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Chapters

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Praise for
Global Productivity - Trends, Drivers, and Policies

This book is must-reading for specialists in emerging economies, but also provides deep insights for anyone interested in economic growth and productivity.

Martin Neil Baily, Senior Fellow, The Brookings Institution, Former Chairman U.S. President's Council of Economic Advisers

This is an important book at a critical time. For anyone wanting to understand or influence productivity growth, this is an essential read.

Nicholas Bloom, William D. Eberle Professor of Economics, Stanford University

This extraordinarily valuable and timely book brings considerable new evidence that shows the broad-based, long-standing nature of the slowdown. Importantly, it shows how severe disasters (of which COVID-19 is just the latest) typically harm productivity.

John Fernald, Schroders Chair in European Competitiveness and Reform and Professor of Economics, INSEAD

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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.

* EMDEs = Emerging Market and Developing Economies

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Comprehensive databases

1 Aggregate Productivity

- Labor productivity levels and growth rates, TFP and capital deepening

- Available for up to 172 countries for 1980-2018

2 Sectoral Productivity

- The most comprehensive labor productivity sectoral database

- Available for nine sectors for up to 103 countries over 1975-2017

Databases available on the web:

www.worldbank.org/globalproductivity

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Book content

PART A. Productivity: Trends and Explanations

Chapter 1. Global Productivity Trends
Chapter 2. What Explains Productivity Growth
Chapter 3. What Happens to Productivity During Major Adverse Events
Chapter 4. Productivity Convergence: Is Anyone Catching Up?

PART B. Regional Dimensions of Productivity

Chapter 5. Regional Productivity: Trends, Explanations, and Policies

PART C. Technological Change and Sectoral Shifts

Chapter 6. Productivity Technology, Demand, and Employment Trade Offs
Chapter 7. Sectoral Sources of Productivity Growth

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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*

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

* EMDEs = Emerging Market and Developing Economies

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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.*

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Implications of productivity
Income convergence, poverty reduction

