

<http://www.worldbank.org/globalproductivity>

Global Productivity

Trends, Drivers, and Policies

Edited by Alistair Dieppe



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Why this book on productivity?

- 1 Comprehensive assessment of productivity.** Trends, Drivers, Convergence, Disasters, Structural Transformation, and Employment Displacement.
- 2 EMDE emphasis.** First with overarching global and in-depth view of productivity in EMDEs, including extensive regional analysis.
- 3 Analysis of the implications of COVID-19.** Examines critical role of human capital accumulation, investment, global integration, and past disasters.
- 4 Multiple approaches.** Synthesizes findings from macroeconomic, sectoral, and firm-level data on productivity and uses state-of-the-art empirical methodologies.

Aggregate and Sectoral Databases available on the web:

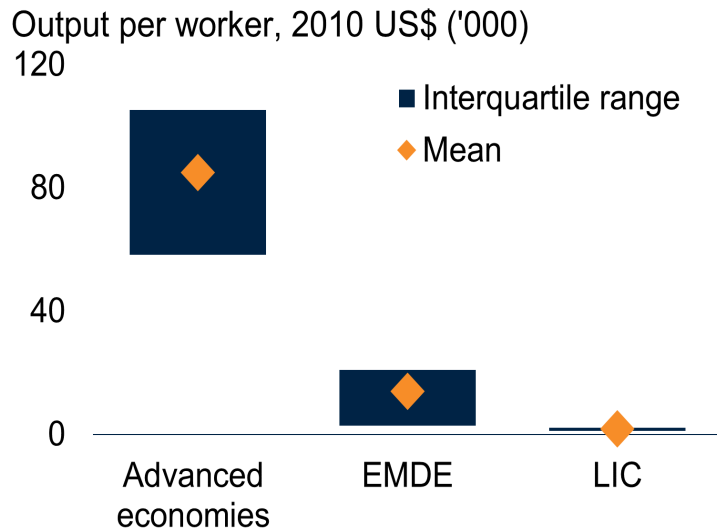
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* EMDEs = *Emerging Market and Developing Economies*

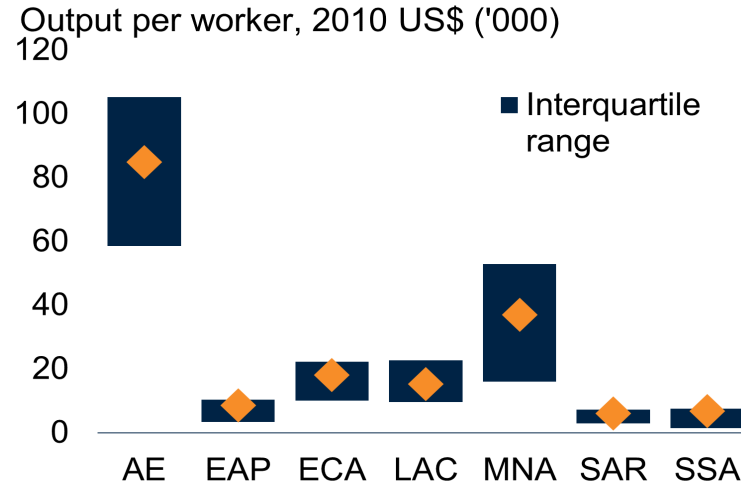
Implications of productivity

Income convergence, poverty reduction

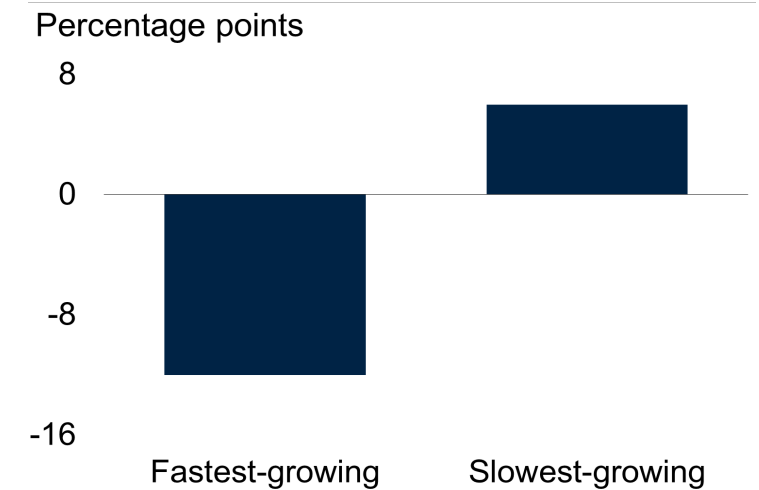
Labor productivity by country group, 2010-18 average



Labor productivity levels by EMDE region, 2010-18 average



Decade change in the poverty rate in EMDEs, by productivity growth



Source: Penn World Table; The Conference Board; World Bank (PovcalNet, World Development Indicators).

Note: Productivity defined as output per worker in U.S. dollars (at 2010 prices and exchange rates).

Left: Based on 35 advanced economies and 126 EMDEs, of which 27 are LICs.

Middle: Sample of 35 advanced economies and 126 EMDEs, of which 27 are LICs.

Right: The sample is balanced over 1980-2017 includes 29 advanced economies (AEs), 54 emerging market and developing economies (EMDEs) including LICs, and 6 low-income countries (as of 2019 World Bank classifications), 36 EMDE commodity exporters, and 18 EMDE commodity importers. Productivity is defined as output per worker in U.S. dollars (at 2010 prices and exchange rates).

Unweighted averages using annual data during 1981-2015. Fastest-growing EMDEs are those in the top quartile by productivity growth; slowest-growing EMDEs are those in the bottom quartile of labor productivity growth. Poverty rate defined as the share of the population living on less than \$1.90 a day (2011 PPP).

Four questions

- 1 How has productivity evolved?** Broad-based post-crisis decline in labor productivity growth. *Driven by subdued investment and slowing total factor productivity growth.*
- 2 What have been its drivers?** Drivers of EMDE productivity growth are slowing. *Sectoral reallocation weakening.*
- 3 What are the prospects for productivity in light of COVID-19?** An increasing number of adverse productivity shocks. *The COVID-19 pandemic will compound the slowdown.*
- 4 What are the policy implications?** No silver bullet. *Need to be comprehensive.*

* *EMDEs = Emerging Market and Developing Economies*

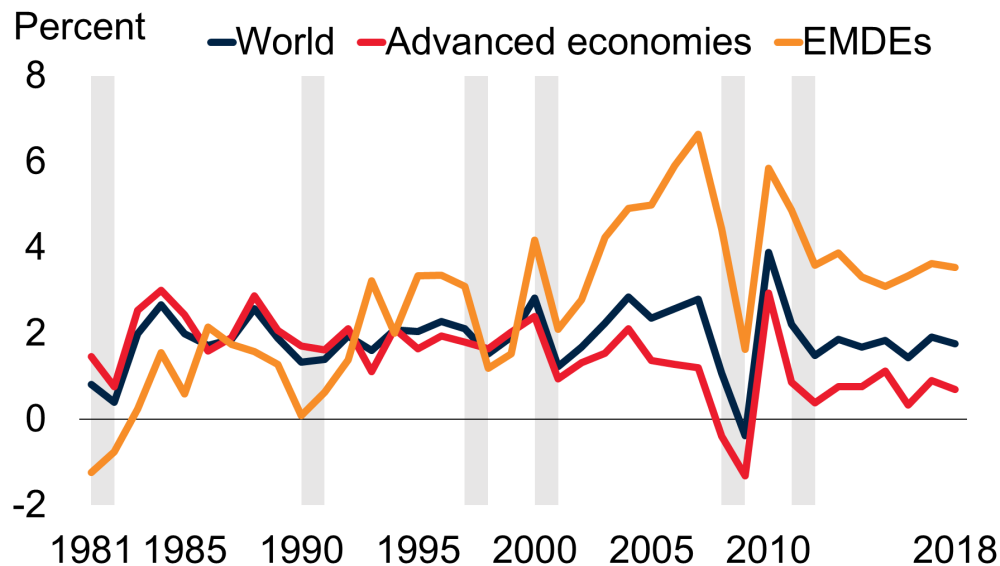
Four questions

- 1 How has productivity evolved?** Broad-based post-crisis decline in labor productivity growth. *Driven by subdued investment and slowing total factor productivity growth.*

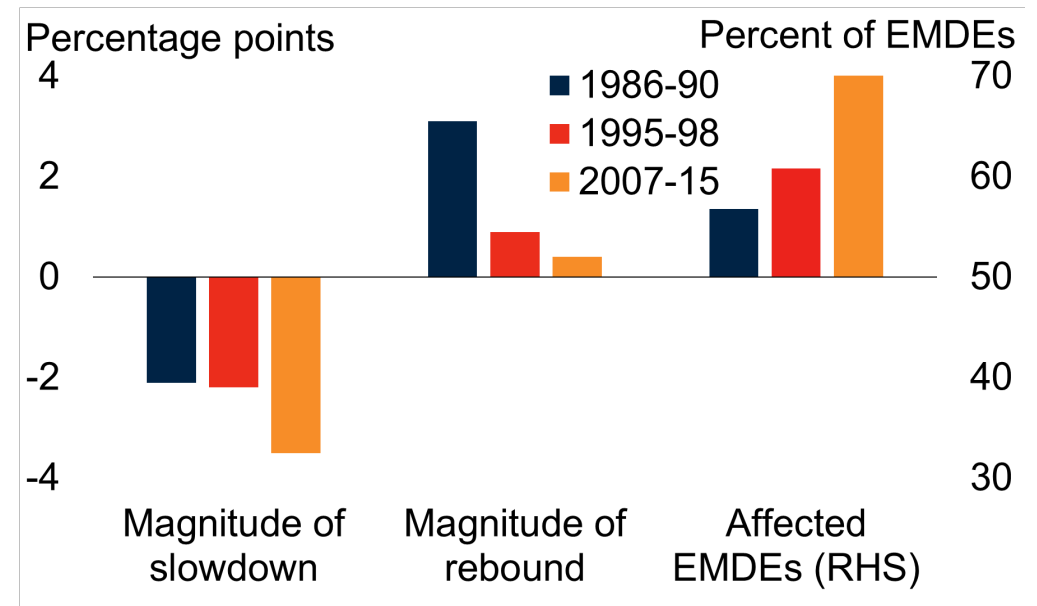
Evolution of productivity

Slowdown long preceded COVID-19 pandemic

Global, advanced-economy, and EMDE productivity growth



Magnitude and extent of multi-year productivity slowdowns and recoveries



Source: Penn World Table; The Conference Board; World Bank (PovcalNet, World Development Indicators).

