemic have resulted in lasting damage to the human capital of a generation of students (Azevedo et al. 2021; Mizunoya et al. 2021; UNICEF 2022). The development of metrics to assess progress toward learning goals is a prerequisite for effective policy actions to improve educational outcomes (World Bank 2018b). At the national level, such actions generally include policies to improve teacher training, increase teacher accountability, and enhance teachers' performance incentives (Evans and Popova 2016).[16] At the student level, policies include efforts to tailor teaching methods to the requirements of students (Kremer, Brannen, and Glennerster 2013); grants to encourage school attendance by disadvantaged students (Glewwe and Maralidharan 2015); and better early childhood nutrition and cognitive development to improve students' capacity to learn (Tsimpo Nkengne, Etang Ndip, and Wodon 2017).

In a stylized policy scenario, education-related policy indicators—secondary and tertiary enrollment and completion rates—are assumed to rise over the course of 2022-30 in each country by as much as their largest improvement in any ten-year period during 2000-21. This means that EMDEs, on average, would raise secondary school completion rates by almost 4 percentage points and secondary and tertiary enrollment rates by 12 and 5 percentage points, respectively, on average, in the remainder of this decade. In EMDEs that have made particularly

[15] The impact of such technological disruptions on output may not be clear-cut. For example, in aging societies, technological change that makes certain jobs redundant may relieve pressures from a shrinking labor supply (Acemoglu and Restrepo 2017b, 2017c). But automation may also expand labor demand by creating new tasks for which labor has a comparative advantage (Acemoglu and Restrepo 2016).

[16] Other measures, such as reducing student-teacher ratios or additional years of schooling, have had effects that have differed widely among countries (Evans and Popova 2016; Hanushek and Woessmann 2008).

large strides in improving education outcomes but still have ample room for further improvements, such as those in SAR, secondary school completion rates could rise as much as 20 percentage points in 2022-30, of which 6 percentage points would be due to such reforms. Advanced economies also have room for improvement, especially in higher level of education: tertiary enrollment rates would rise by 11 percentage points, on average during next decade, compared to the baseline scenario.

Rapid technological change and greater needs for interdisciplinary skills may also require new strategies for life-time education and retraining that enable workers to be more mobile and adaptable through their careers. For example, analysis of jobs posting suggests that a growing number of jobs across a range of industries required soft skills as well as communications and artificial intelligence-related skills (Liu and Lyu 2021; Squicciarini and Nachtigall 2021). Hence, an ability to acquire new skill sets may be a critical competency for workers to meet the demands of future labor markets (OECD 2018).

Healthcare policies

Average life expectancy in EMDEs is still lower than in advanced economies: in 2011-21, they averaged 75 and 81 years, respectively. While life expectancy in some EMDEs, particularly in SAR and SSA, has risen significantly—by 4-7 years over the past two decades—it remains about one-fifth below advanced-economy levels in SSA and about one-seventh below in SAR.

Policies to improve public health, and to promote longer, healthier, and more productive working lives, range widely. In many EMDEs, better sanitation and access to clean water remain key to improvements in public health. The communities most affected by poor sanitation tend to be the poorest (Andres 2021). However, improvements in sanitation have to be accompanied by high sanitation usage and widespread handwashing to yield health benefits such as lower malnutrition and disease burdens (Carter 2017).

Improvements in healthcare provision can be spurred by well-defined and regularly monitored performance indicators (Bradley et al. 2010). In countries with higher per capita incomes, comprehensive provision of healthcare services has been followed by better health outcomes (Maeda et al. 2014). Programs carefully targeted at local health service providers or groups of patients have generated considerable improvements in healthcare services and outcomes. For example, in Rwanda, performance-based incentive payments helped significantly improve health indicators for children (Gertler and Vermeesch 2012). In India, enhanced training of primary healthcare providers led to better identification and treatment of ailments (Das et al. 2017).

In a stylized scenario of improved health outcomes, life expectancy is assumed to rise over the course of 2022-30 in each country by as much as its largest improvement over any historical ten-year period during 2000-21. This would imply an increase in average life expectancy in EMDEs of 1.4 years on top of the trend increase of almost 2 years, on average, but an additional increase of 4 years in SSA.

Effects on potential growth

These stylized scenarios suggest that improvements in education and health outcomes—via their effects on the growth of the labor supply and TFP—could lift EMDE potential growth by 0.1 percentage point a year above the baseline, on average, in 2022-30.[17] In EMDEs with strong track records of, and ample room for, improving education and health outcomes, such as many of those in SSA, potential growth could be increased by more than twice as much. In contrast, the impact on potential growth for advanced economies would be negligible.

IV.4 Raising labor supply growth

A country's labor supply can be increased by raising the active share of the working-age population. This can be achieved through policies to "activate" discouraged workers or groups with historically low participation rates, such as women and younger or older workers.[18] In advanced economies and EMDEs, active labor market policies and reforms to social benefits have often been followed by higher labor force participation rates (Betcherman, Dar, and Olivas 2004; Card, Kluve, and Weber 2010). In contrast, less rigid employment protection regulation and lower minimum wages have had mixed effects on employment and labor force participation and, at times, unintended side effects such as lower labor force participation by disadvantaged groups (Betcherman 2014). In any event, the effects of such policies on output will depend on circumstances and country specifics. For example, De Haan and Wiese (2022) find that labor market reforms in 25 OECD countries in 1985-2013 were associated with higher output growth only when they were introduced during the periods of expansionary fiscal policy.

Data suggest that there is significant scope for increasing labor force participation particularly by women and older workers. Globally, average female labor force participation in 2011-21, at 54 percent, was three-quarters of that of men, which stood at 72 percent, and the gap between male and female participation was even larger in EMDEs, at 25 percentage points. Similarly, in both EMDEs and advanced economies, the average participation rate of workers aged 55 years or older was about half that of 30-45-year-old workers, and labor force participation among those aged 19-29 years was only four-fifths that of their 30-45 year olds.

Raising female labor force participation is a formidable task for policy makers because it depends on many factors, including economic structure and its transformation over time (especially shifts

[17] This modest effect is in line with the meta regression analysis of 57 studies of the link between education and growth by Benos and Zotou (2014). They find an economically small, although statistically significant, link between standardized enrolment rates on growth. The small average effect disguises a wide range of impact estimates that also reflect different quality of schooling (Glewwe, Maiga, Zheng 2014). The empirical literature on the link between life expectancy is even more mixed, with results varying widely depending country circumstances and with the direction of causality debated (Acemoglu and Johnson 2007; He and Li 2018; Desbordes 2011).

[18] The impact of such labor market reforms might depend on circumstances and country specifics. For example, De Haan and Wiese (2022) finds that labor market reforms in 25 OECD countries in 1985-2013 were associated with higher growth only when they were introduced during periods of expansionary fiscal policy.

towards tradable sectors) as well as social norms and values (Klasen 2019; Erten and Metzger 2019). That said, in EMDEs, policies aimed at other objectives have sometimes raised labor force participation by women and older adults. For example, in Nigeria, improved access to finance and training programs increased female labor force participation by encouraging firm startups (Brudevold-Newman et al. 2017). In Uruguay, the extension of the school day was associated with higher adult labor force participation (Alfaro, Evans, and Holland 2015). In Mexico and Colombia, subsidized daycare was associated with increased female labor force participation (World Bank 2013). In ECA, improvements in healthcare services for the elderly have helped extend productive life spans, and improved support services for women with families has encouraged female participation (Bussolo, Koettl, and Sinnott 2015). Improved transport and communications, including improved road systems and access to power and telecommunications infrastructure have also facilitated labor force participation and promoted job creation (World Bank 2013).

The upside scenario for labor force participation by older workers assumes a social benefit reform that gradually raises participation rates in each five-year age group from 55-59 years onwards. In each country and for each gender, participation rates for workers in the age groups of 55-59 years, 60-64 years, and 65 years or older are assumed to rise to the rates of the age groups that are five years younger—the age groups of 50-54, 55-59, and 60-64 years, respectively. The increases are assumed to occur gradually over 20 years. Such an increase in participation—roughly equivalent to raising the average effective retirement age by five years—would be sizable: for comparison, between 2000 and 2020, the effective retirement age in the average advanced economy rose by 2.4 years for men (and fell in EMDEs with available data) and 3 years for women.

In this scenario, global and advanced-economy potential output growth would rise by 0.2 and 0.3 percentage point a year, respectively, on average, in 2022-30. For EMDEs, the effect is smaller, at 0.1 percentage point a year. The largest boost to growth would materialize in EAP and ECA, the two regions with the most rapidly aging populations.

IV.5 Raising TFP growth

The scenario analysis thus far has considered enhancements to the growth of the factors of production, capital and labor, and how they might be brought about by policy action. But in the framework of the production function, output growth can also be raised through faster growth of TFP, which again can be promoted by policies. Policies that improve institutional quality, such as stronger application of the rule of law and better control of corruption; greater political stability; and policies that improve business climates could all raise TFP, including by encouraging a shift from informal to more productive formal activities. Policies that promote spending on research and development (R&D) can also raise TFP growth by fostering technological progress.