Labor productivity by country group, 2010-18 average
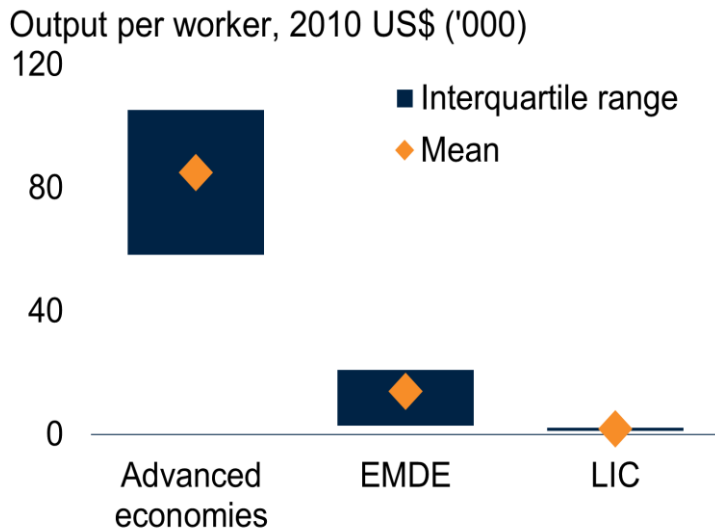
Labor productivity levels by EMDE region, 2010-18 average
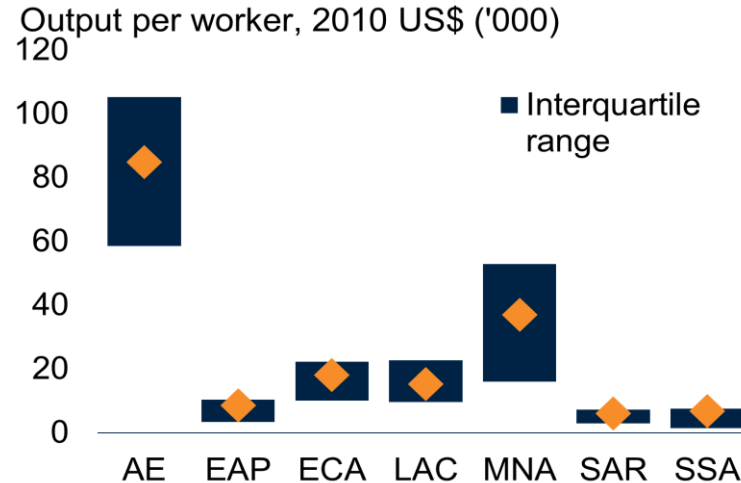
Decade change in the poverty rate in EMDEs, by productivity growth
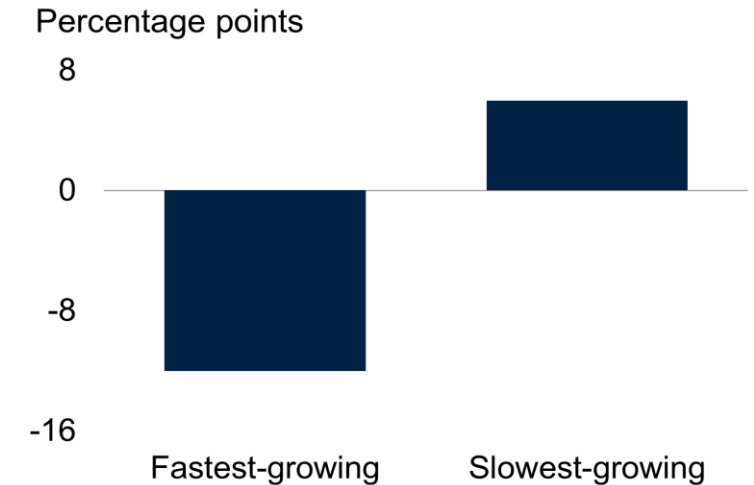
Source: Penn World Table; The Conference Board; World Bank (PovcalNet, World Development Indicators).
Note: Productivity defined as output per worker in U.S. dollars (at 2010 prices and exchange rates).