Note: The sample is balanced over 1980-2017 includes 29 advanced economies (AEs), 54 emerging market and developing economies (EMDEs) including LICs, and 6 low-income countries (as of 2019 World Bank classifications), 36 EMDE commodity exporters, and 18 EMDE commodity importers. Productivity is defined as output per worker in U.S. dollars (at 2010 prices and exchange rates).

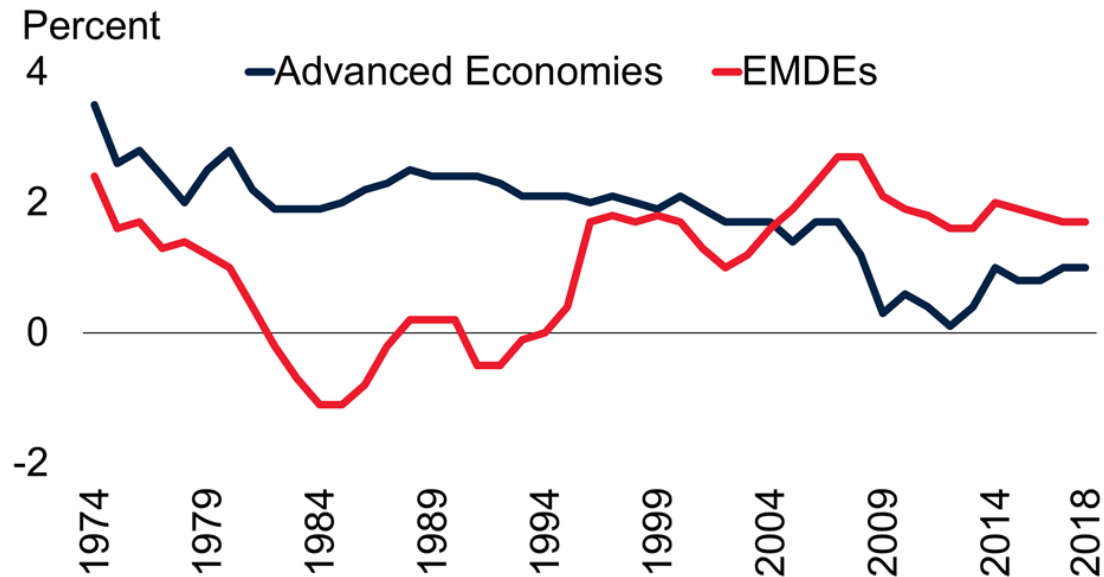
Left: GDP weighted averages (at 2010 prices and exchange rates). Shaded regions indicate global recessions and slowdowns (1982, 1991, 1998, 2001, 2009, and 2012), as defined in Kose and Terrones (2015) and Kose, Sugawara, and Terrones (2020).

Right: GDP-weighted at constant 2010 prices and exchange rates. "Magnitude of slowdown" is the cumulative decline in EMDE productivity growth from the peak of the episode to the trough for episodes lasting more than two years. "Magnitude of rebound" is the cumulative increase in EMDE productivity growth from the trough (end) of the episode to three years later. "Affected EMDEs" is the share of EMDEs that experienced a slowdown.

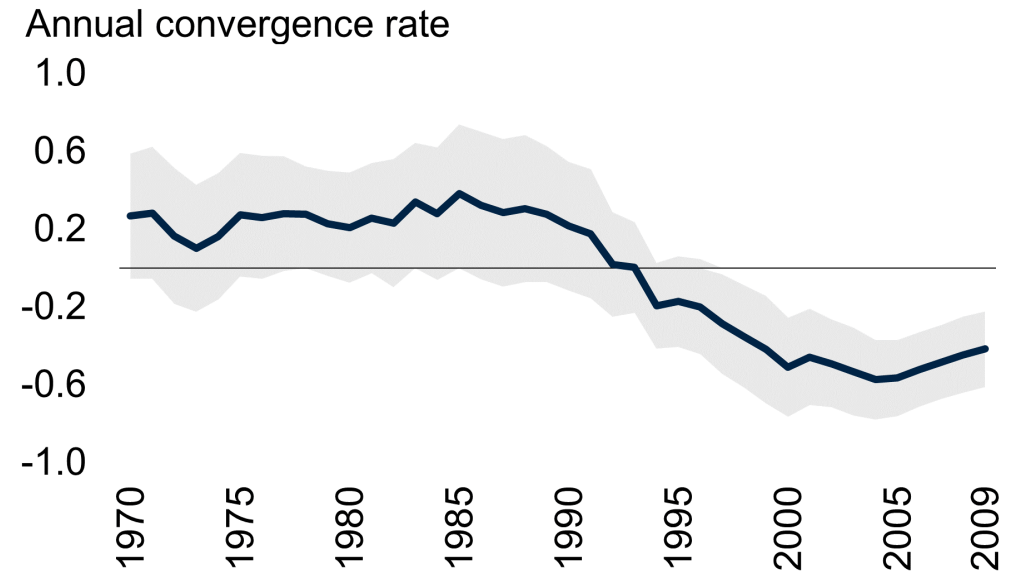
Productivity convergence in EMDEs

slowly converging

Labor productivity growth (5-year moving average)



Unconditional convergence rate



Source: Penn World Table; The Conference Board; World Bank, World Development Indicators.

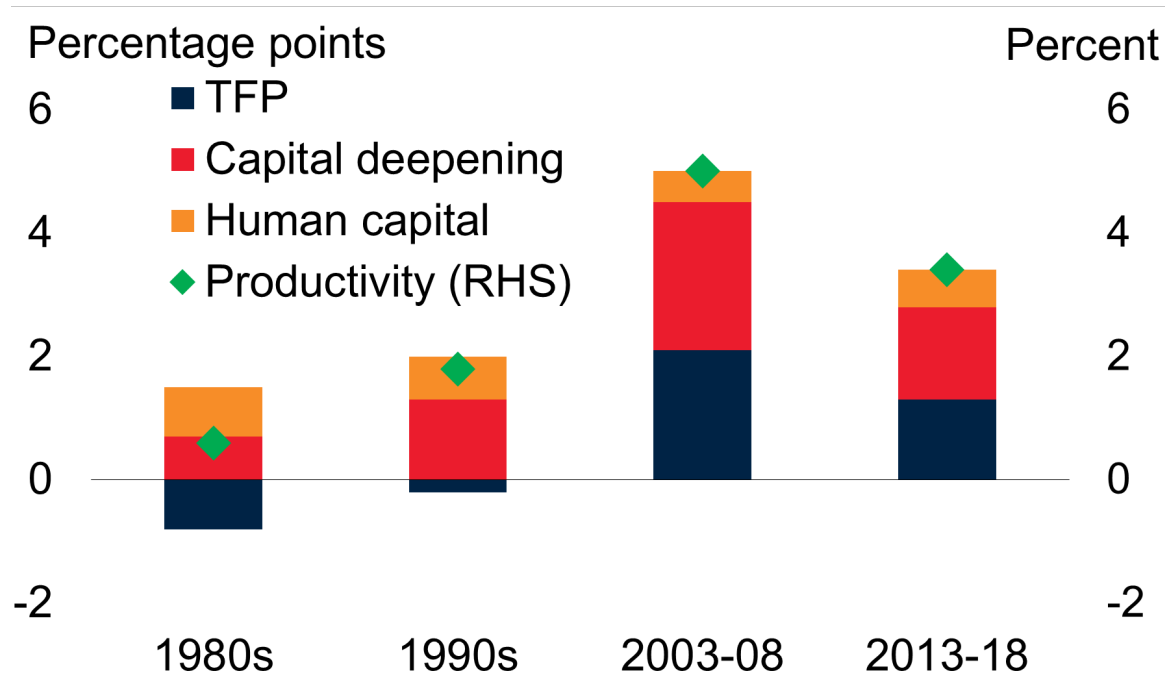
Left: Based on a sample of 35 advanced economies and 123 EMDEs for a consistent sample since 1990, and 29 advanced economies and 74 EMDEs for a consistent sample since 1970.

Right: Based on a sample of 29 advanced economies and 74 EMDEs for a consistent sample since 1970. Share of EMDEs with average productivity growth above average advanced-economy productivity growth in each decade.

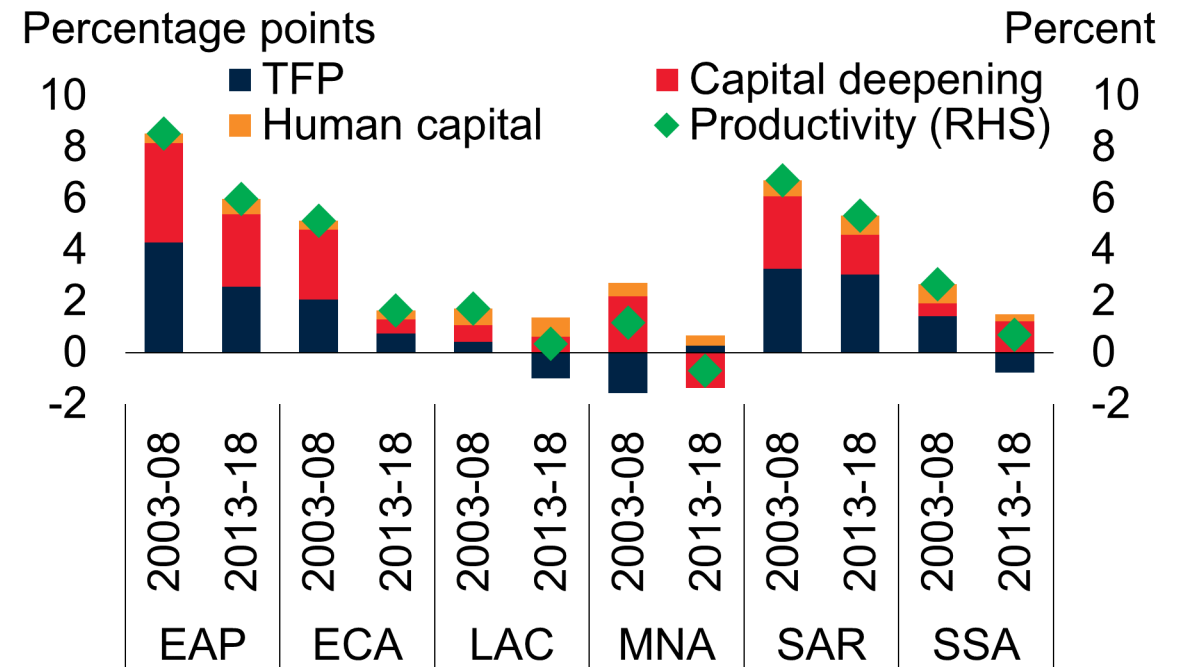
Broad based Productivity slowdown

Driven by both weaker TFP and capital deepening

Contributions to productivity growth in EMDEs



Contributions to regional productivity growth



Source: International Monetary Fund; Penn World Table; The Conference Board; World Bank, World Development Indicators.