There is broad consensus in the literature that market-friendly institutional reforms have been associated with stronger economic growth, albeit with varying results across countries and

disagreements about optimal institutional arrangements (Bluhm and Szirmai 2011; Nawaz 2015; Prati, Onorato, and Papageorgiou 2013). Institutional change can raise investment and productivity growth both directly, by raising private returns to productivity-enhancing investment in human and physical capital, and indirectly, by removing obstacles to other drivers of productivity growth, such as innovation, openness to international trade and investment, competition, and financial development (Acemoglu et al. 2005; Botero, Ponce, and Shleifer 2012; Glaeser et al. 2004; Glaeser, Ponzetto, and Shleifer 2007). Institutional reforms can encourage private sector investment and innovation by establishing secure and enforceable property rights, minimizing expropriation risk, promoting competition and limiting market concentration, creating a stable and confidence-inspiring policy environment, lowering the costs of doing business, and encouraging participation in the formal sector where productivity tends to be higher (World Bank 2018c, 2019c).

Poor business climates allow anticompetitive practices to flourish, perpetuate corruption, discourage innovation, and distort the efficient allocation of factors of production (Aghion and Schankermann 2004; Bourles et al. 2013; Buccirossi et al. 2013). Burdensome and unnecessary business regulations can amplify the adverse effect of corruption on productivity (Amin and Ulku 2019). Conversely, good governance ensures competitive and flexible markets with limited market concentration, effective regulation, and the efficient and equitable provision of public services, including healthcare, education, and public infrastructure (Acemoglu and Johnson 2005; Dort, Méon, and Sekkat 2014; Gwartney, Holcombe, and Lawson 2006).

The potential benefits of reforms in these areas are underscored by the fact that, in many EMDEs, institutions and governance remain weak (World Bank 2018b). The lack of secure and enforceable property rights, pervasive corruption and crime, and large informal sectors often limit the ability of private firms to invest and innovate and thus the ability of many EMDEs to close productivity gaps with the advanced economies. This means that institutional reforms provide considerable scope for EMDE governments to stem and reverse the slowdown in the growth of productivity and potential output.

Reforms of institutions and business climates: Literature review

The literature reviewed in annex A indicates that substantial improvements in the quality of regulations, institutions, and business climates have often been associated with significant increases in long-term economic growth.

Regulatory reforms have encouraged the entry of more productive firms, including multinational companies, and stimulated research and development spending (Alam, Uddin, and Yazdifar 2019; Egan 2013). Reforms to increase labor market flexibility have helped improve firm-level productivity, increase labor force participation, reduce informality, and encourage a more efficient allocation of labor.[19] EMDEs with business-friendly regulations have tended to have

[19] See Blanchard, Jaumotte, and Loungani (2013); Bruhn (2011); La Porta and Shleifer (2014); Loayza, Oviedo, and

greater economic inclusiveness and smaller informal sectors, and have grown faster (Djankov, McLiesh, and Ramalho 2006; World Bank 2014). Conversely, trade restrictions have been associated with lower firm-level productivity, especially when accompanied by intrusive domestic industrial policy (Topalova and Khandelwal 2011). Weak business environments have also diminished complementarities between public, foreign direct, and domestic investment (Kose et al. 2017). Major improvements in business environments have been associated with increased output growth (Divanbeigi and Ramalho 2015; Kirkpatrick 2014).

A number of factors have affected the impact and success of institutional reforms, including the country's stage of development and distance to the technological frontier (Dabla-Norris, Ho, and Kyobe 2016). Thus investment in physical and human capital has often been associated with stronger long-term outcomes when the quality of institutions exceeded certain thresholds (Hall, Sobel, and Crowley 2010; Jude and Levieuge 2017). EMDEs with stronger institutions and better regulations may have achieved greater output gains from financial liberalization and trade openness (Atkin and Khandelwal 2020; Slesman, Baharumshah, and Azman-Saini 2019; Williams 2019).

The ability of governments to maintain the pace of institutional reforms has often been uneven, in part because the growth dividends from reforms have often materialized with substantial lags and reforms may have initially been unpopular and politically costly, including at election times (Alesina et al. 2020). Major growth downturns have sometimes been associated with subsequent reform accelerations; conversely, growth-enhancing reforms have often been delayed or even reversed during times of economic stress and in economies with high debt burdens (Gokmen et al. 2020; Muller, Storesletten, and Zilibotti 2019). Even during more tranquil times, meaningful reforms have often been postponed or abandoned because of their redistributive effects, including their costs to vested interests. (Gradstein 2007).

Reforms to institutions and business climates: Empirical estimation

A local projection approach is used to estimate the impact of major, sustained institutional reform advances and setbacks on the growth of TFP and investment in EMDEs. Sustained institutional advances (or setbacks) are defined as increases (or decreases) in the unweighted average of four indicators from the International Country Risk Guide (ICRG)—bureaucracy quality, law and order, corruption, and investment profile—provided the increase (or decrease) is not unwound for at least three consecutive years. The local projection model estimates the effect of the reform event on the cumulative growth of investment and TFP over horizons of two and four years after the start of the event (annex B).

The estimates suggest that reform advances were associated with significant and, in some cases, lasting increases in the growth of TFP and investment whereas the impacts of setbacks were highly heterogeneous. TFP was, on average, about 1.9 percent above the baseline two years after

Serven (2005); and Loayza and Serven (2010).

reform advances (figure 11). Over time, this impact became more heterogeneous and more difficult to estimate precisely. By contrast, the impact on investment strengthened over time: four years after reform advances, investment was, on average, 16-17 percent above the baseline. Sustained reform setbacks were followed by a wide range of TFP outcomes. Investment also evolved in too heterogeneous a manner for a well-defined estimate of the impact but often fell well below the baseline over several years.

Reforms to fiscal frameworks

Fiscal reforms can also yield important productivity dividends. Several studies have highlighted the long-term growth benefits of fiscal reforms, especially when combined with other structural reforms (IMF 2016a). In OECD countries, the growth-enhancing effects of a budget-neutral shift in government spending towards health, education, and transport often becomes apparent after five years (Barbiero and Cournède 2013). On the revenue side, a budget-neutral increase in the efficiency of the tax system could raise long-term growth. One study found that sixty percent of fiscal reform episodes in 112 countries—such as switching from labor taxation to consumption taxation and shifting spending towards health, education, and infrastructure—were followed by growth accelerations of more than 1 percentage point a year (IMF 2016b). Over the longer term, fiscal reforms such as the establishment of fiscal rules have also proven to be growth-enhancing in EU countries (Afonso and Jalles 2012; Castro 2011; Miyazaki 2014).

IV.6 Implications of policies for potential growth prospects

The stylized scenarios above suggest that a combination of measures—policies to promote investment, better educational and health outcomes, more efficient product and labor markets, an improved business climate, and higher quality of governance—or various subsets of them could more than reverse the projected decline in potential growth in the remainder of this decade. The scenarios with scaled-up physical capital, enhanced human capital, and faster labor supply growth alone are associated, together, with 0.7 percentage point a year higher global potential growth, sufficient to reverse the 0.4 percentage point slowdown projected for 2022-30 (figure 9).

Policies could help reverse the projected further slowdown in global potential growth. Reforms associated with higher physical capital investment, enhanced human capital, and faster labor supply growth could raise potential growth by 0.7 percentage point a year in 2022-30, globally and in EMDEs. This would offset the 0.4 percentage point decline in global potential growth between 2011-21 and 2022-30 projected in the baseline scenario, and most of the 1.0 percentage point slowdown projected for EMDEs.

One of the options for a major investment boost is climate-related infrastructure investment, especially if this infrastructure investment is accompanied by improved spending efficiency (figure 10). A climate-related infrastructure investment surge amounting to 3.5 percentage points of GDP alone could raise potential growth globally by 0.1 percentage point per year and

in EMDEs by 0.3 percentage point. If this was accompanied by improved spending efficiency in EMDEs, potential growth could rise by another 0.1 percentage point.

V. Conclusion

Global potential output growth is projected in the baseline to slow further in 2022-30, by 0.4 percentage point per year from 2011-21, to 2.2 percent per year, with all the main drivers of growth weakening. EMDE potential growth, too, is expected to slow, by 1.0 percentage point per year to 4.0 percent per year in 2022-30. The slowdown would come on the heels of the slowing of potential growth between 2000-10 and 2011-21—globally, by 0.9 percentage point per year. The slowdown in the remainder of this decade could be even more pronounced than projected in the baseline, by 0.2-0.9 percentage point per year, if improvements in investment, education and health outcomes, or female labor force participation, which are assumed in the baseline, fail to occur or if such adverse events as a global recession or more frequent natural disasters materialize.

A comprehensive reform package that replicates past successes could more than reverse the decline in global potential growth projected for the remainder of the 2020s. Such a package could include an investment boost (including for climate-related purposes); reforms of labor markets, education and healthcare; and institutional and business climate reforms.

The design of any reform package should take into account several considerations. First, implementing multiple reforms simultaneously rather than piecemeal can generate mutually-reinforcing synergies (annex A). For example, in OECD countries, labor and product market reforms, measures to promote FDI, and trade liberalization have yielded important synergies (OECD 2017). Also in OECD countries, labor market reforms have been more growth-enhancing when combined with an expansionary fiscal stance (de Haan and Wiese 2022). There may also be cross-country synergies from reforms that are coordinated internationally. The potential for growth spillovers puts a premium on reform efforts in advanced economies that can have large beneficial repercussions for their EMDE trading partners.