Left: Based on 35 advanced economies and 126 EMDEs, of which 27 are LICs.
Middle: Sample of 35 advanced 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).
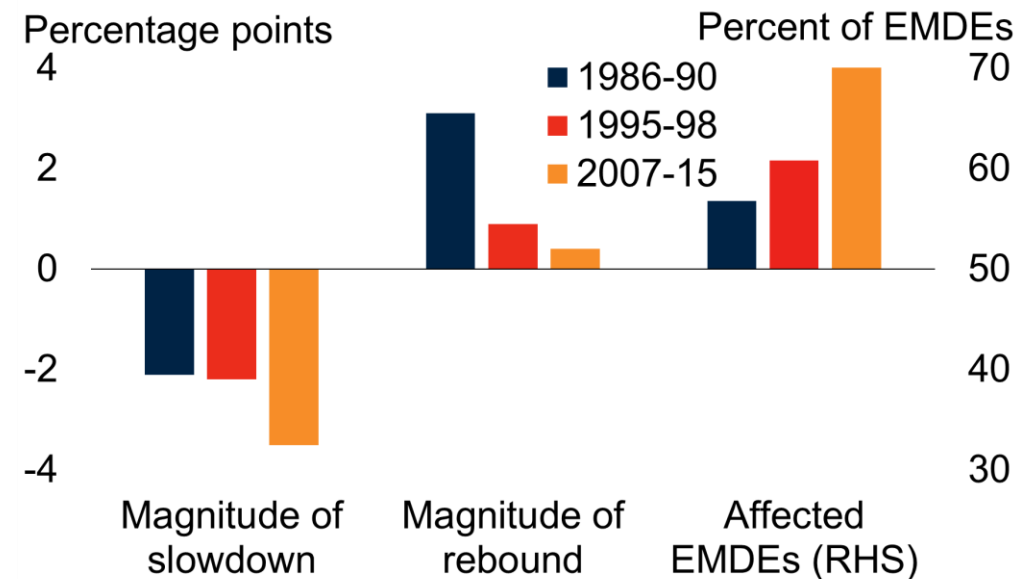
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Evolution of productivity
Slowdown long preceded COVID-19 pandemic

Global, advanced-economy, and EMDE productivity growth
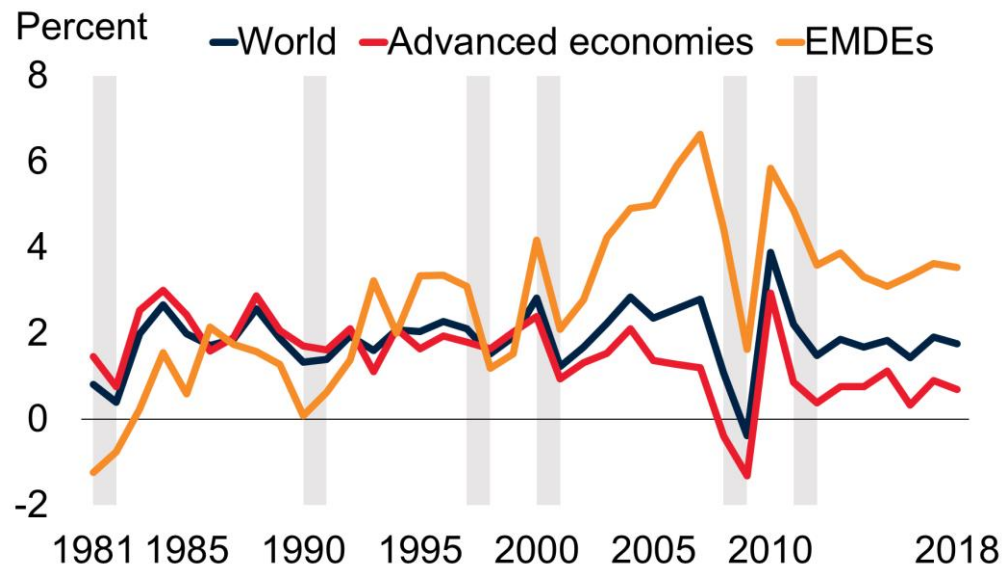
Magnitude and extent of multi-year productivity slowdowns and recoveries