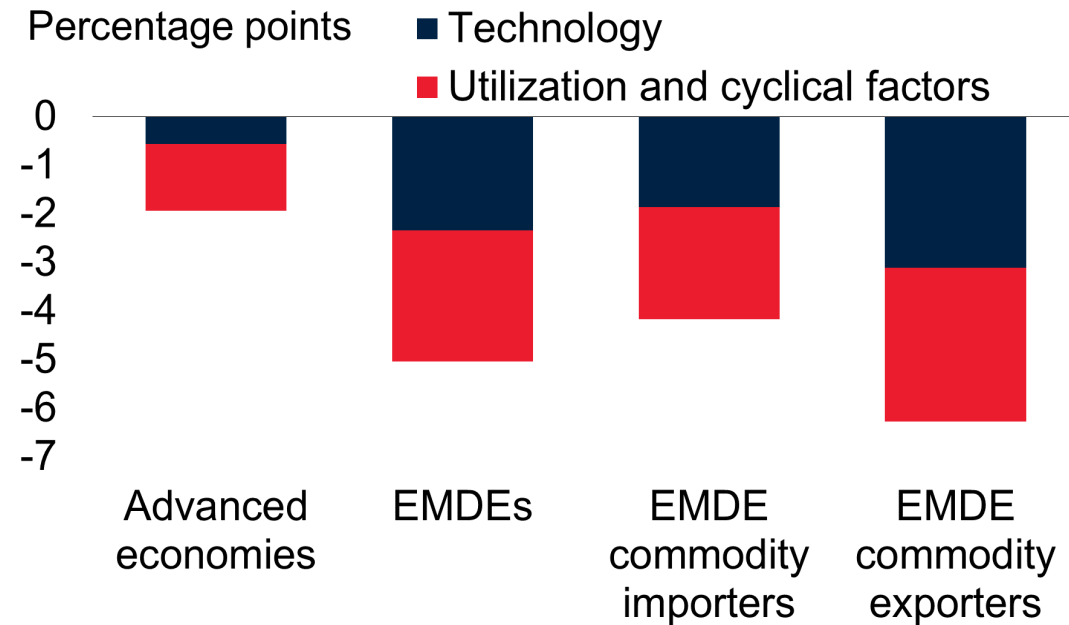
Note: Productivity refers to output per worker at 2010 prices and exchange rates. Sample includes 35 advanced economies (AE) and 16 EMDEs in East Asia and the Pacific (EAP), 21 EMDEs in Eastern Europe and Central Asia (ECA), 25 EMDEs in Latin America and the Caribbean (LAC), 14 EMDEs in Middle East and North Africa (MNA), 7 EMDEs in South Asia (SAR), and 44 EMDEs in Sub-Saharan Africa (SSA).

Left: and Right Aggregates calculated using GDP weights at 2010 prices and exchange rates. The sample includes 92 emerging market and developing economies (EMDEs), including 8 East Asia and Pacific, 21 Europe and Central Asia, 19 Latin America and the Caribbean, 12 Middle East and North Africa, 2 South Asia, and 30 Sub-Saharan Africa economies.

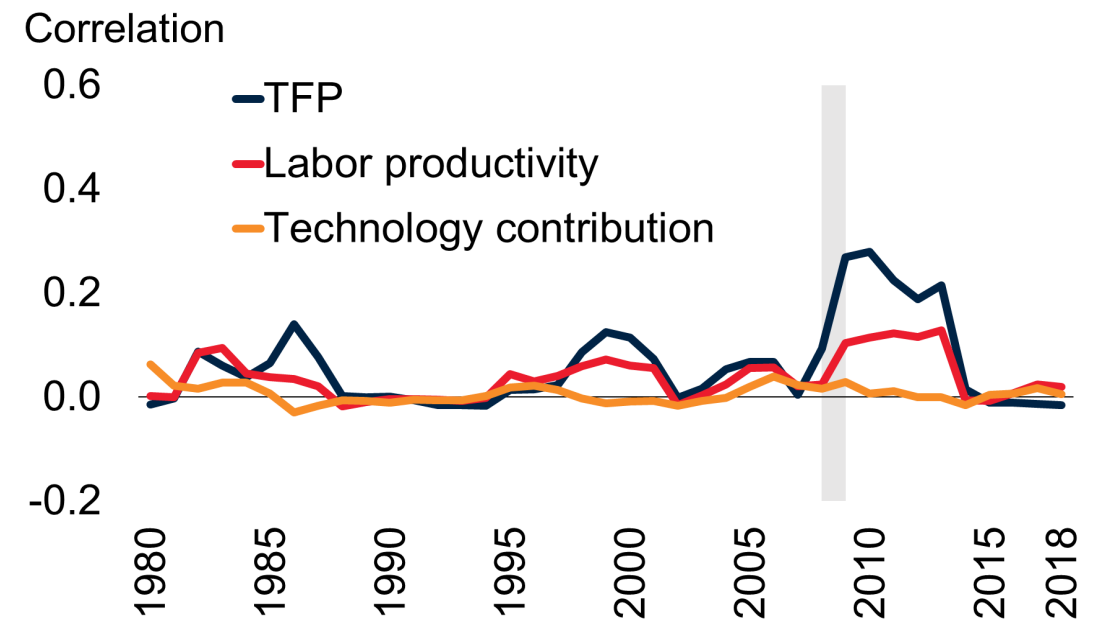
Drivers of post-crisis productivity growth slowdown

Strong cyclical component

Labor productivity growth change 2007-09: Advanced economies and EMDEs



Average 5-year rolling correlation: EMDEs



Source: Penn World Table; The Conference Board; World Bank, World Development Indicators.

Note: Productivity is defined as output per worker. Data is from a balanced sample between 1981-2018 and includes 29 advanced economies (AEs), and 74 emerging market and developing economies (EMDEs) including 11 low-income countries (LICs), as of 2019 World Bank classifications, 52 commodity exporters and 22 commodity importers. Note:

EMDEs = emerging market and developing economies, LICs = low income countries

Left: The “technology” contribution to labor productivity growth consists of the contribution of the Spectral SVAR-identified technology shock, identifying long-term drivers of productivity growth (Chapters 1 and 3). Utilization and cyclical factor contributions are defined as the residual of the contribution of “technology” and labor productivity growth. Chart shows the contributions to labor productivity slowdown during 2007-09.

Right: 5-year rolling correlations. Simple average across all bilateral pairs of economies for each measure of productivity. The “technology” measure is the contribution of “technology” drivers to productivity growth. This measure removes cyclical components that are present in labor productivity and TFP growth.



Four questions

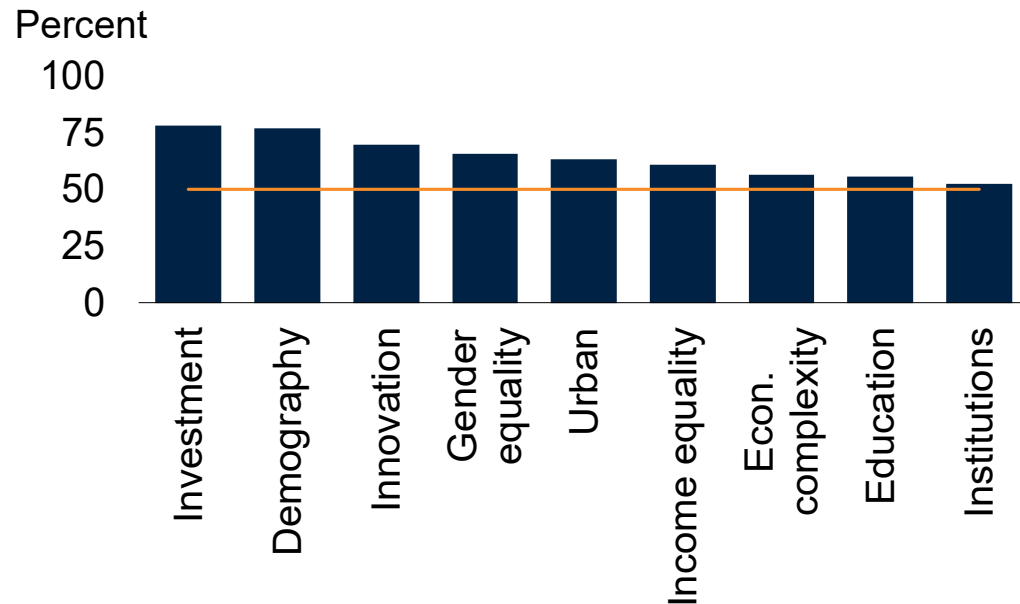
2

What have been its drivers? Drivers of EMDE productivity growth are slowing. *Sectoral reallocation weakening.*

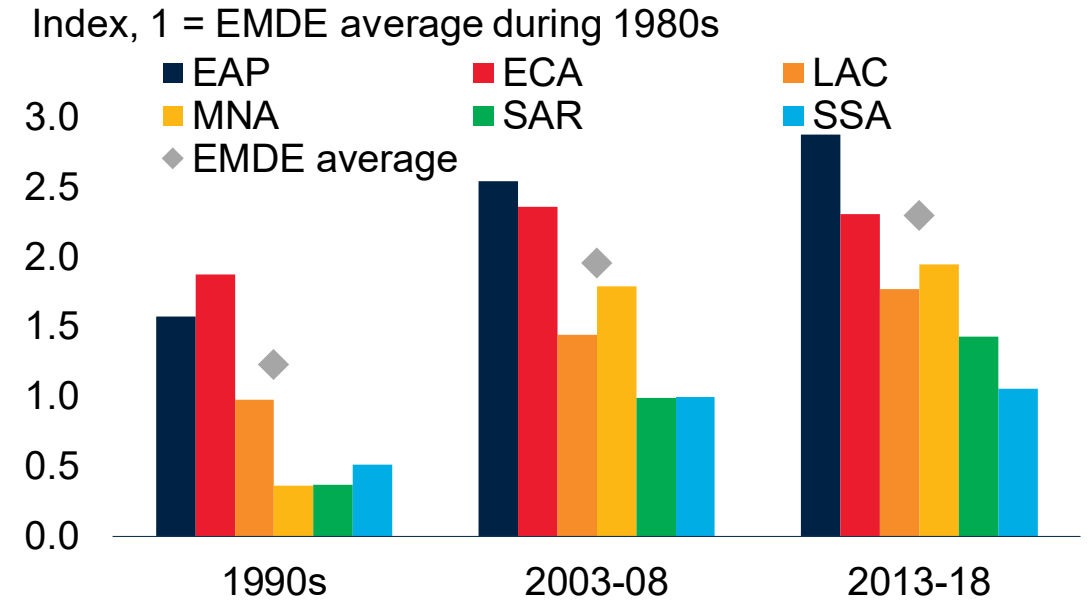
Drivers of post-crisis labor productivity growth

Weakening fundamentals

Share of EMDEs with a slowdown in productivity drivers in 2008-18 relative to 1998-2007



Index of productivity drivers



LHS: Share of economies where improvements in each driver of productivity during 2008-2018 was lower than those in the pre-crisis period 1998-2007. Variables corresponding to each concept are (sample in parentheses): Institutions (75)= WGI Government Effectiveness Index, Innovation (27)=patents per capita, Investment (69)=investment to GDP ratio, Income equality (73) =(-1) *Gini coefficient, Urbanization (75) = Urban population (% total), ECI (56) defined as Economic Complexity Index of Hidalgo and Hausmann (2009), Education (52) = years of schooling, Demography (75) = share of working-age population, Price stability excluded due to demand-side influences on inflation following the global financial crisis.