Second, reform payoffs may take more time to materialize than in the stylized scenarios discussed above and they are also likely to depend on the timing of reform. There is some evidence that reforms have had the largest growth dividends when they were well-timed—at least in the context of advanced economies. For example, labor market reforms may lift growth more during economic upswings or during periods of expansionary fiscal policy, when job entrants can more easily find jobs appropriate to their skills (de Haan and Wiese 2022; IMF 2016b).

Third, reform priorities naturally differ across countries—one of the reasons reform packages have to be tailored to the circumstances and features of individual countries (Dabla-Norris 2016). For example, school enrollment and completion rates in several economies in MNA exceed the EMDE average. However, education reforms continue to be needed to address poor scores on

international tests and pervasive skills mismatches in the labor market.

Future research on the questions discussed in this study could take several directions. We list a few below.

Benefits from reforms involving state-owned enterprises. First, many EMDEs host large state-owned enterprises or poorly regulated private monopolies. Reforms to these could trigger increases in productivity as capital and labor are reallocated towards more productive uses. A better understanding of the impact on potential growth for EMDEs (beyond individual case studies) as well as the identification of conducive preconditions and complementary reforms would be helpful.

Benefits from improvements of governance and business climates. Second, many EMDEs have weak governance and business climates. A fuller quantitative assessment of the effects of improvements in various dimensions of governance and business climates on potential growth, including through firm productivity and household decisions on labor force participation and informal employment, would be helpful.

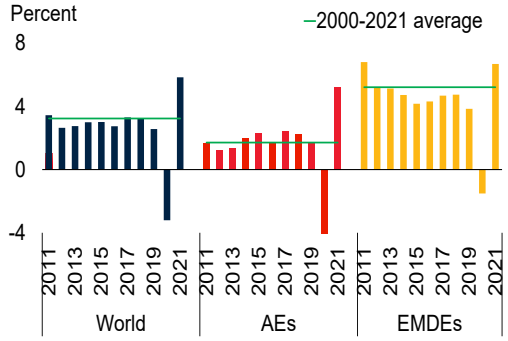
Better understanding of longer-term impact of reforms. Third, the exercise conducted for this study rested on as wide a cross-country sample of data as possible, in order to be representative of the heterogeneity of EMDEs. Data constraints prohibited analysis of developments before 1990. However, for a smaller set of countries, earlier data should be obtainable which could allow analysis of the longer-term effects of the profound structural policy changes that occurred in the 1970s and 1980s. Analysis of a longer time period may also allow for a better assessment of the possible cleansing effects of adverse shocks at the macroeconomic level.[20]

Additional analysis on climate-related infrastructure investment. Fourth, the climate change scenario explored in this study is based on regional estimates of infrastructure investment needs because of data limitations for a large number of individual EMDEs. Given the wide heterogeneity in climate challenges, these regional estimates should ideally be supplemented or replaced by country-specific estimates that can provide more precision. For some countries, country-specific infrastructure investment goals are available, including, for EU countries, in the national Recovery and Resilience plans funded by NextGeneration EU investments. For other regions, however, such country-specific data are for now unavailable.

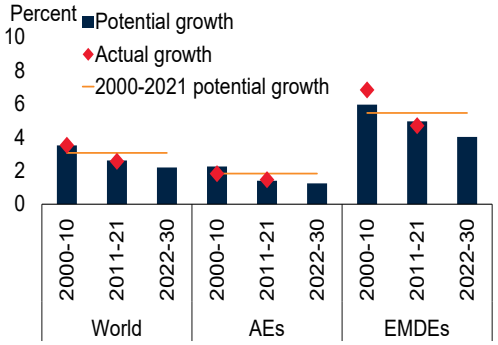
[20] Loayza and Pennings (2022) have developed tools to model long-term growth. These include applications such as how public investment affects growth, the determinants of Total Factor Productivity (TFP), and the evolution of growth in resource-rich economies.

Figure 1. Global output growth and relative per capita incomes

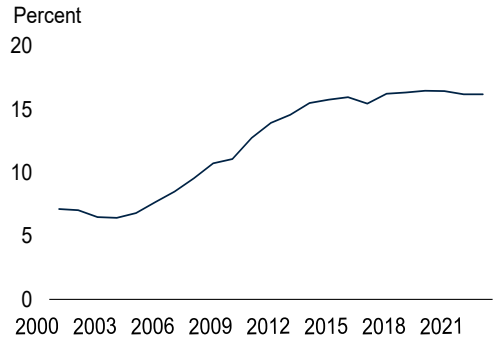
A. Actual output growth



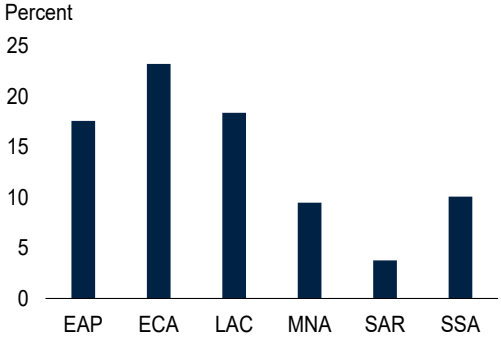
B. Potential output growth



C. Per capita income in EMDEs relative to advanced economies



D. Per capita income relative to advanced economies, 2022



Sources: Penn World Tables, World Bank.

Note: AEs = advanced economies; EAP = East Asia and Pacific, ECA = Europe and Central Asia, EMDE = emerging market and developing economy, LAC = Latin America and the Caribbean, MNA = Middle East and North Africa, SAR = South Asia, SSA = Sub-Saharan Africa.

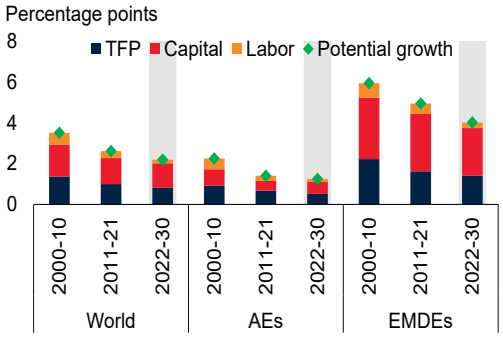
A. Sample of 181 countries.

B.-D Based on production function approach. GDP-weighted averages for a sample of 29 advanced economies and 53 EMDEs.

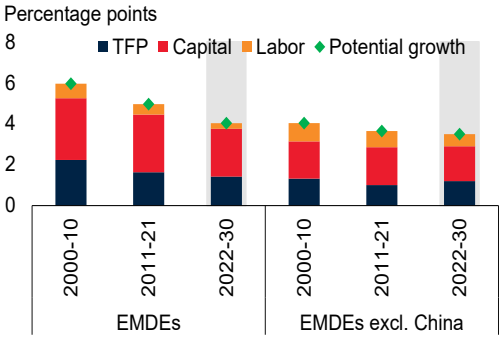
C. Per capita income differential between EMDEs and advanced economies are defined as the GDP-weighted average of percent of GDP per capita of the EMDEs as a ratio of GDP-weighted average of advanced economies.

Figure 2. Composition of potential growth

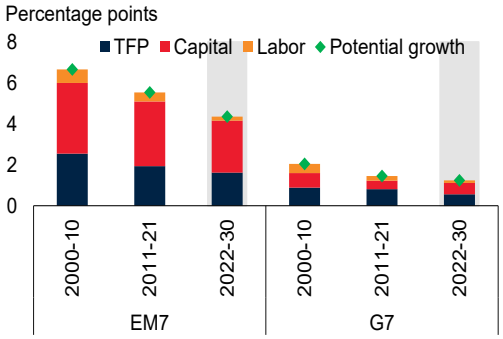
A. Contributions to potential growth



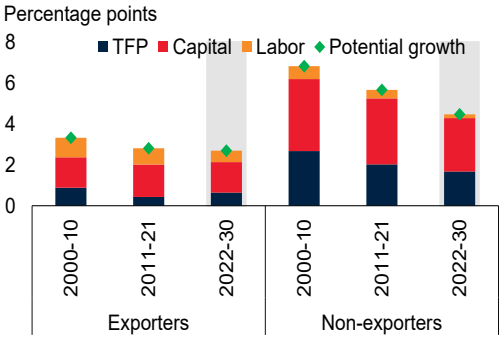
B. Contributions to potential growth in EMDEs



C. Contributions to potential growth in G7 and EM7



D. Contributions to potential growth in EMDE commodity exporters and non-exporters

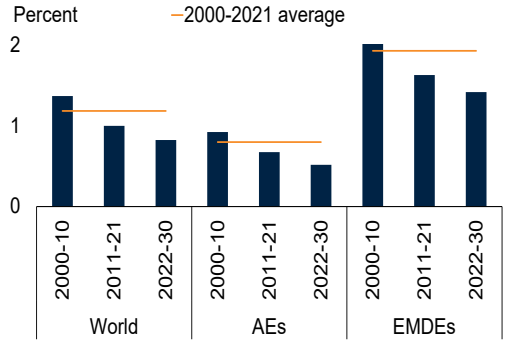


Sources: Penn World Tables, World Bank.