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.

Evolution of productivity
slowdown affecting all regions

Productivity growth in EMDE regions
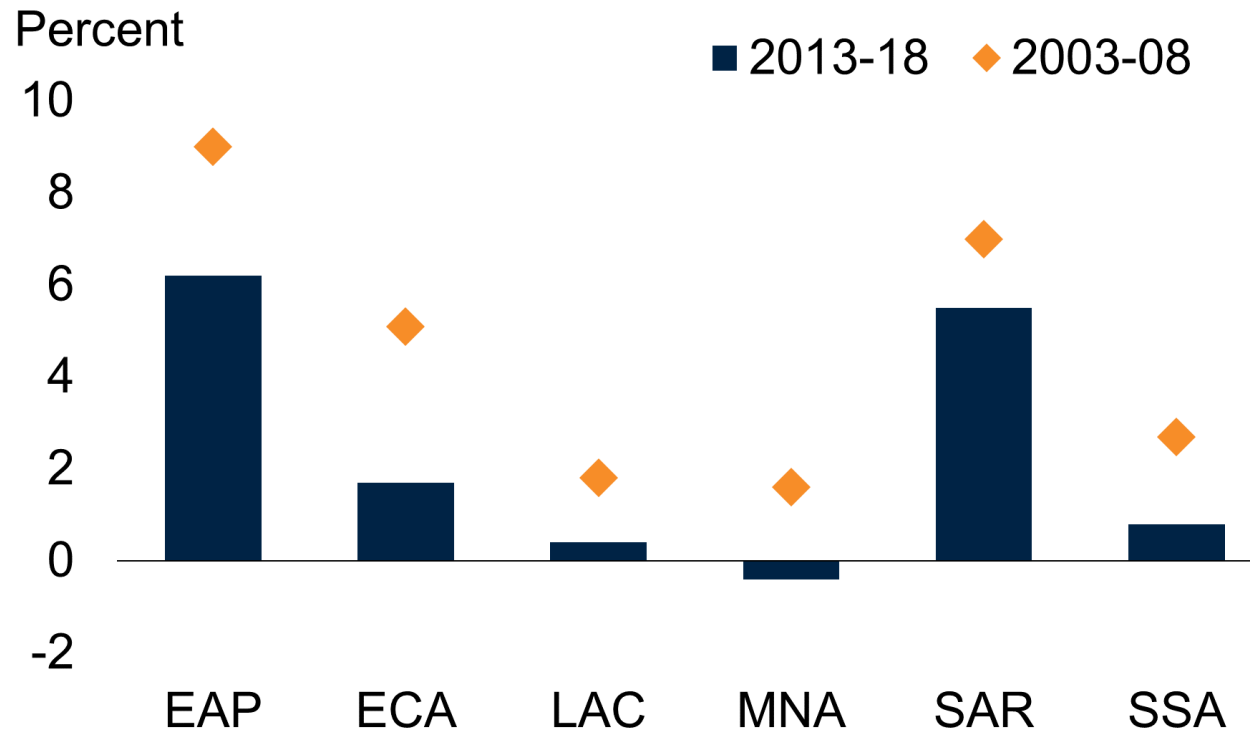
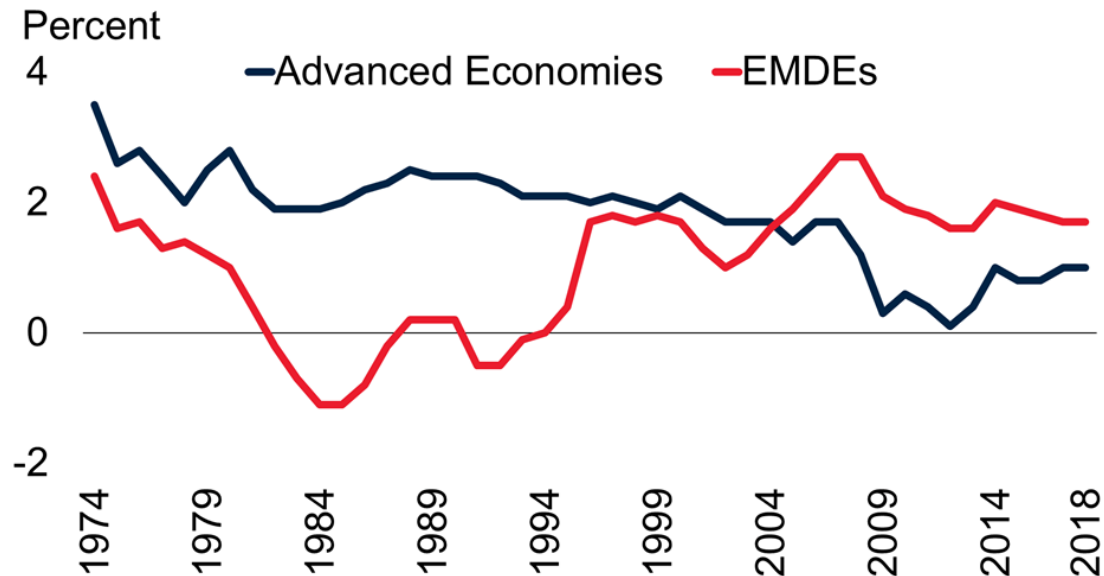Source: Penn World Table; The Conference Board; World Bank, World Development Indicators.
Note: Productivity is defined as output per worker. Data is from a balanced sample between 1981-2018 and includes 29 advanced economies (AEs), and 74 emerging market and developing economies (EMDEs) including 11 low-income countries (LICs), as of 2019 World Bank classifications, 52 commodity exporters and 22 commodity importers. Aggregate growth rates are GDP-weighted at constant 2010 prices and exchange rates.
GDP-weighted productivity growth for 8 EMDEs in East Asia and the Pacific (EAP), 10 EMDEs in Eastern Europe and Central Asia (ECA), 19 EMDES in Latin America and the Caribbean (LAC), 10 EMDEs in Middle East and North Africa (MNA), 2 EMDEs in South Asia (SAR), and 26 EMDEs in Sub-Saharan Africa (SSA.
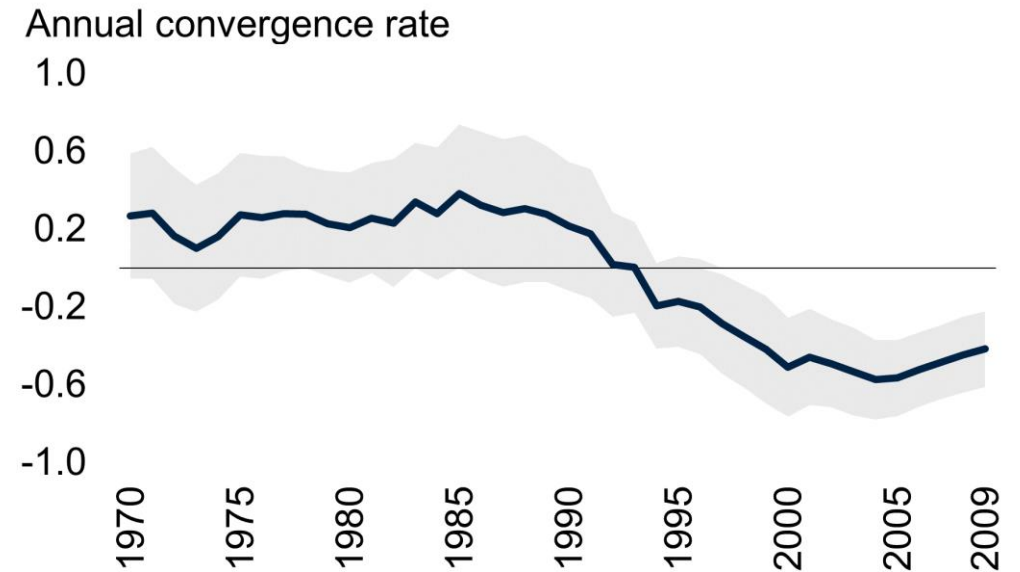
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Productivity convergence in EMDEs
slowly converging

Labor productivity growth
(5-year moving average)