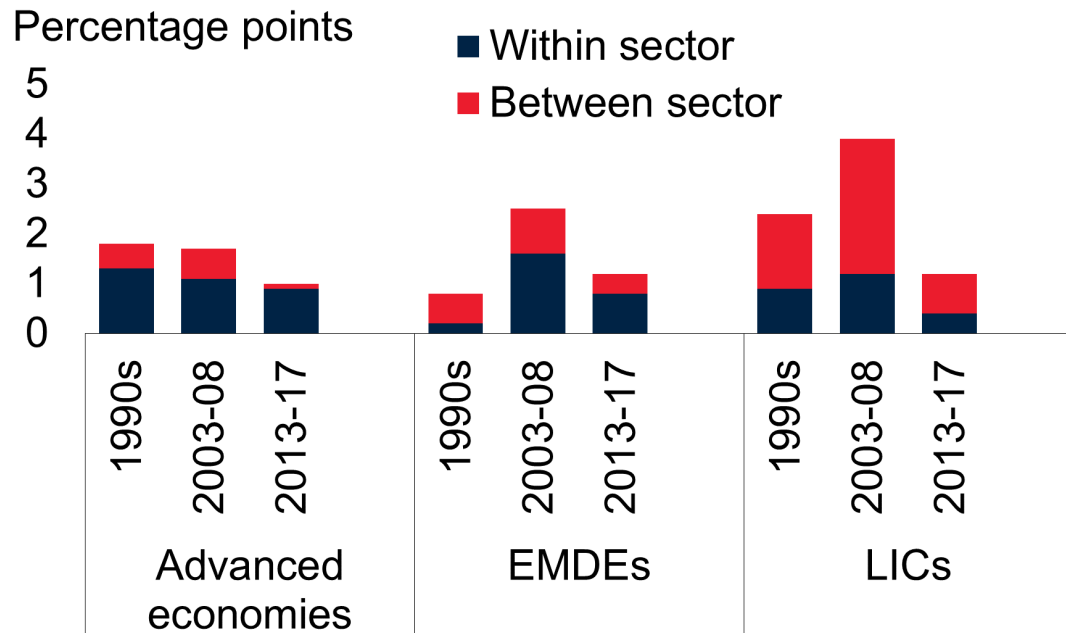
Source: World Bank.

RHS: Index of drivers created by weighting normalized levels of each potential driver by its estimated impact on productivity growth (Book Figure 2.9; Annex 2.2). Drivers include the ICRG rule of law index, patents per capita, non-tropical share of land area, investment as percent of GDP, ratio of female average years of education to male average years, share of population in urban area, economic complexity index of Hidalgo and Hausmann (2009), years of schooling, working-age share of population, and inflation. Regional and EMDE indexes are GDP-weighted averages for single years and simple averages for time periods.

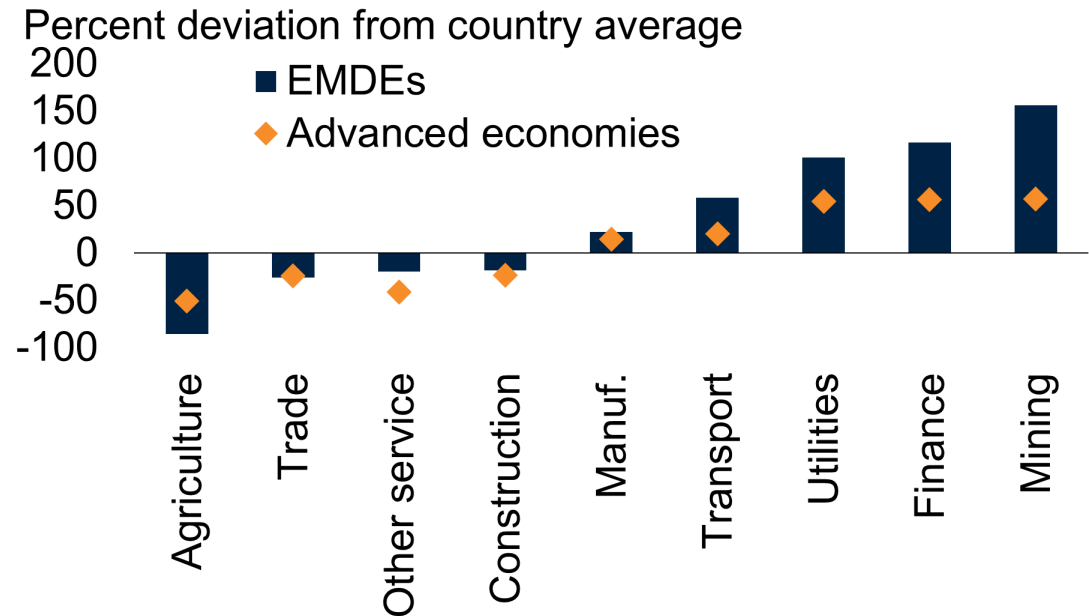
Drivers of post-crisis productivity growth slowdown

Slowing within- and between-sector productivity gains

Within and between sector contributions to productivity growth



Average productivity gap 2017: AEs and EMDEs



Source: Source: Kose and Terrones (2015); Penn World Table; PovcalNet; The Conference Board; World Bank, World Development Indicators.

Note: The sample is balanced over 1980-2017 includes 29 advanced economies (AEs), 54 emerging market and developing economies (EMDEs) including LICs, and 6 low-income countries (as of 2019 World Bank classifications), 36 EMDE commodity exporters, and 18 EMDE commodity importers. Notes: Productivity is defined as output per worker in U.S. dollars (at 2010 prices and exchange rates).

Left: Based on samples of 54 countries during 1975-1995, 94 countries during 1995-1999, and 103 countries during 2003-2017.

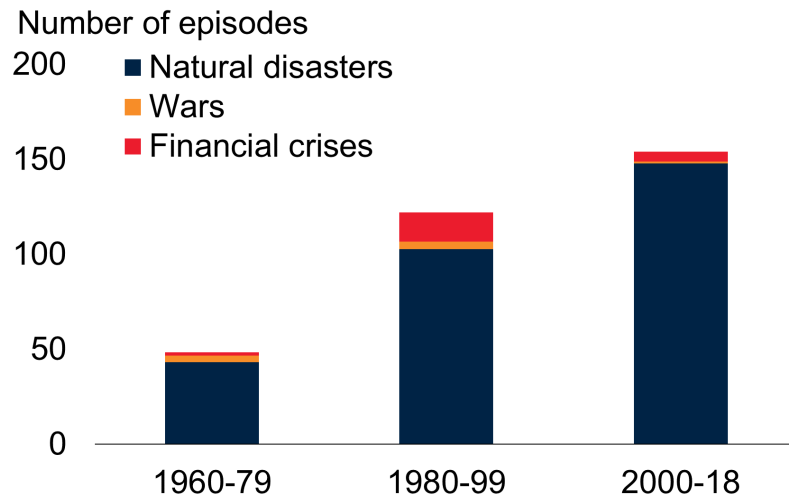
Right: Average labor productivity is value-added per worker in 2017. "Finance" includes business services; "Other services" includes government and personal services.

Four questions

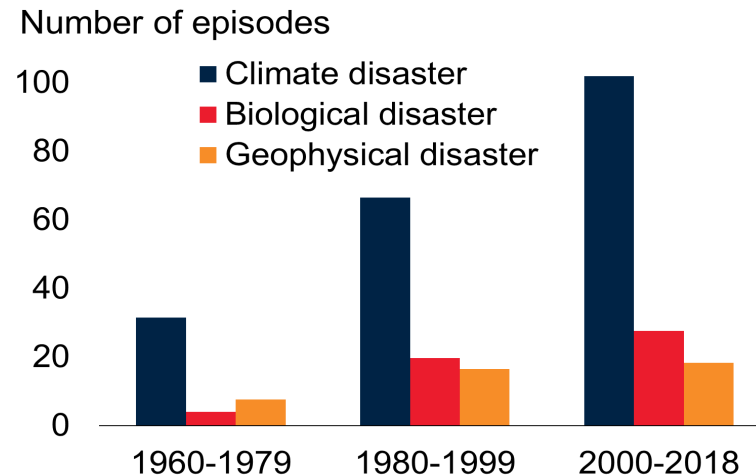
- 3 **What are the prospects for productivity in light of COVID-19? An increasing number of adverse productivity shocks. *The COVID-19 pandemic will compound the slowdown.***

Frequent disasters *increasing*

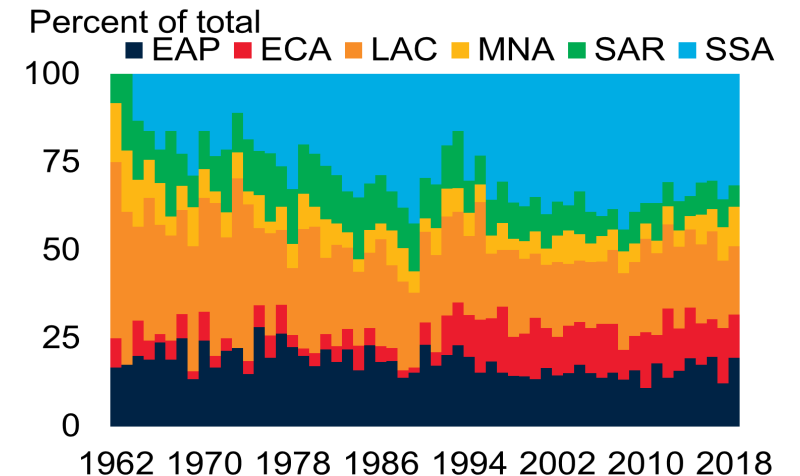
Average number of episodes per year



Average number of natural disaster episodes per year, by type



Share of natural disasters, by region



Source: Correlates of War (COW); EM-DAT; Laeven and Valencia (2018); Peace Research Institute Oslo (PRIO); World Bank.