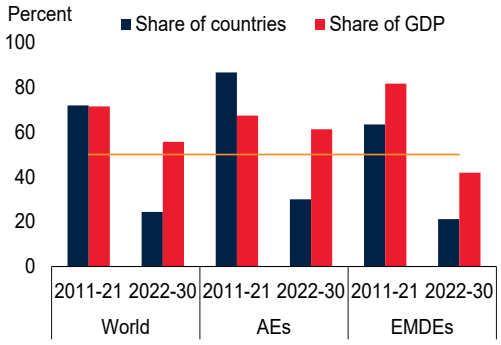
Note: AEs = advanced economies; EMDEs = emerging market and developing economies. Based on production function approach, GDP-weighted arithmetic averages for a sample of 29 advanced economies and 53 EMDEs. G7 is the GDP-weighted arithmetic average of Canada, France, Germany, Italy, Japan, the United Kingdom and the United States. EM7 is the GDP-weighted arithmetic average of Brazil, China, India, Indonesia, Mexico, and Türkiye. Shaded areas indicate projections.

Figure 3. Total factor productivity growth

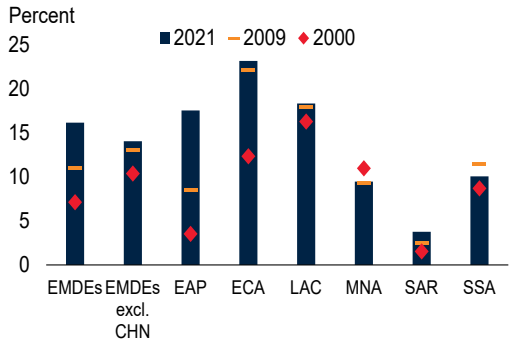
A. Average TFP growth



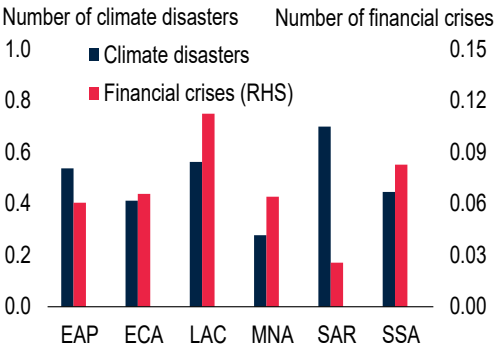
B. Share of economies and GDP with TFP growth below the previous decade average



C. Per capita income relative to advanced economies in 2000, 2009, and 2021



D. Average number of climate disasters and financial crises per year



Sources: Penn World Tables, World Bank.

Note: AEs = advanced economies; EAP = East Asia and Pacific, ECA = Europe and Central Asia, EMDE = emerging market and developing economy, LAC = Latin America and the Caribbean, MNA = Middle East and North Africa, SAR = South Asia, SSA = Sub-Saharan Africa, TFP = total factor productivity.

A. GDP-weighted arithmetic average of total factor productivity growth. Includes 53 EMDEs and 29 advanced economies.

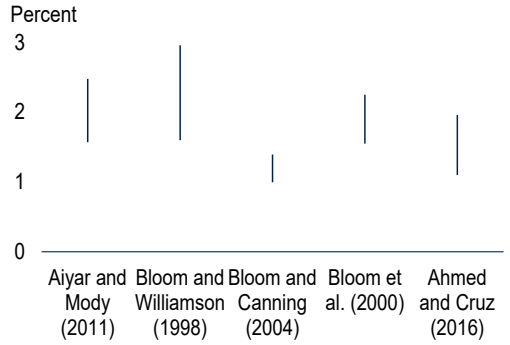
B. Number of economies among 29 advanced economies and 53 EMDEs in which potential total factor productivity growth is lower than the previous decade average.

C. GDP-weighted average of GDP per capita differential to advanced economies between 2009 and 2021. In percent of advanced-economy per capita incomes.

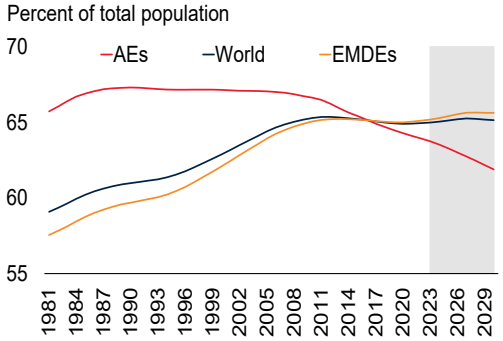
D. Simple average of number of climate disasters (1980-2018) and financial crises (1980-2018) per year in each region.

Figure 4. Demographics

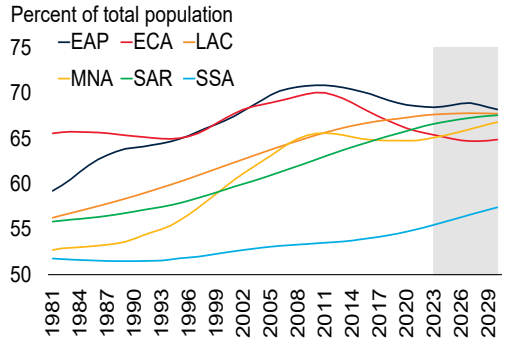
A. Impact of 1 percentage point higher working- age population share on per capita GDP growth



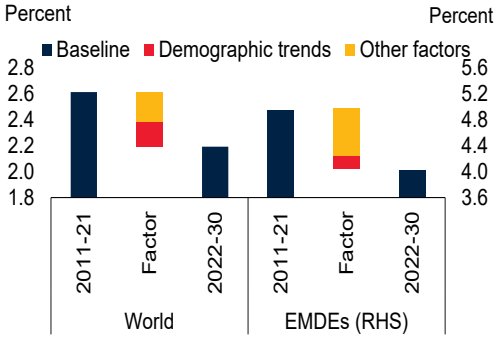
B. Working-age population



C. Working-age population



D. Potential growth



Sources: United Nations World Population Prospects: The 2022 Revision. World Bank.

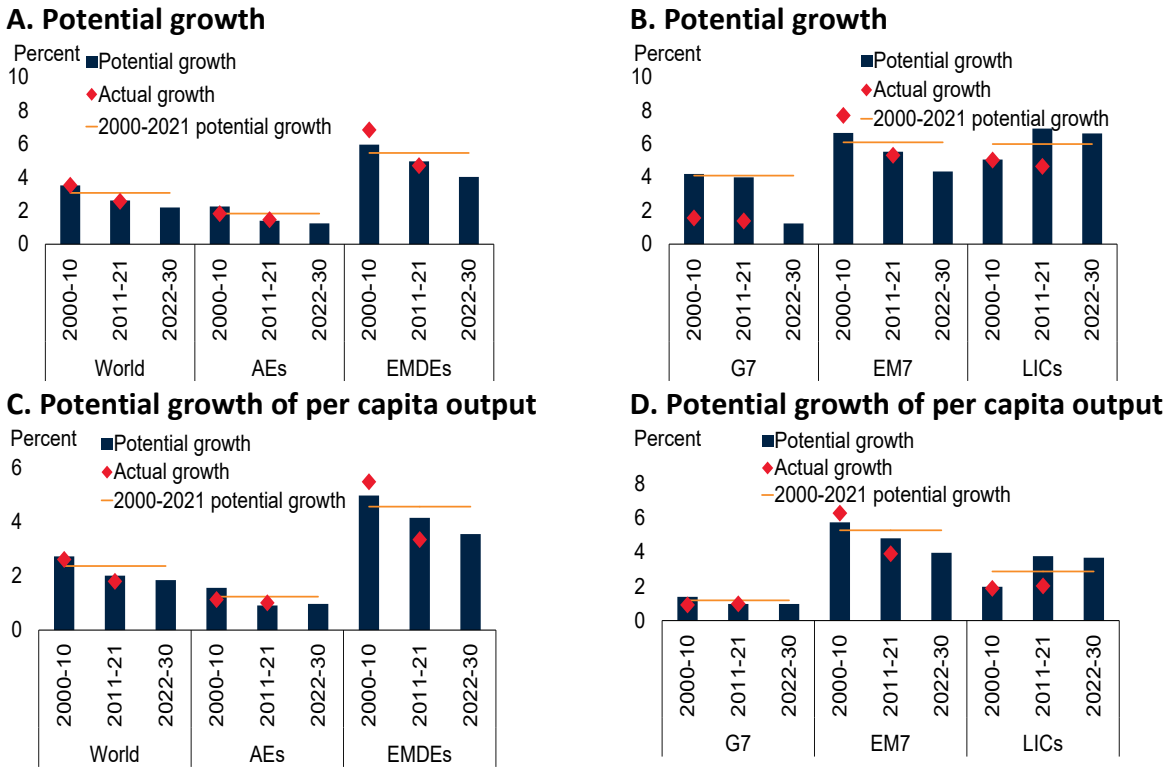
Note: AEs = advanced economies; EMDEs = emerging market and developing economies; EAP = East Asia and Pacific, ECA = Europe and Central Asia, LAC = Latin America and the Caribbean, MNA = Middle East and North Africa, SAR = South Asia, and SSA = Sub-Saharan Africa.