Unconditional convergence rate

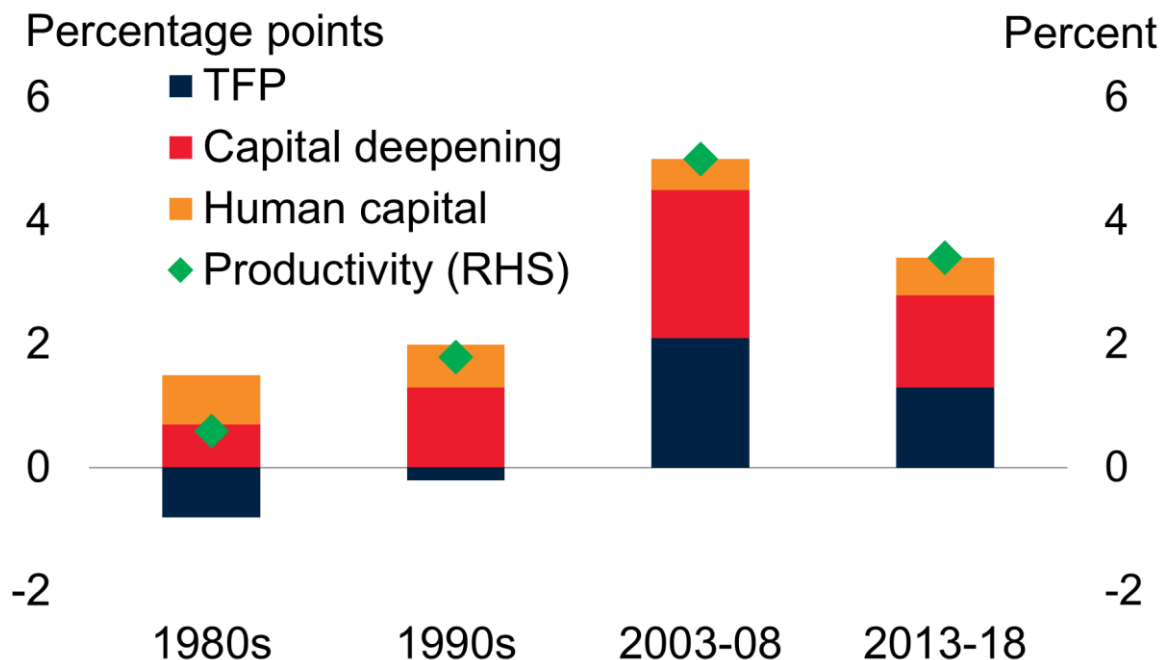Source: Penn World Table; The Conference Board; World Bank, World Development Indicators.
Left: Based on a sample of 35 advanced economies and 123 EMDEs for a consistent sample since 1990, and 29 advanced economies and 74 EMDEs for a consistent sample since 1970.
Right: Based on a sample of 29 advanced 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.
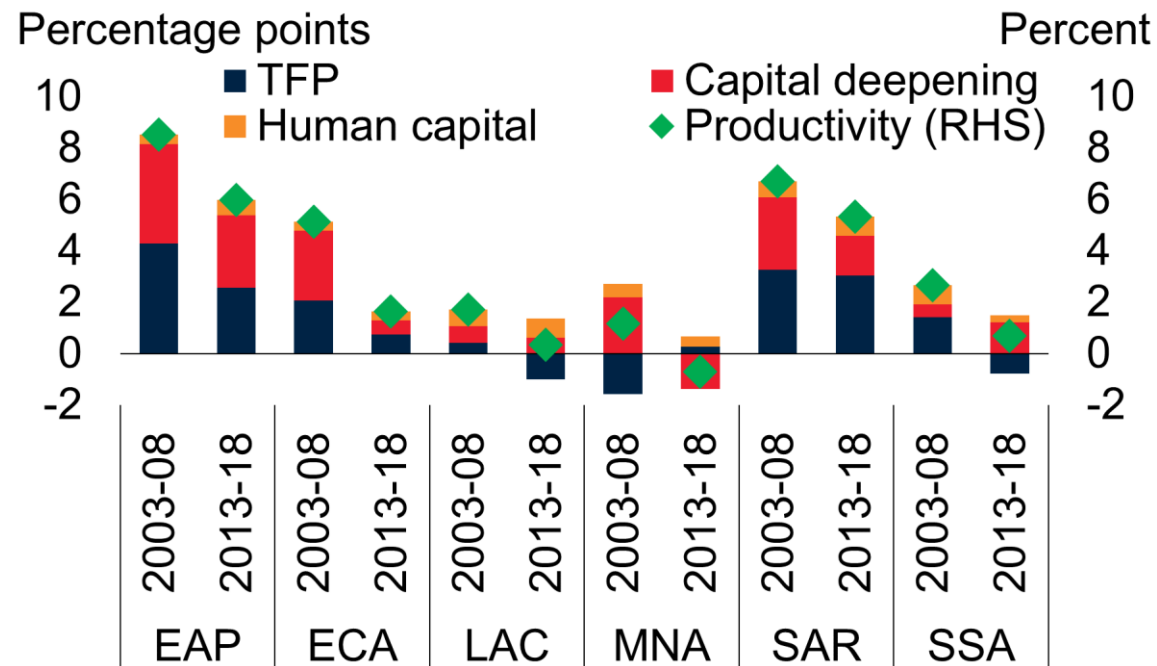
Broad based Productivity slowdown
Driven by both weaker TFP and capital deepening