Note: Natural disasters include climate, biological, and geophysical disasters (EM-DAT). Wars include intra-state and external (extra-state and inter-state) wars (COW and PRIO). Financial crises include banking crisis, currency crisis, and sovereign debt crisis (Laeven and Valencia 2018). Definitions are in **Annex 2.1**. An episode dummy for a specific type of event is 1 if the event occurs at least once (≥ 1) in a country-year pair and 0 otherwise. The sample includes 170 countries, 35 AEs, 135 EMDEs, and 27 LICs.

Left: Average number of episodes per year for each type of adverse event

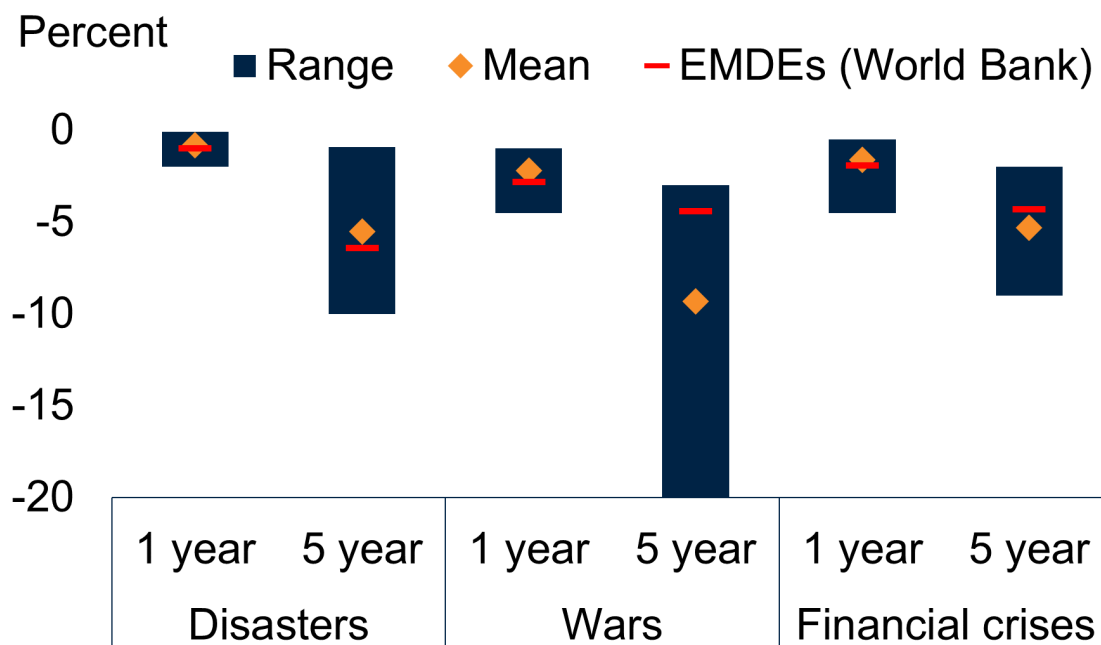
Middle: Average number of natural disaster episodes per year by type of disaster.

Right: 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, SSA = Sub-Saharan Africa.

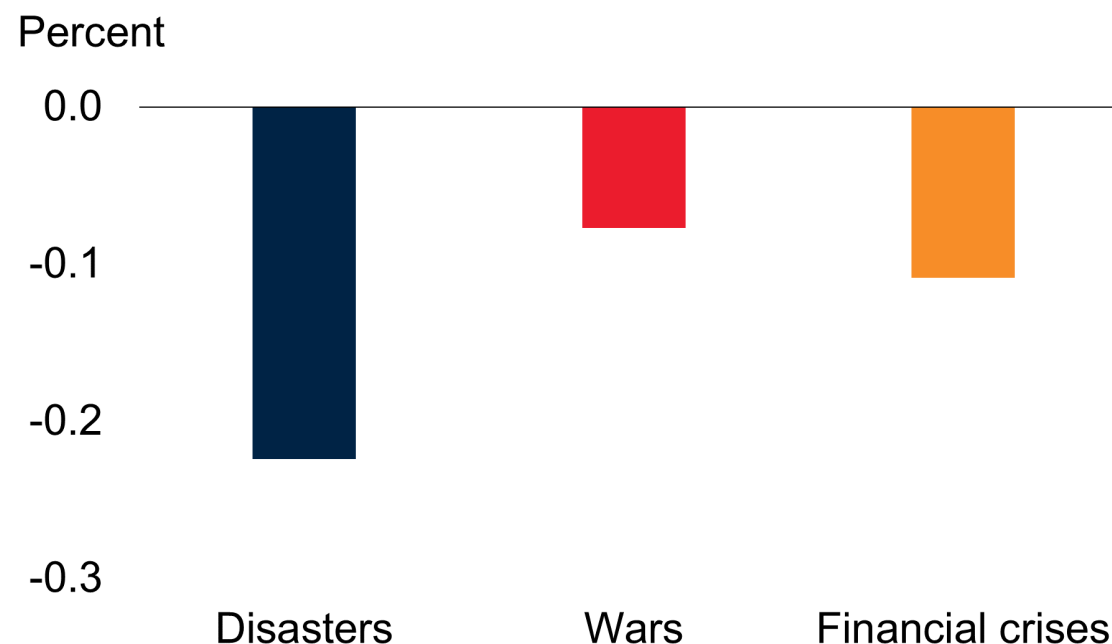
Frequent disasters

persistent effects on productivity

Estimated effects of natural disasters, wars and financial crises on output per capita



Decline in labor productivity in EMDEs, after natural disasters, wars, and financial crises



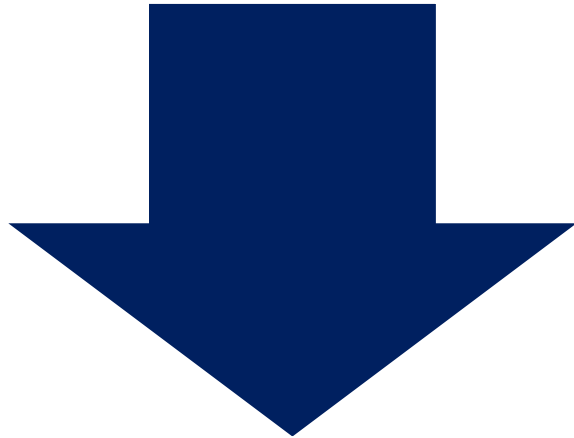
Source: Correlates of War (COW); EM-DAT; Laeven and Valencia (2018); Peace Research Institute Oslo (PRIO); World Bank.

Note: Natural disasters include climate, biological, and geophysical disasters (EM-DAT). Wars include intra-state and external (extra-state and inter-state) wars (COW and PRIO). Financial crises include banking crisis, currency crisis, and sovereign debt crisis (Laeven and Valencia 2018). Definitions are in **Annex 2.1**. An episode dummy for a specific type of event is 1 if the event occurs at least once (≥ 1) in a country-year pair and 0 otherwise. The sample includes 170 countries, 35 AEs, 135 EMDEs, and 27 LICs. Left: The range of estimates is from the literature.

Right: The average impact of the event, i.e., the effect of an event multiplied by the probability of that particular event occurring in EMDEs.

Prospects for productivity growth

Dim in the short-term, with upside potential



- Weaker investment and trade
- Erosion of human capital and shifts in labor markets
- Slowing momentum in labor reallocation
- Heavy debt burden



- Organizational and technological changes
- Diverse and resilient supply chains
- Improvements in education
- Financial development



Four Questions

4 **What are the policy implications?** No silver bullet. *Need to be comprehensive*

Policy Implications

No silver bullet – need to be comprehensive

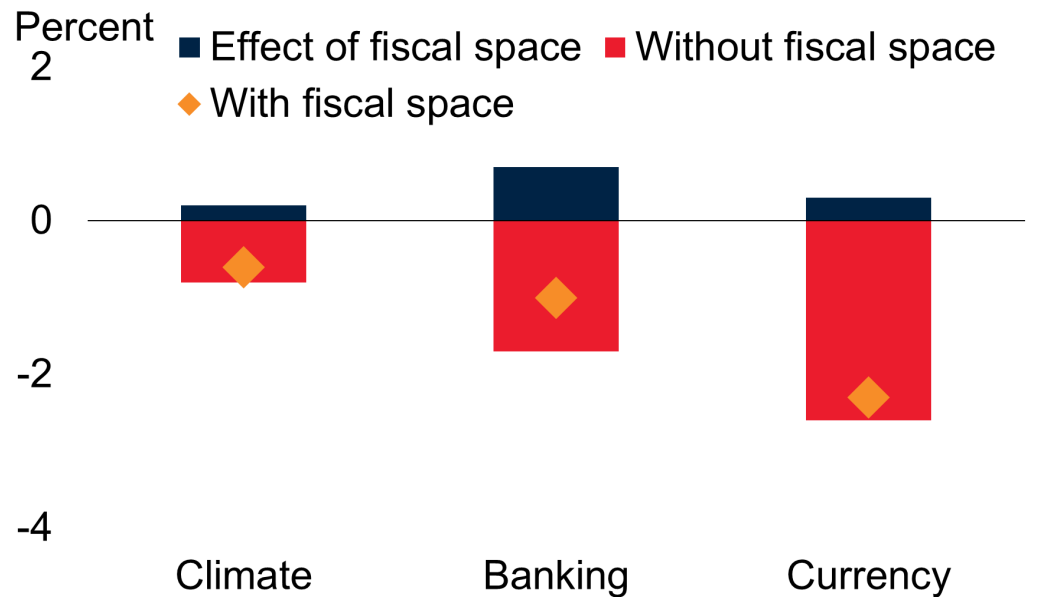
- 1 Stimulate investment and improve human capital**
- 2 Facilitate the mobility and reallocation of resources toward more productive and more diverse sectors**
- 3 Boost productivity growth at the firm level**
- 4 Measures to manage technology-driven labor market disruptions**

Building back better after the pandemic

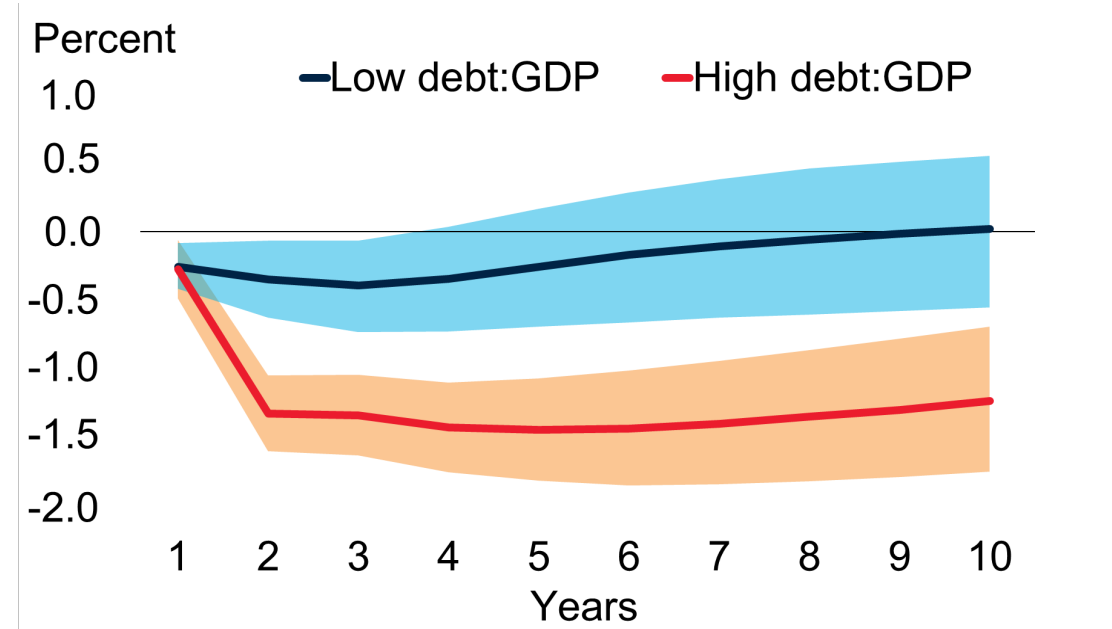
Fiscal space

counters the adverse effects of shocks

Contemporaneous impacts of climate, banking and currency episodes on labor productivity



Debt-to-GDP and response of labor productivity to demand shocks: EMDEs



Source: EM-DAT; Laeven and Valencia (2018); Peace Research Institute Oslo (PRIO); World Bank.