A. The sample of each study differs. Aiyar and Mody (2011): Indian states,1961-2001; Bloom and Williamson (1998): 78 countries, 1965-90; Bloom and Canning (2004): over 70 countries, 1965-95; Bloom et al. (2000): 70 countries, 1965-90; Amer and Cruz (2016): 160 countries, 1960-2010.

B.C. Population weighted averages. The working-age population is defined as people aged 15-64 years.

D. GDP-weighted arithmetic averages. Derived using production function-based potential growth. "Other factors" reflects declining population growth, convergence-related productivity growth, policy changes, cohort effects, and a slowdown in investment growth relative to output growth. "Factor" reflects the percentage-point changes between the averages of 2011-21 and 2022-30.

Figure 5. Evolution of potential growth



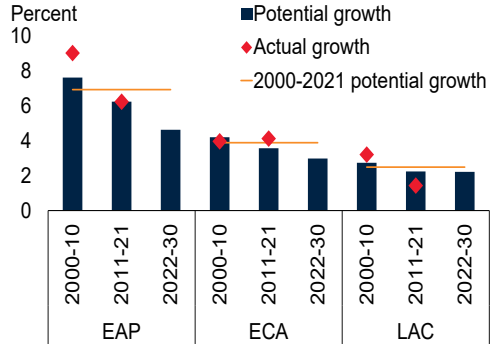
Sources: Penn World Tables, World Bank.

Note: AEs = advanced economies; EMDEs = emerging market and developing economies; EM7 = Brazil, China, India, Indonesia, Mexico, and Turkey; G7 = Canada, France, Germany, Italy, Japan, the United Kingdom, and the United States; LICs = four low-income countries; Based on potential growth derived using production function approach. GDP-weighted average.

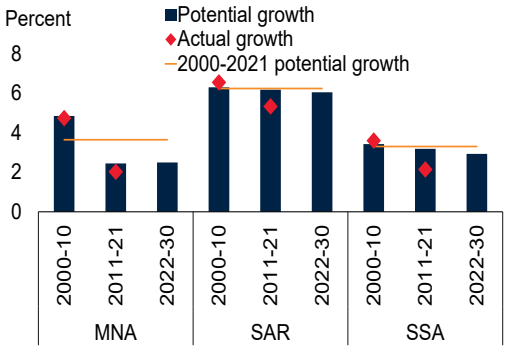
A.C. Sample includes 29 advanced and 53 emerging market and developing economies.

Figure 6. Regional potential growth

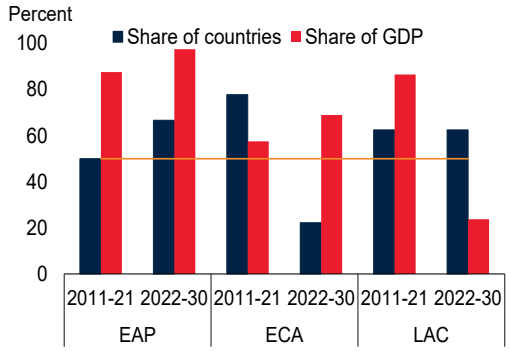
A. Potential growth in EMDE regions



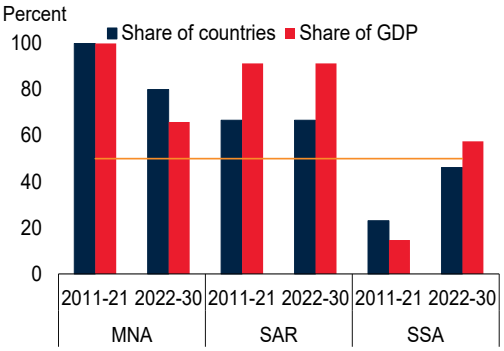
B. Potential growth in EMDE regions



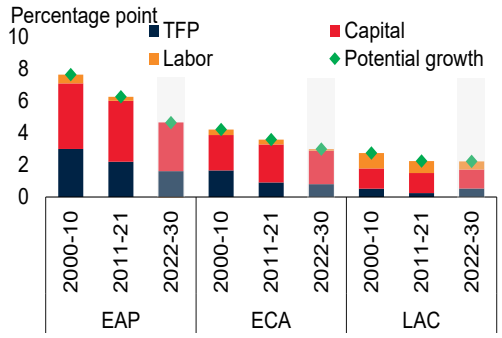
C. Share of countries and GDP with potential growth below the previous decade average in EMDE regions



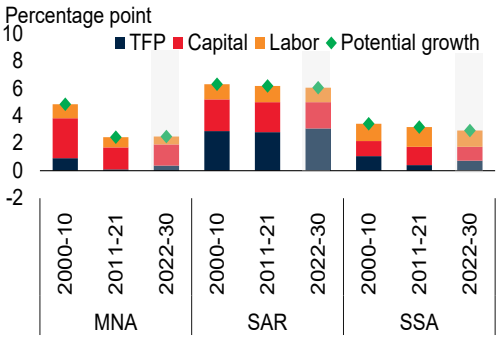
D. Share of countries and GDP with potential growth below the previous decade average in EMDE regions



E. Contributions to regional potential growth



F. Contributions to regional potential growth



Sources: Penn World Tables, World Bank.

Note: EAP = East Asia and Pacific, ECA = Europe and Central Asia,

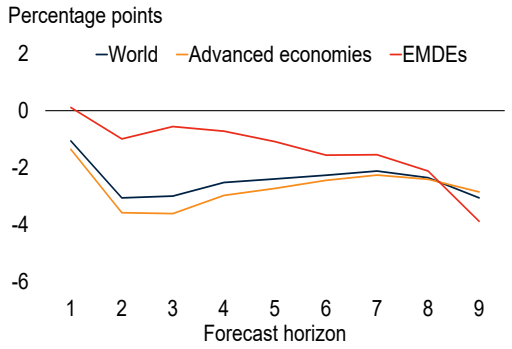
LAC = Latin America and the Caribbean, MNA = Middle East and North Africa, SAR = South Asia, and SSA = Sub-Saharan Africa.

A. B. E. F. GDP-weighted arithmetic averages using potential growth estimate based on production function approach.

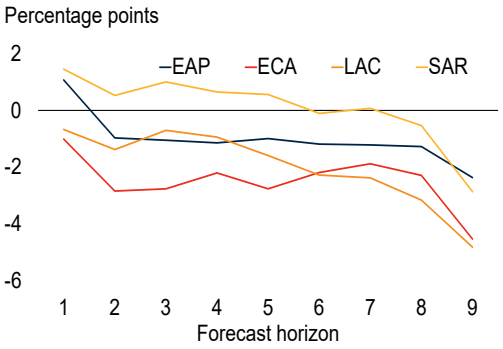
C. D. Number of economies and their share of GDP in the region among 61 EMDEs with potential growth in each region.

Figure 7. Risks to potential growth prospects

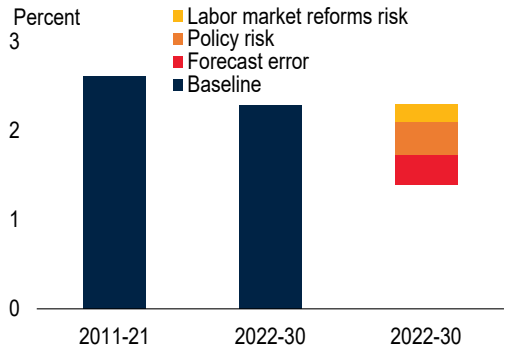
A. Forecast errors in global, advanced economy and EMDE investment growth



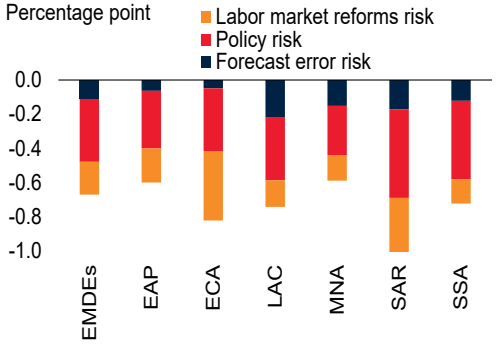
B. Forecast errors in EMDE regional investment growth



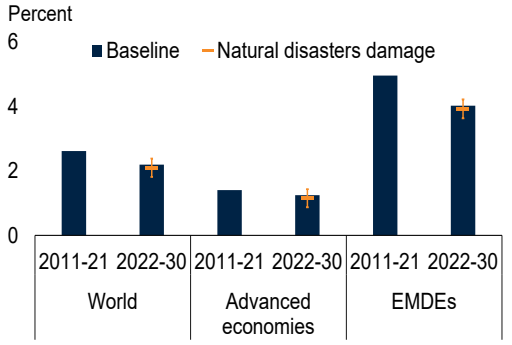
C. Global potential growth, adjusting for risks



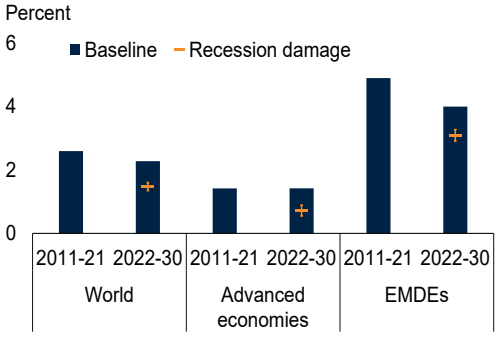
D. Deviation from baseline scenario for EMDE potential growth, adjusting for risks



E. Potential growth with more frequent natural disasters



F. Potential growth after a global recession in 2023



Sources: Consensus Economics, Haver Analytics, World Bank.