Contributions to productivity growth in EMDEs

Contributions to regional productivity growth

13

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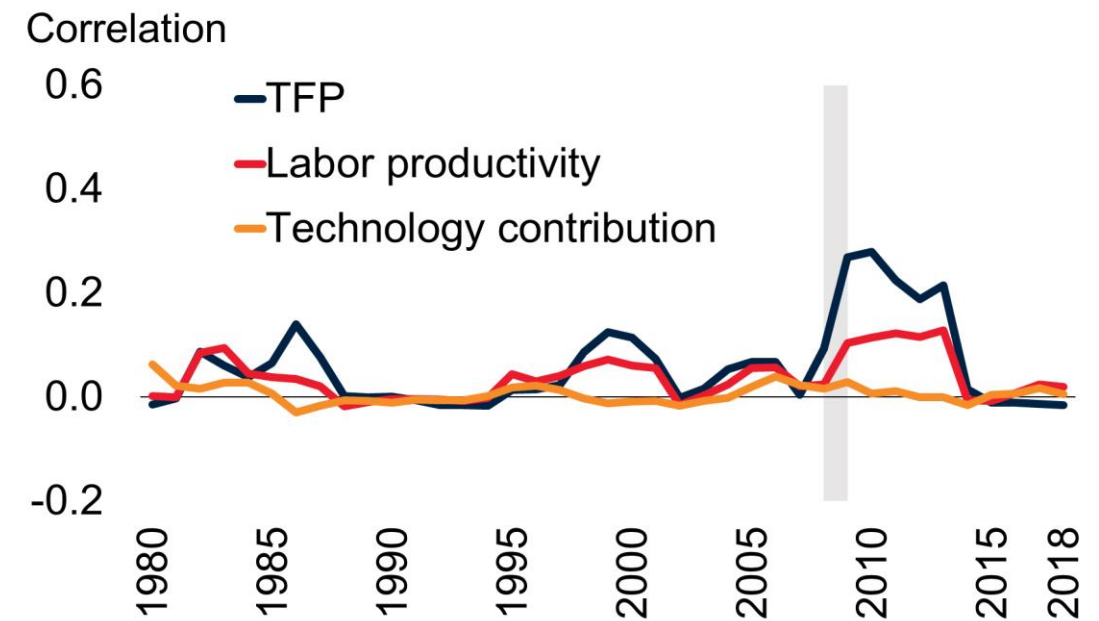Equitable Growth, Finance & Institutions
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Drivers of post-crisis productivity growth slowdown
Strong cyclical component

Labor productivity growth change 2007-09: Advanced economies and EMDEs
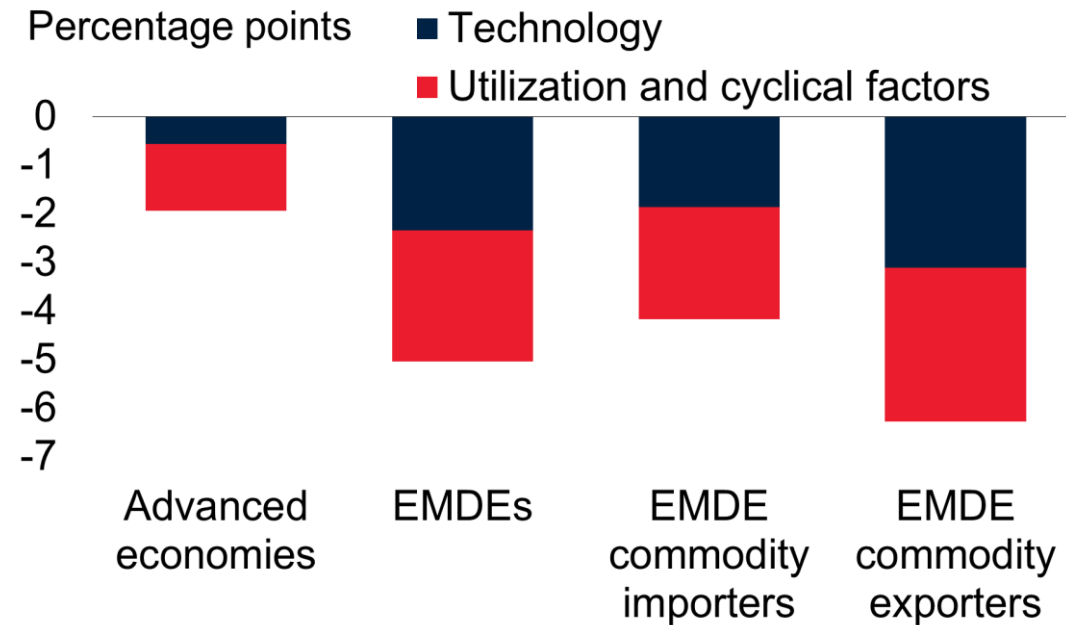
Average 5-year rolling correlation: EMDEs