LHS: Blue bars indicate the impact of having fiscal space on the effect of the adverse events on labor productivity (effect of fiscal space); red bars represent the gross effect of adverse events on labor productivity without the fiscal space impact (without fiscal space); and orange markers show the average net effect of adverse events for the countries that have fiscal space (with fiscal space). The sample includes 170 countries, of which 35 are advanced economies and 135 are EMDEs, including 27 LICs.

RHS: 30 advanced economies and 95 EMDEs are grouped into a top and bottom quartile by their average government debt-to-GDP ratio during 1990-2018. The panel VAR is estimated for each group, producing an impulse response of the level of labor productivity in response to the dominant driver of business-cycle frequency investment fluctuations

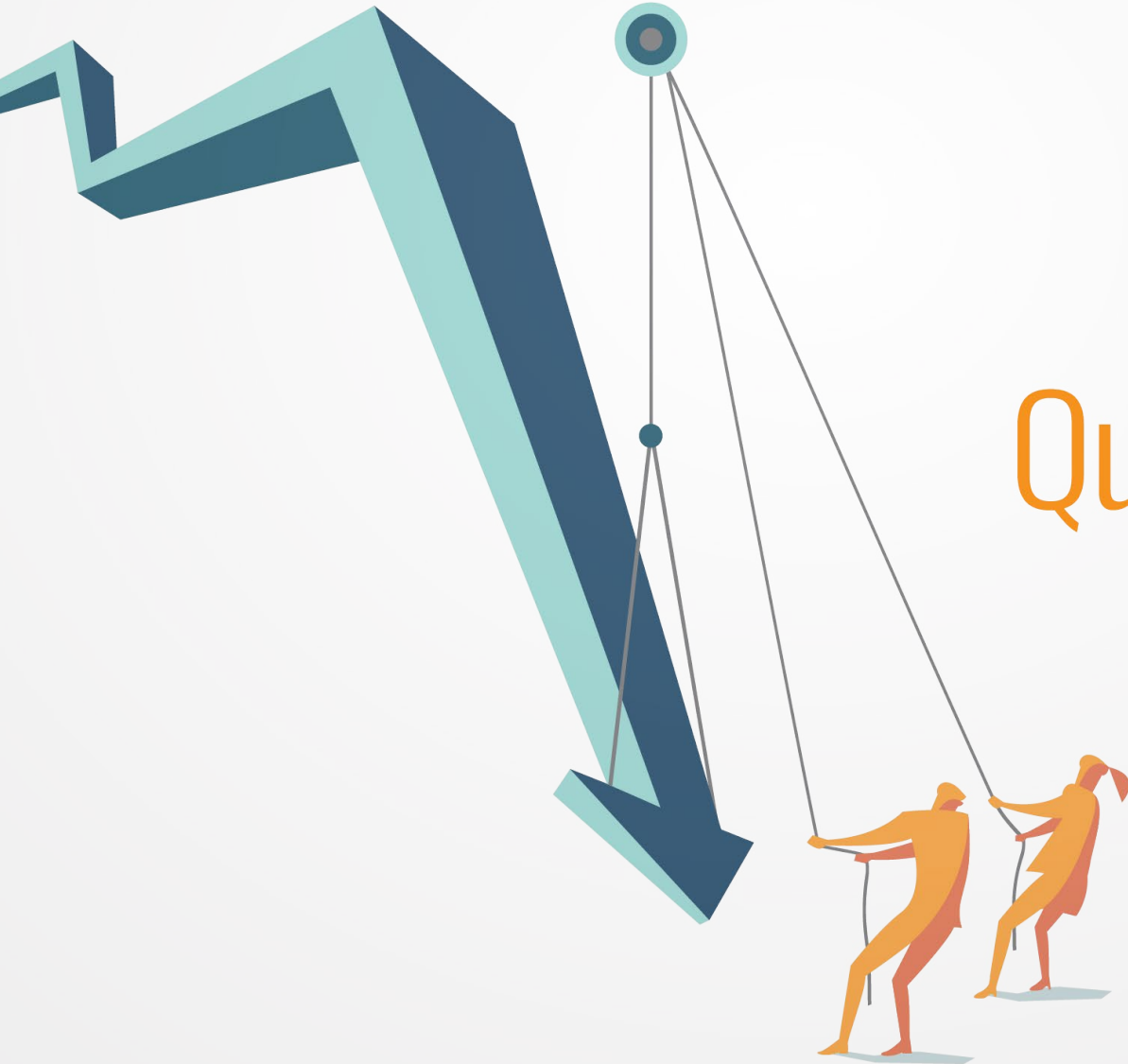
Four Questions

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Thank you,

Alistair Dieppe

Questions and Comments



Government
of Japan

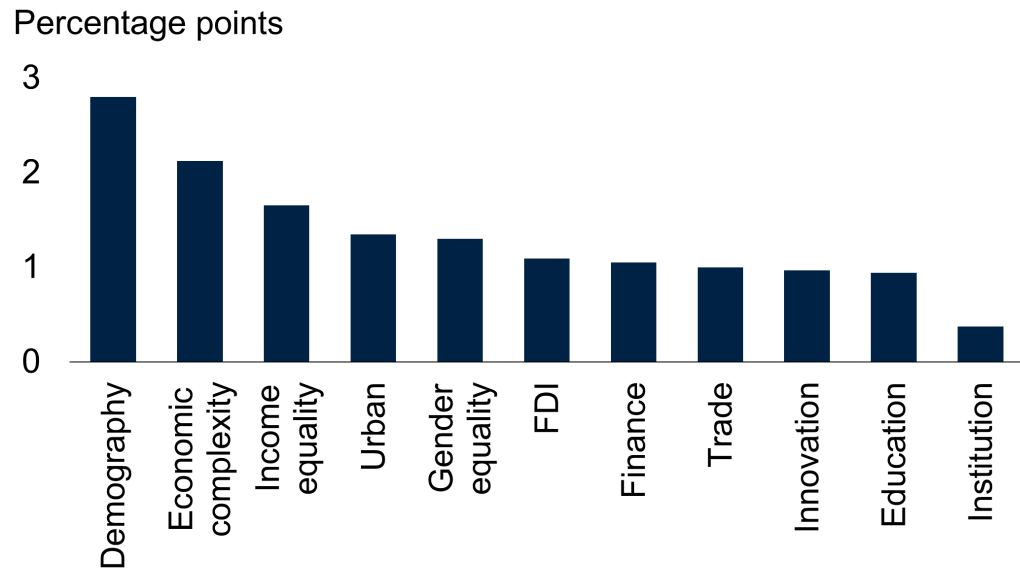


WORLD BANK GROUP

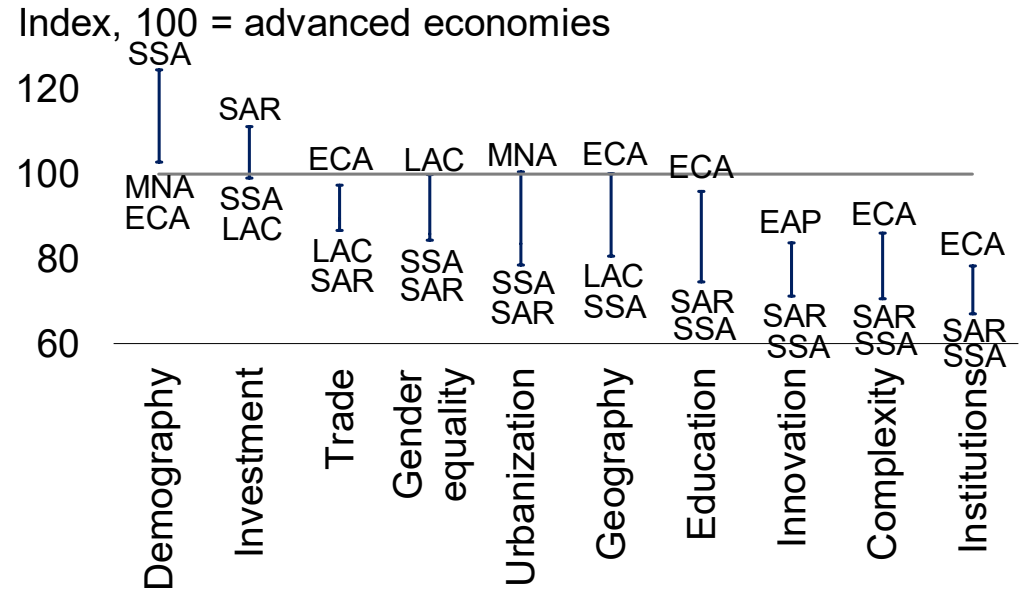
Drivers of productivity growth

Multiple with strong associations

Improvement in productivity growth with favorable initial conditions



Drivers of productivity growth, 2017



Source: World Bank.

LHS: The difference in average labor productivity growth between the highest 25 percent and lowest 25 percent of the distribution of 1995 initial levels of key correlates of productivity growth. Variables corresponding to each concept and sample years are: Demography=working age population share (1995-2018); Economic complexity= Economic Complexity Index of Hidalgo and Hausmann (2009) and Saleh et al (2017) (1970-2018); Income equality= income share of poorest 10% (1995-2018); Innovation=patents per capita (1995-2018); Finance=financial development index (1995-2018); Education=share of population with secondary education and above (1960-2018); FDI=inward FDI as a percent of GDP (1995-2018); Gender equality= the ratio of the female years of schooling to male (1995-2018); Trade=global value chain participation (total amount of intermediate goods in imports and exports, as a percentage of GDP) (1995-2018); Urban=urban population share (1960-2018); Institution=rule of law index (1996-2018).