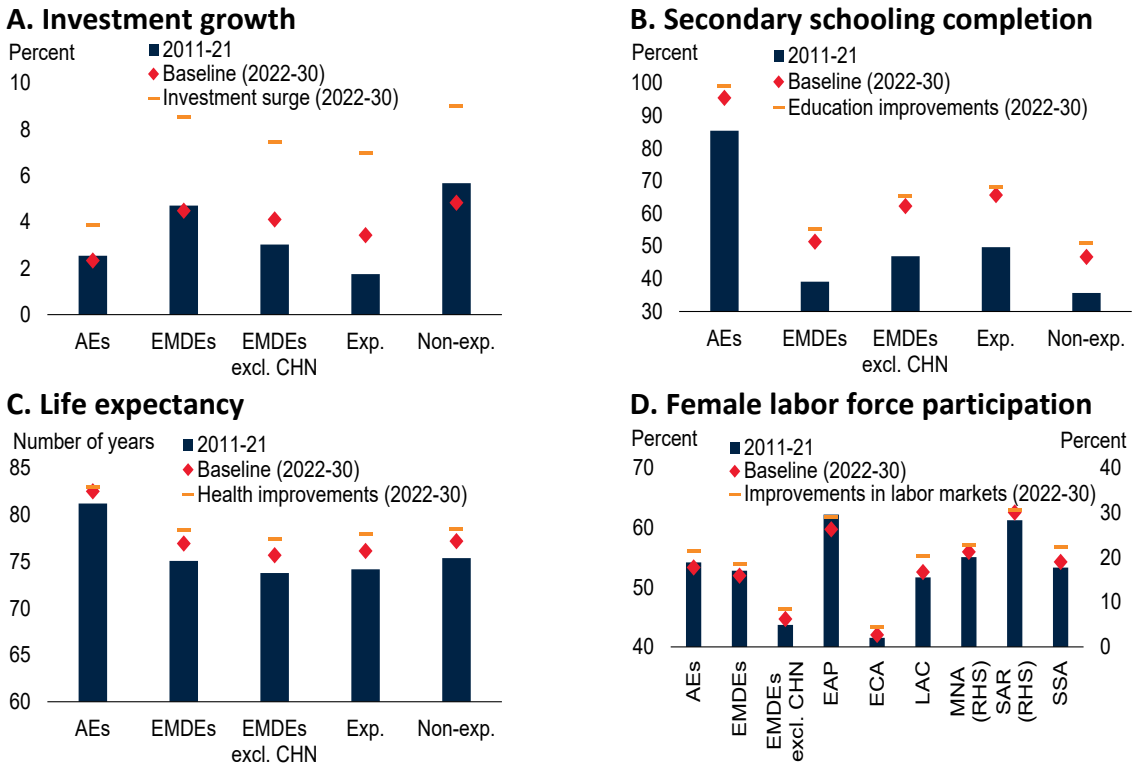
Note: EMDEs = emerging market and developing economies; EAP = East Asia and Pacific, ECA = Europe and Central Asia, LAC = Latin America and the Caribbean, MNA = Middle East and North Africa, SAR = South Asia, and SSA = Sub-Saharan Africa.

A. B. Data for 34 countries, of which 13 EMDEs (3 in EAP [Indonesia, Malaysia, Thailand], 3 in ECA [Hungary, Poland, Romania], 6 in LAC [Argentina, Brazil, Chile, Colombia, Mexico, Peru], India in SAR) since 2000. GDP-weighted averages (at 2010-19 exchange rates and prices). Forecast error is the difference between actual and forecast investment growth; a negative error indicates overoptimism.

C. D. GDP-weighted arithmetic averages. Baseline scenario assumes that investment growth will match consensus forecasts for one- to nine-year-ahead investment growth for 2022-30. Correction for forecast errors assumes that investment growth will fall by the country-specific average historical forecast error over 1-9-year horizons;

correction for policy risk assumes that health and education outcomes will repeat the smallest increase on record over any ten-year period; correction for labor market reforms risk assumes that female labor force participation rate will repeat the smallest increase.
E. Impact of natural disasters assumes that the number of climate disasters in 2022-30 will increase as much as it rose between 2000-10 and 2011-21 for each country, that is, from once every two years to twice every three years, on average.
F. Recession impact based on estimated impact of recessions in Kilic Celik et al. (2023), table 1F.15.
E.F. Orange whiskers display one standard deviation of the impact of climate disasters and recessions, respectively.

Figure 8. Policies to strengthen drivers of potential growth



Sources: Penn World Tables, World Bank.

Note: AEs = advanced economies; CHN = China; EMDEs = emerging market and developing economies; Exp. = commodity exporters; Non-exp. = Commodity importers; EAP = East Asia and Pacific; ECA = Europe and Central Asia; LAC = Latin America and the Caribbean; MNA = Middle East and North Africa; SAR = South Asia; and SSA = Sub-Saharan Africa.

A. Baseline investment growth assumes investment forecasts of Consensus Economics, and investment surge assumes best ten-year improvement record for each country.

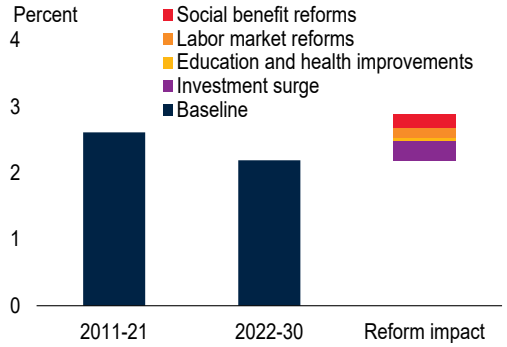
B. Baseline secondary school completion rate assumes the trend improvements in education and education improvements assumes best ten-year improvement record for each country.

C. Baseline life expectancy assumes the trend improvements in education and health improvements assumes best ten-year improvement record for each country.

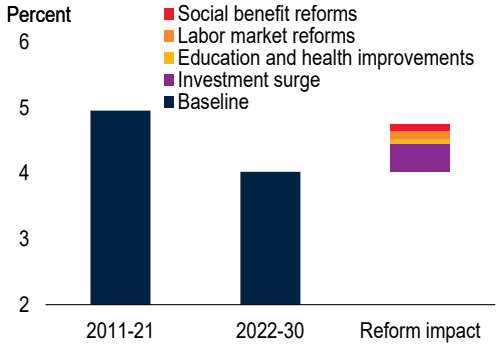
D. Baseline female labor force participation (LFPR) assumes the predicted value of female LFPR based on the trend improvements in determinants of the LFPRs and improvements in labor market assumes best ten-year improvement record in female LFPR for each country.

Figure 9. Effect of policies on potential output growth

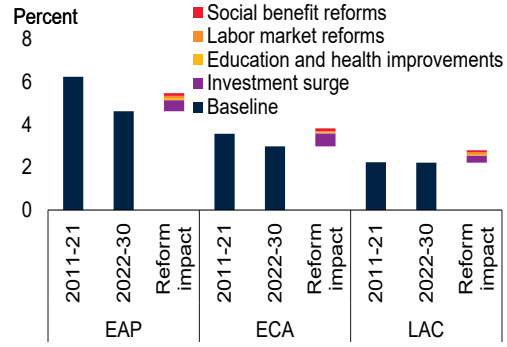
A. Global potential growth in reform scenarios



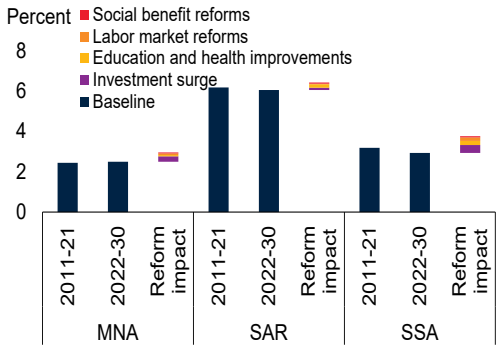
B. EMDE potential growth in reform scenarios



C. EMDE potential growth in reform scenarios



D. EMDE potential growth in reform scenarios



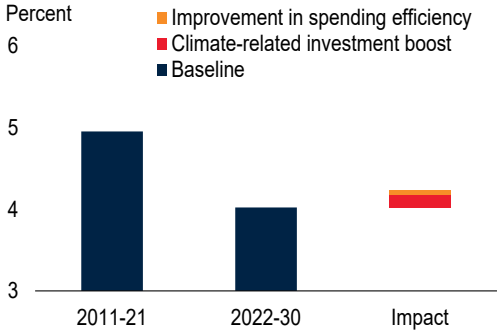
Source: World Bank estimates.

Note: EAP = East Asia and Pacific, ECA = Europe and Central Asia, LAC = Latin America and the Caribbean, MNA = Middle East and North Africa, SAR = South Asia, and SSA = Sub-Saharan Africa.