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.
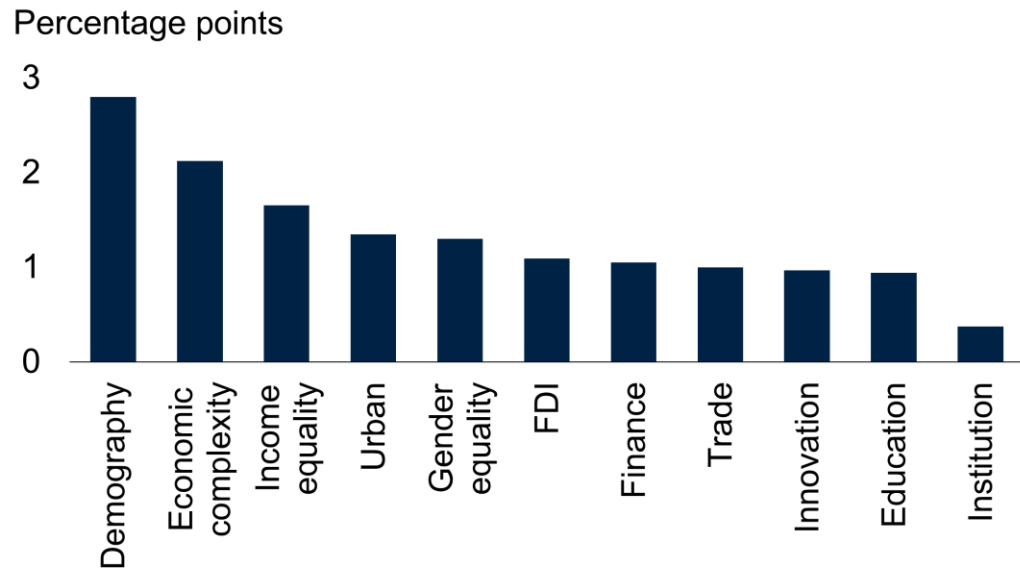
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Four questions

2 **What have been its drivers?** Drivers of EMDE productivity growth are slowing. *Sectoral reallocation weakening.*
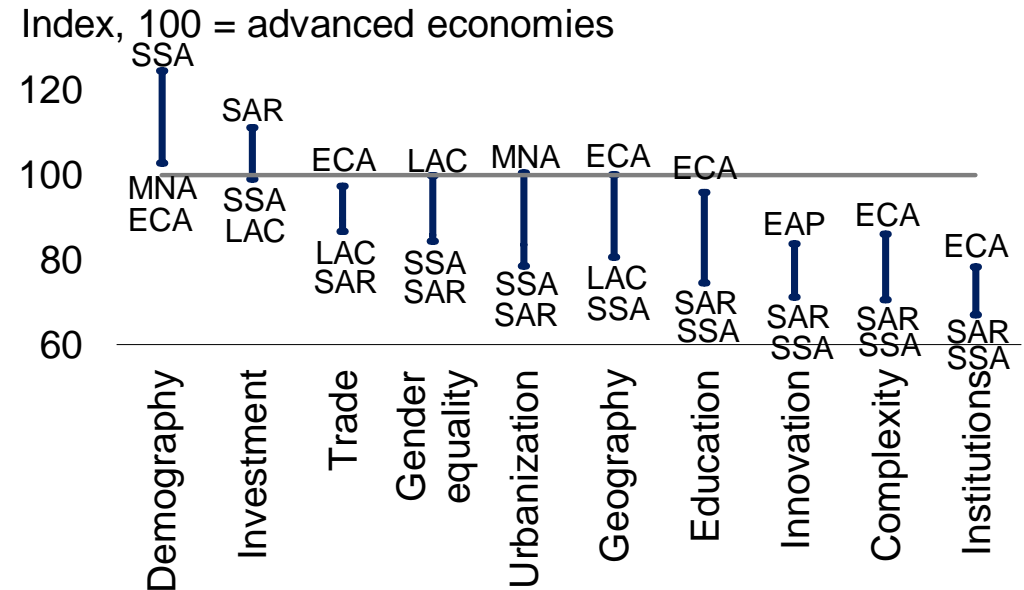
Drivers of productivity growth
Multiple with strong associations