RHS: Unweighted average levels of drivers normalized as an average of advanced economies as 100 and standard deviation of 10. Blue bars represent average within LAC economies. Orange whiskers represent the range of the average drivers for the six EMDE regions.

Frequent disasters

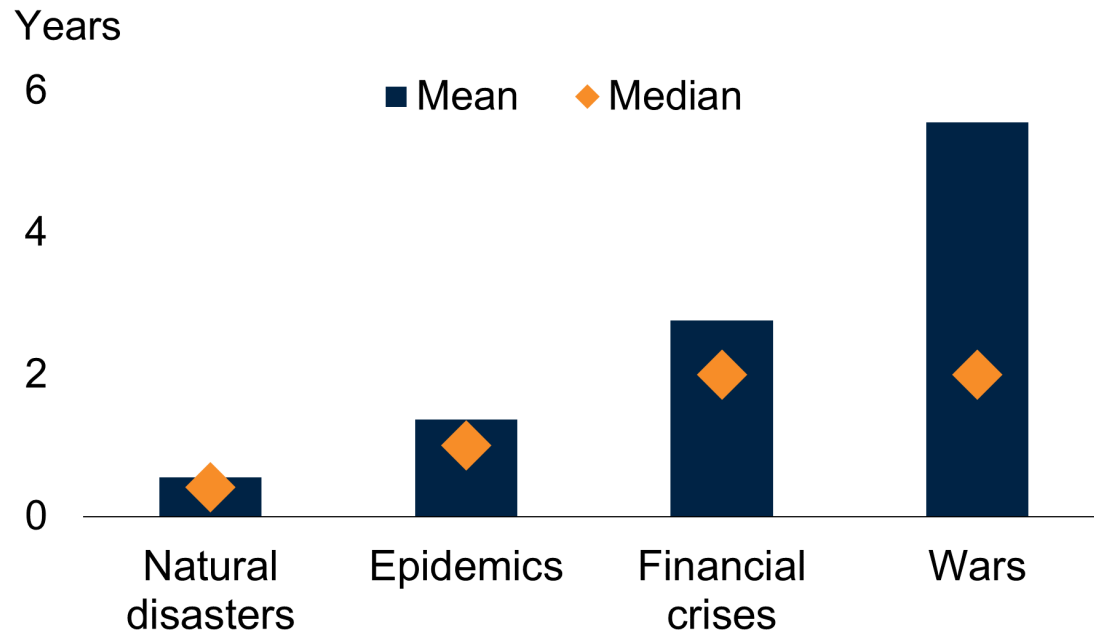
threaten productivity through many channels

- **Natural disasters:** erosion of human capital, destruction of physical capital, and disruption of innovation.
- **Wars:** reduced labor force, weakened capital deepening, and hindered innovation.
- **Financial crises:** compounded recession, depressed investment, and subdued innovation.

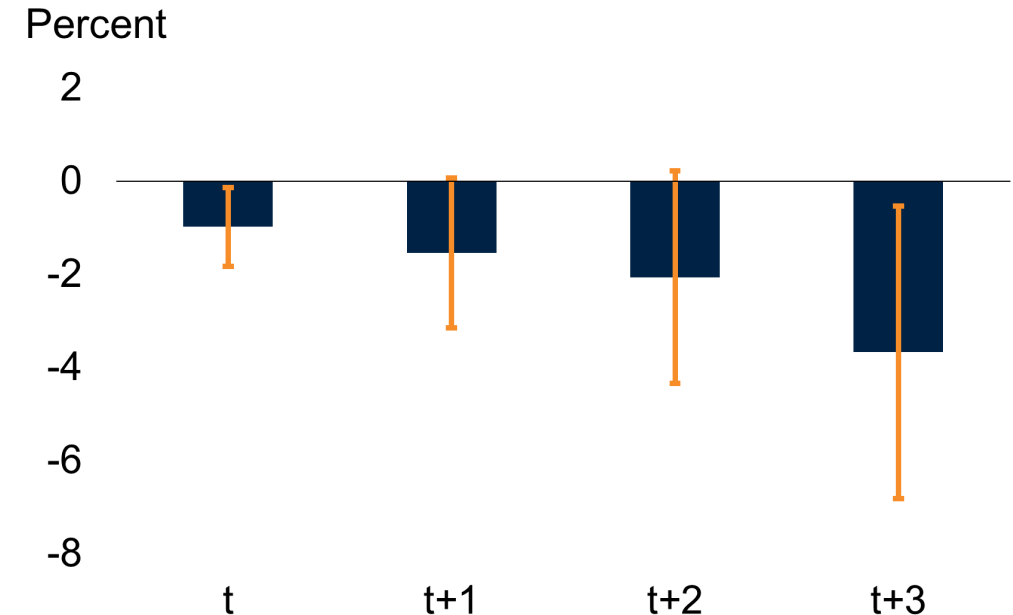
Prospects for productivity growth

Past epidemics lowered productivity for many years

Average duration



Effects of epidemics on labor productivity



Source: Correlates of War (COW); EM-DAT; Laeven and Valencia (2018); Peace Research Institute Oslo (PRIO); World Bank.

Note: Natural disasters include climate, biological, and geophysical disasters (EM-DAT). Wars include intra-state and external (extra-state and inter-state) wars (COW and PRIO). Financial crises include banking crisis, currency crisis, and sovereign debt crisis (Laeven and Valencia 2018). Definitions are in **Annex 2.1**. An episode dummy for a specific type of event is 1 if the event occurs at least once (≥ 1) in a country-year pair and 0 otherwise. The sample includes 170 countries, 35 AEs, 135 EMDEs, and 27 LICs.

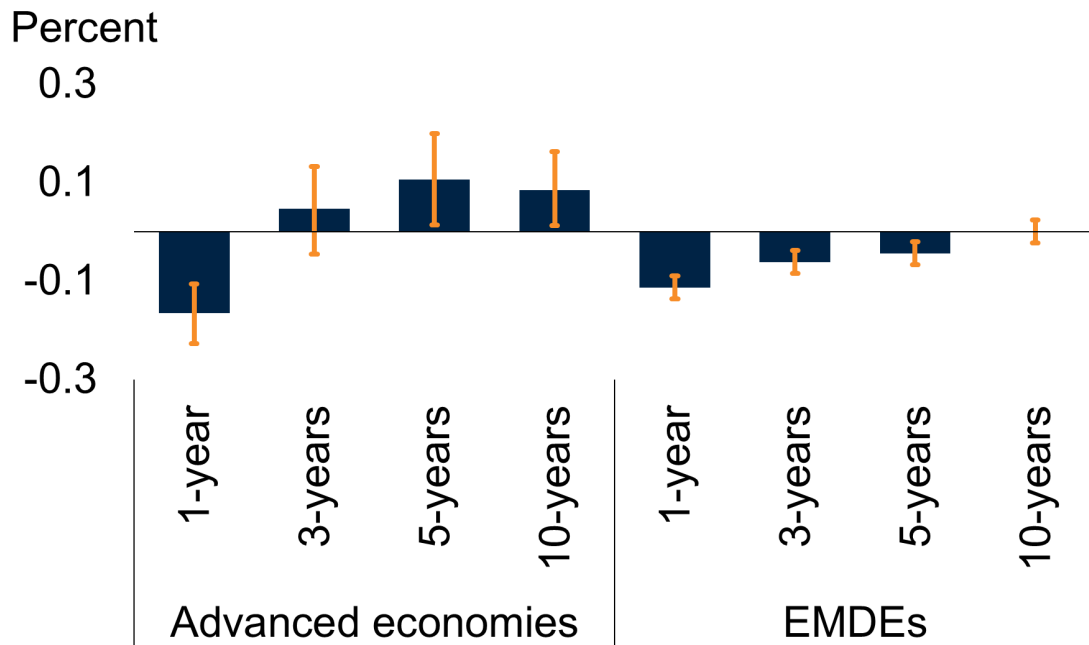
Left: The five pandemics and epidemics considered are SARS (2002-03), MERS (2012), Ebola (2014-15), and Zika (2015-16).

Right: Bars show the cumulative estimated impacts of the four most severe biological epidemics on labor productivity and total factor productivity levels relative to non-affected EMDEs. The four epidemics considered are SARS (2002-03), MERS (2012), Ebola (2014-15), Zika (2015-16). Swine flu (2009), which coincided with the 2008-09 global financial crisis, is excluded to limit possible confounding effects. The sample includes 116 economies: 30 advanced economies, and 86 EMDEs.

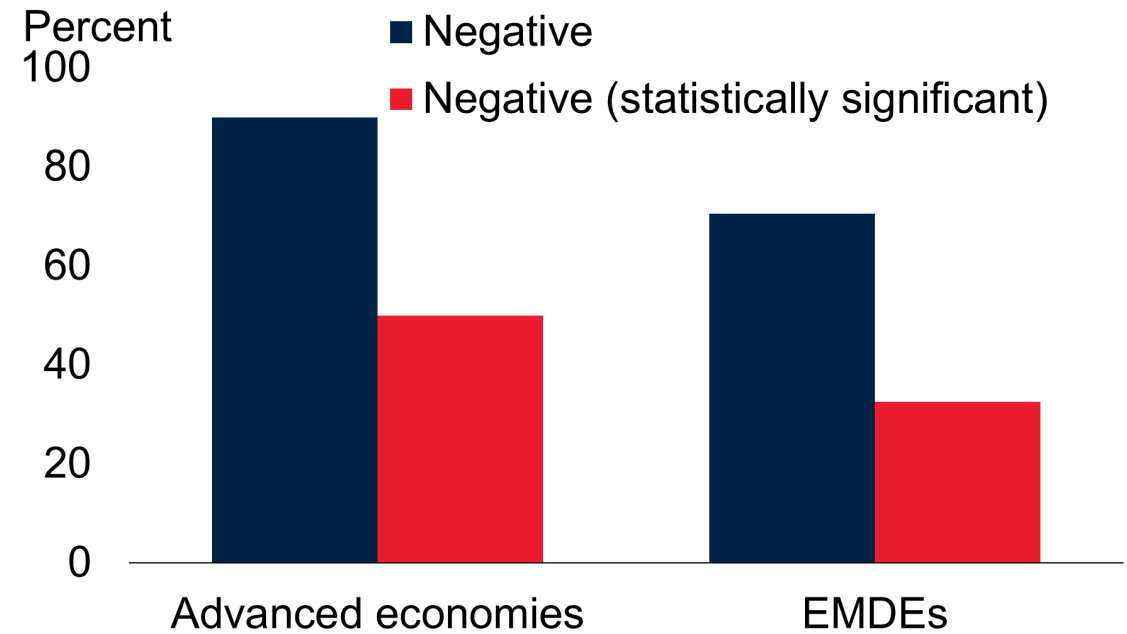
Prospects for productivity growth

Jobless recovery?