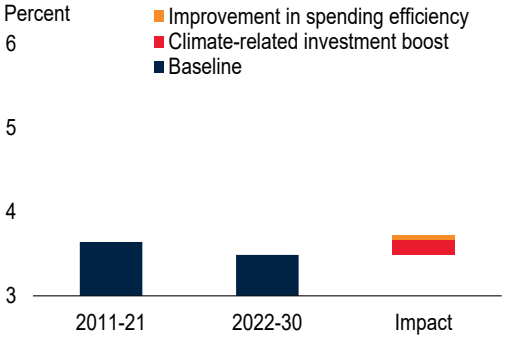
A.-D. GDP-weighted arithmetic averages. Scenarios assume a repeat, in each country, of each country's best ten-year improvement.

Figure 10. Effects of climate-related infrastructure investment on potential growth

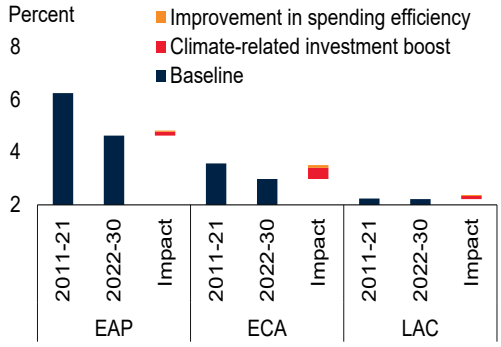
A. EMDEs: potential growth in climate-related infrastructure investment scenarios



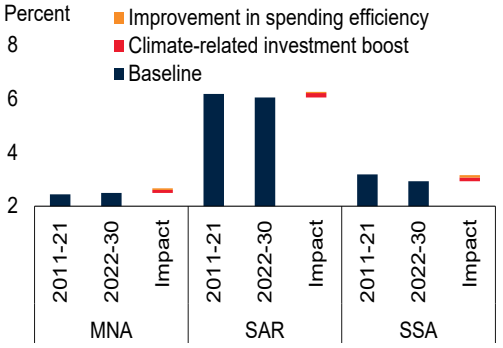
B. EMDE excluding China: potential growth in climate-related infrastructure investment scenarios



C. EMDEs: potential growth in climate-related infrastructure investment scenarios



D. EMDEs: potential growth in climate-related infrastructure investment scenarios



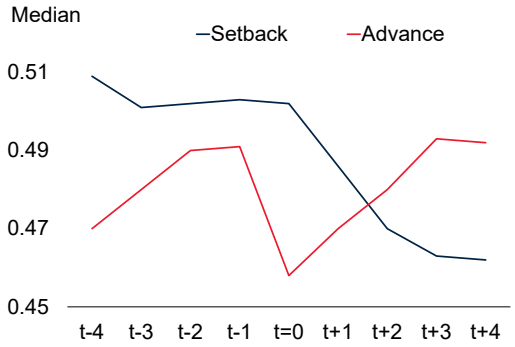
Source: World Bank estimates.

Note: EAP = East Asia and Pacific, ECA = Europe and Central Asia, LAC = Latin America and the Caribbean, MNA = Middle East and North Africa, SAR = South Asia, and SSA = Sub-Saharan Africa.

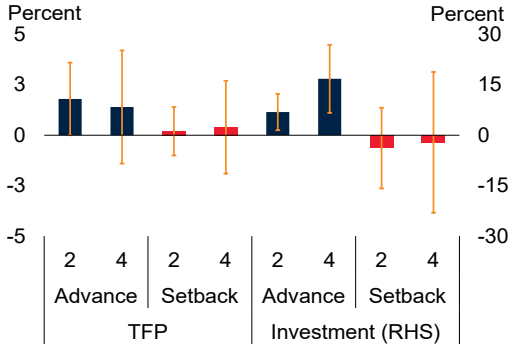
A.-D. GDP-weighted arithmetic averages. Climate-related investment boost assumes an increase in average annual investment between 2011-21 and 2022-30 of 2.3 percentage points of GDP in line with the average of World Bank's Country Climate and Development Reports of 13 countries (Argentina, China, Egypt, Ghana, Iraq, Jordan, Kazakhstan, Morocco, Peru, Philippines, South Africa, Turkiye, and Vietnam) The regional differences are in line with Rozenberg and Fay (2019). Improvement in spending efficiency assumes that each quartile of the spending efficiency moves two quartiles among emerging market and developing economies (EMDEs).

Figure 11. Institutional reforms

A. ICRG indicators around sustained reform advances and setbacks in EMDEs



B. Cumulative change in EMDE investment and TFP two to four years after a sustained change in institutional quality



Sources: Penn World Tables, World Bank.

Note: EMDEs = emerging market and developing economies; TFP = Total factor productivity. Sustained institutional advances or setbacks are defined as an increase or decrease, respectively, in the unweighted average of four ICRG indicators—bureaucracy quality, law and order, corruption, and investment profile—provided the increase is not unwound for at least three consecutive years. A detailed methodology is available in annex 5B.

A. Average of four indicators: bureaucracy quality, law and order, corruption, and investment profile. t=0 indicates the year when a sustained reform advance or setback started.

B. Sample starts in 1985. Chart shows regression coefficients on TFP and investment growth with dummies for the start of sustained reform advances and setbacks from local projection estimation for lags of two and four years. Vertical lines show the 90 percent confidence intervals.

ANNEX A Literature review: Effects of economic reforms on growth

An extensive literature has explored the effects on economic growth of various structural reforms in recent decades. This annex reviews the main findings of the literature on reforms to enhance human capital, increase and improve infrastructure investment, and raise female labor force participation.

Human capital and growth

Conceptual links. In the production function framework, human capital is a factor of production, and human capital accumulation raises output growth directly (Mankiw, Romer, and Weil 1992). But it can also raise output growth indirectly by stimulating technological progress, technology adoption, and knowledge spillovers, and thus raising TFP growth.[21] In both ways, human capital accumulation is a key driver of growth in labor productivity, the key to sustained growth in living standards.[22] The literature is divided on the degree to which human capital can explain cross-country differences in per capita incomes.[23] Two dimensions of human capital accumulation have been studied for their impact on output growth: education and health.

Education and growth: Empirical evidence. A large literature has established that a better educated population is associated with higher incomes or faster income growth. Both school enrollment and the quality of education have been shown to benefit the growth or levels of income, especially when combined with a supporting environment.

Higher school enrollment or educational attainment—especially in primary and secondary education—has been found to be associated with stronger growth.[24] Primary and secondary education appears to be more important for knowledge diffusion, and post-secondary education for innovation and creation of new knowledge (Vandenbussche, Aghion, and Meghir 2006). The growth-enhancing effect of better-quality education is even stronger than that of more schooling as captured in enrollment and attainment rates.[25] For example, measures of acquisition of

[21] The role of education in encouraging technological progress is discussed in Acemoglu and Autor (2012); its role in technology adoption is discussed in Danquah and Amankwah-Amoah (2017), Che and Zhang (2018), and Huffman (2020); and its role in knowledge spillovers is discussed in Kienow and Rodriguez-Clare (2005), Easterly (2005), and Ehrlich and Pei (2020).

[22] See Dieppe (2020), de la Fuente (2011), Flabbi and Gatti (2018), and World Bank (2018c).

[23] Some studies find that only 10-50 percent of cross-country income variation can be explained by human capital accumulation (Caselli 2005; Caselli and Ciccone 2013; Kienow and Rodriguez Clare 1997; Mankiw, Romer, and Weil 1992). Other studies, which differentiate between different types of human capital and skill complementarity, find that the majority of cross-country differences can be attributed to human capital (Hendricks and Schoellman 2017; Jones 2014; Malmberg 2016; Sasso and Rirzen 2016).

[24] See Barro (1991, 1997); Krueger and Lindahl (2001); Mankiw, Romer, and Weil (1992); Sala-i-Martin, Doppelhofer, and Miller (2004); Sianesi and Van Reenen (2003); Topel (1999); and Temple (2001). For the impact of primary and secondary schooling, see Barro and Sala-i-Martin (1995).

[25] See Barro (2001); Bosworth and Collins (2003); Coulombe and Tremblay (2006); Hanushek (2002); Hanushek and Woessmann (2008); and Woessmann (2003a, 2003b).

specific skills or academic achievement, such as test scores, are statistically significantly associated with higher growth.[26] This is especially true for LICs (Hanushek, Ruhose, and Woessmann 2017a, 2017b).

Other factors can slow human capital accumulation or dampen its growth-enhancing effects. These include unsupportive household environments (Hanushek 2002; Woessmann 2003a). It also includes weak institutional environments that can divert highly skilled labor into unproductive activities such as rent-seeking.[27] Similarly, a stagnating economy with limited job creation may struggle to employ productively a better educated workforce and thus fail to reap the full gains in terms of growth (World Bank 2018c). Some studies find evidence of self-reinforcing feedback loops from higher growth to higher investment in human capital.[28]

Health, nutrition, and growth: Empirical evidence. Both at the individual worker level and at the country level, improved health has been found to be associated with greater productivity and higher incomes. Early childhood interventions appear to be particularly beneficial (Grantham-McGregor et al. 2007). For children, better nutrition has been associated with better educational performance and, once they enter the labor market, higher incomes.[29] As with education, there appear to be positive feedback loops as higher incomes allow more investment into healthcare and related infrastructure (Weil 2014).