Response of employment to technology shock that boosts labor productivity by 1 percent



Proportion of economies with negative employment impact in year 1: AE and EMDEs



Source: World Bank.

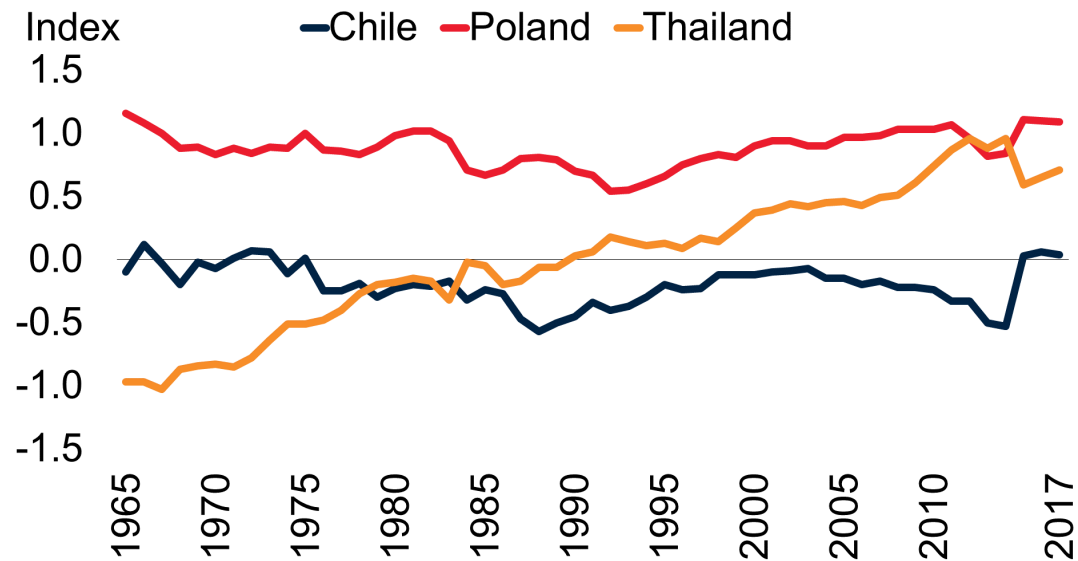
Left: Panel-VAR estimates of impulse responses from a technology shock identified using the Spectral VAR methodology. Panel estimations with fixed effects are performed separately for advanced economies and EMDEs. All impulse responses are scaled to the size of the impact on labor productivity. Therefore, each IRF can be viewed as the response of the variable for each one-percent increase in labor productivity.

Right: Based on individual VAR estimations. The proportion of economies where the median of the IRF is negative in the dark blue bars, and proportion where the 84th percentile is below zero in year 1 in the red bars.

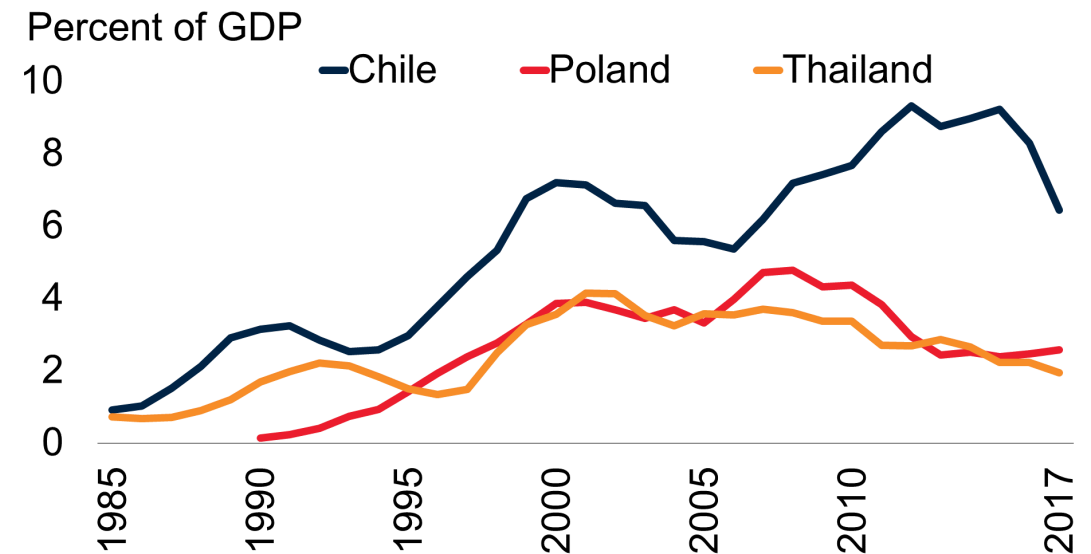
Policies to lift productivity growth

different paths for successful transitions

Economic complexity



FDI inflows

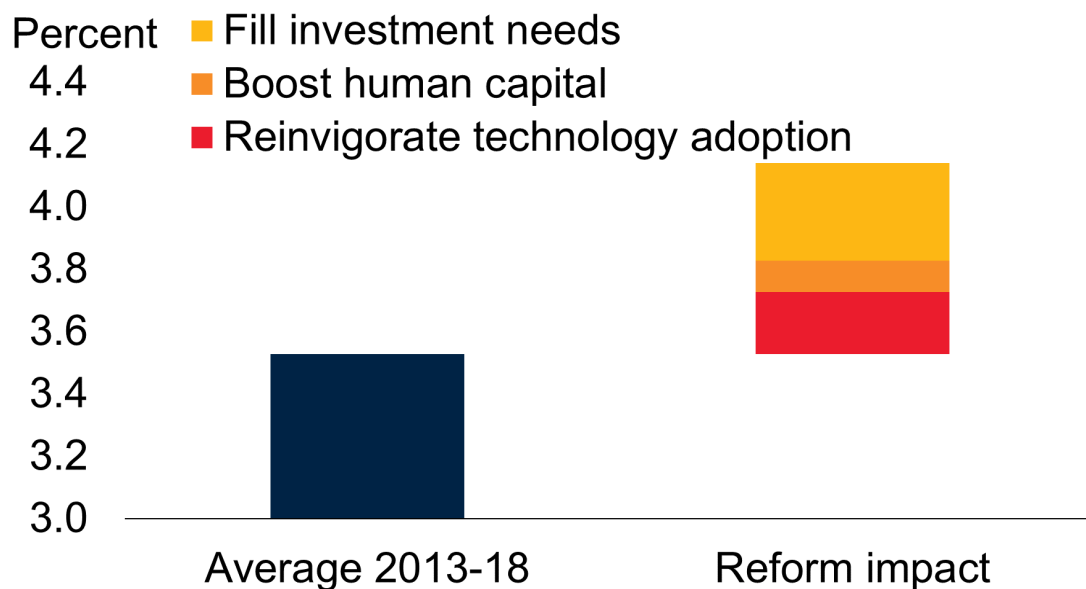


Source: Barro and Lee (2015); Hausmann and Hidalgo (2009); World Bank, World Development Indicators.

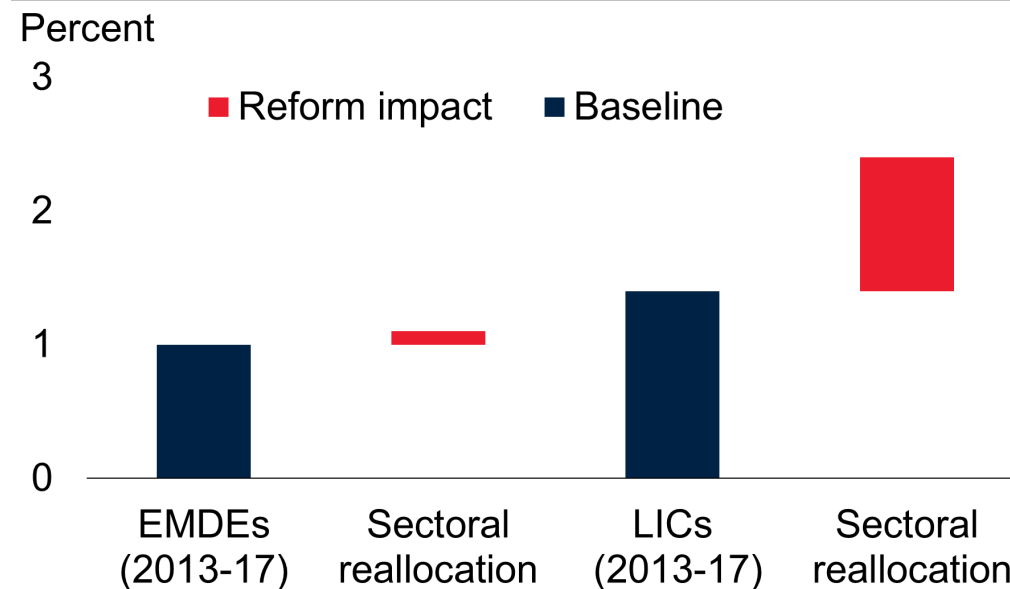
Left and Right: Marginal effect of a one unit increase in the covariates on the probability of an EMDE joining the fast productivity growth convergence Club 1. Derived using a logit model. Detailed results in Annex 4.5. Average years of schooling for males and females from Barro and Lee (2015). Economic complexity index of Hidalgo and Hausmann (2009). FDI is measured in percent of GDP. Government effectiveness survey from the World Bank's Worldwide Governance Indicators. Measures include perceptions of the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies.

Policies to lift productivity growth *can provide a substantial boost*

Simulated Policy Impact



Sectoral reallocation scenario



Source: RHS:APO; EASD; GGDC; ILO; KLEMS; national sources; OECD; United Nations; World Bank

LHS: Annual average labor productivity growth in EMDEs and the long-run effect on labor productivity growth based on the reform scenario assuming: (1) Fill investment needs: the investment share of GDP increases by 4.5 percentage points each year as in the Rozenberg and Fay (2019) "preferred" infrastructure scenario, (2) Boost human capital: the education attainment gap between advanced economies and EMDES is reduced by half; (3) Reinvigorate technology adoption: The economic complexity gap between advanced economies and EMDES is reduced by half.

RHS: The reform scenario assumes that the sectoral reallocation reform is calibrated for China and Vietnam, which experienced successful structural change during 2003-2008. More specifically, it assumes a decrease in the share of employment in the agriculture sector by 15 percent, a corresponding increase in the share of manufacturing and trade sectors.