Infrastructure and growth

Conceptual links. Like human capital accumulation, infrastructure investment can raise output growth both directly through growth of the capital stock, which is a factor of production, and indirectly through its collateral benefits for TFP growth. Good infrastructure investment can encourage innovation and knowledge diffusion, enhance human capital and TFP, and thus lower production costs, improve a country's international competitiveness, and facilitate trade (Agenor 2013; Demetriades and Mamuneas 2000). For example, better transportation networks can reduce the cost of, and time taken in, new construction and the installation of new equipment (Turnovsky 1996), while improved access to electricity and better sanitation can help to raise educational attainment and public health standards (Agenor 2011; Getachew 2010). The growth-enhancing effects of infrastructure investment depend on its quality and, for some types of infrastructure investment, the interconnectedness of networks and freedom from congestion.[30]

Infrastructure investment and growth: Empirical evidence. Studies of the effects of infrastructure investment spending typically find that it raises output, but only modestly and without accompanying productivity increases (Straub and Terada-Hagiwara 2010).[31] These mixed results

[26] See Hanushek and Kimko (2000) and Hanushek and Woessmann (2015a, 2015b, 2016).

[27] See Easterly (2001); Pritchett (2001); and Murphy, Shleifer, and Vishny (1991).

[28] See Bils and Klenow (2000), Pritchett (2001, 2006), and Weil (2014).

[29] See Galasso et al. (2017), Luo et al. (2012), and Taras (2005).

[30] See Hulten (1994), OECD (2007), and Sanchez-Robles (1998).

[31] Surveys of the literature include Pereira and Andraz (2013), Bom and Ligthart (2014), and Romp and de Haan

have been attributed to uncaptured spillovers, weak institutions, corruption, and inadequate public spending management that impairs the overall efficiency of public investment management.[32] However, studies using physical measures of infrastructure investment have found that it has been associated with significantly higher output.[33] Access to specific infrastructure services, such as electricity, better roads, or telephones, has also been associated with higher growth or higher income.[34]

Female labor force participation and growth

Empirical evidence. Greater female labor force participation raises labor supply and thus output. However, women often face restrictions in freely pursuing occupations or engaging in economic transactions, or face gaps in education or healthcare (Gonzalez et al. 2015; World Bank 2012). To the extent that this holds them back from realizing their most productive employment, it weighs on output. Increased female labor force participation may also generate long-lasting effects by improving education outcomes of children or encouraging other women to enter the labor market (Duflo 2012; Fogli and Veldkamp 2011).

Reinforcing interactions between reforms

Interactions between reforms in multiple areas tend to strengthen their growth dividends. Infrastructure investment in safe water, sanitation, electricity, and transportation improves population health, increases school attendance, and improves learning outcomes (Agénor 2010). Healthier students perform better in school and are more likely to attend, while healthier populations are associated with better-qualified staff in the education sector (Behrman 2010). In turn, better education of mothers improves infant health and prospects (Fuchs, Pamuk, and Lutz

(2007). IMF (2014) finds long-term output elasticities of infrastructure investment in excess of 1. In contrast, more recent studies find that infrastructure investment either does not significantly raise output or growth, or raises output by less than its cost (Ganelli and Tervala 2016).

[32] In a meta-analysis of 68 studies over 1983-2008, Bom and Ligthart (2014) find that output elasticities of public capital at the regional level are considerably less than those of public capital at the central government level, suggesting that cross-regional spillovers are not taken into account. IMF (2015b) argues that countries with stronger public investment management institutions have more predictable, credible, efficient, and productive investments, and that strengthening these institutions could close up to two-thirds of the public investment efficiency gap. IMF (2018) argue that better public sector asset management is associated with higher revenues, greater effectiveness and returns on assets, and lower risk. Pritchett (2000) casts doubt on the robustness of econometric estimates of output elasticities.

[33] Canning (1999); Calderon and Serven (2003); and Calderon, Moral-Benito and Serven (2015) find output gains from electricity generation capacity, transportation networks, and telephone networks. Easterly (2001) finds an association between telephone lines and growth. Fernald (1999) shows that road infrastructure investment raised U.S. productivity. Roller and Waverman (2001) find a positive link between telecommunications networks and growth.

[34] For access to electricity, see Khandker et al. (2012), Kumar and Rauniyar (2011), and Rud (2012). For access to better roads, see Datta (2012), Hu and Liu (2010), and Queiroz and Gautam (1992). For access to telephones, see Canning and Pedroni (2008).

2010). Higher educational attainment is associated with greater labor force participation (Eckstein and Lifshitz 2011; Steinberg and Nakane 2012). Infrastructure investment in electricity, clean water, and sanitation also facilitates female labor force participation by freeing women's time for gainful employment (Ghani, Kerr, and O'Connell 2013; Norando 2010). Better governance is also associated with better education (Gerged and Elheddad 2020) and greater and better-quality infrastructure investment (Aghion et al. 2016; Chen, Liu, and Lee 2020; d'Agostino, Dunne, and Pieroni 2016).[35]

ANNEX B Methodology: Institutional reform impact

The local projection estimation of changes in potential TFP growth and investment after reform episodes draws on an event study of reform episodes (World Bank 2021c). The identification of institutional reform events is based on the duration of changes in ICRG indicator. After a positive change (for reform advances) or negative change (for reform setbacks) is identified, it is considered an event if no changes in the opposite direction are found within three years of the beginning of changes. The initial years are then chosen as event years. If the initial year of the next episode in the same direction is within five years, the next one is merged with the previous episode. If an episode is ongoing, that episode is used in the analysis, regardless of its length.

Reform events are defined as sustained increases in the average of four indicators of institutional quality produced by the International Country Risk Guide (ICRG)—bureaucracy quality, rule of law, corruption, and investment profile. This yields 106 episodes of sustained reform advances and 85 episodes of sustained reform setbacks in 100 EMDEs during 2004-19.

A local projection estimation as in Jorda (2005) using the bias correction specification of Teulings and Zubanov (2014) is estimated to identify the effects of reform events on TFP and real investment growth over time. The main advantages of local projection estimations include their simplicity of estimation, robustness to model misspecifications, ease of inference, and flexibility to incorporate highly nonlinear specifications and interactions of various regressors. In impulse responses, the model estimates the effect of reform events in country i in year t (the dummy variable $shock_{it}$) on cumulative growth in TFP or real investment over a horizon h:

$$y_{i,t+h} - y_{i,t} = \alpha^h + \beta^h shock_{i,t} + \sum_j^2 \theta_{1,j}^h shock_{i,t-j}$$
$$+ \sum_j^{h-1} \theta_{2,j}^h shock_{i,t+h-j} + \sum_j^2 \theta_{3,j}^h dy_{i,t-j}$$
$$+ \theta_{4,i}^h X_i + \mu_i^h + \tau_t^h + \epsilon_{i,t} \quad ,$$

where y_{it} refers to the log level of TFP (or real investment) in county i in year t, dy_{it} to its annual growth rate, and m_i^h and t_i^h to country and year fixed effects. Additional controls X_i include a

[35] See Hulten (1994), OECD (2007), and Sanchez-Robles (1998).

dummy indicating whether a country is a commodity exporter, dummies for financial crises occurring during the period h and the log level of real GDP per capita a t. Since $y_{i,t+h}—y_{i,t}$ is cumulative growth in either TFP or real investment over horizon h, the coefficient β_h represents an estimate of the cumulative response of growth in TFP (or real investment) by time $t + h$ to the reform advance (setback) that happened at time t.

The results are robust to using non-overlapping episodes. That said, like any regression, the possibility remains that the events selected here coincided with other favorable or adverse developments that spurred or slowed growth and the methodology cannot disentangle these two forces.

TABLE 1. Sample and region coverage

Advanced Economies	Emerging Market and Developing Economies	
Austria	East Asia and Pacific	Middle East and North Africa
Belgium	China	Bahrain
Canada	Indonesia	Egypt, Arab Rep.
Cyprus	Philippines	Iran, Islamic Rep.
Czech Republic	Thailand	Jordan
Denmark	Europe and Central Asia	Kuwait
Estonia	Bulgaria	Saudi Arabia
Finland	Croatia	Tunisia
France	Hungary	South Asia
Germany	Kazakhstan	India
Greece	Moldova	Sub-Saharan Africa
Hong Kong SAR, China	Poland	Benin
Iceland	Russia	Botswana
Ireland	Türkiye	Cameroon
Israel	Ukraine	Côte d'Ivoire
Italy	Latin America and the Caribbean	Kenya
Japan	Argentina	Lesotho
Korea, Rep.	Barbados	Mauritius
Latvia	Brazil	Mozambique
Luxembourg	Chile	Niger
Netherlands	Colombia	Rwanda
Norway	Costa Rica	Senegal
Portugal	Ecuador	South Africa
Slovak Republic	Guatemala	Swaziland
Slovenia	Honduras	
Spain	Jamaica	
Sweden	Mexico	
Switzerland	Panama	
United Kingdom	Paraguay	
United States	Peru	
	Uruguay	

Source: World Bank.

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