Improvement in productivity growth with favorable initial conditions

Drivers of productivity growth, 2017
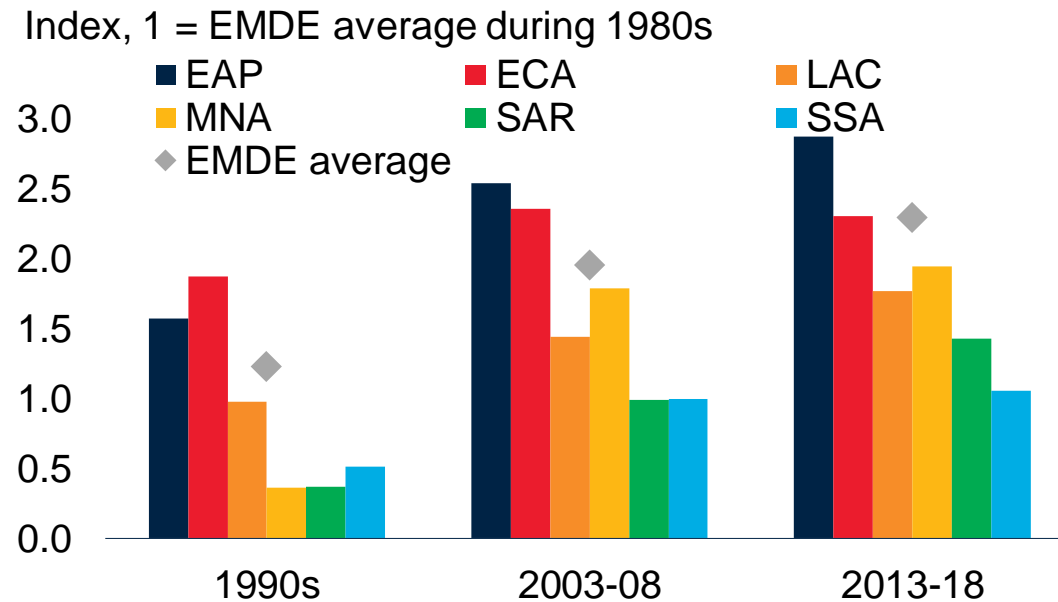

Source: World Bank.
LHS: The difference in average labor productivity growth between the highest 25 percent and lowest 25 percent of the distribution of 1995 initial levels of key correlates of productivity growth. Variables corresponding to each concept and sample years are: Demography=working age population 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.
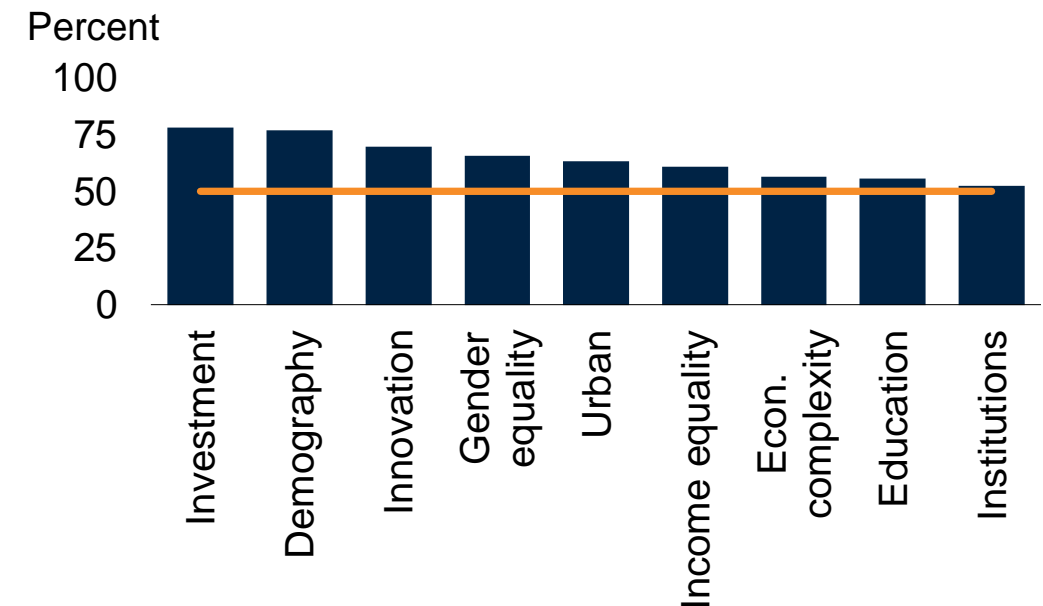
Drivers of post-crisis labor productivity growth
Weakening fundamentals

Index of productivity drivers

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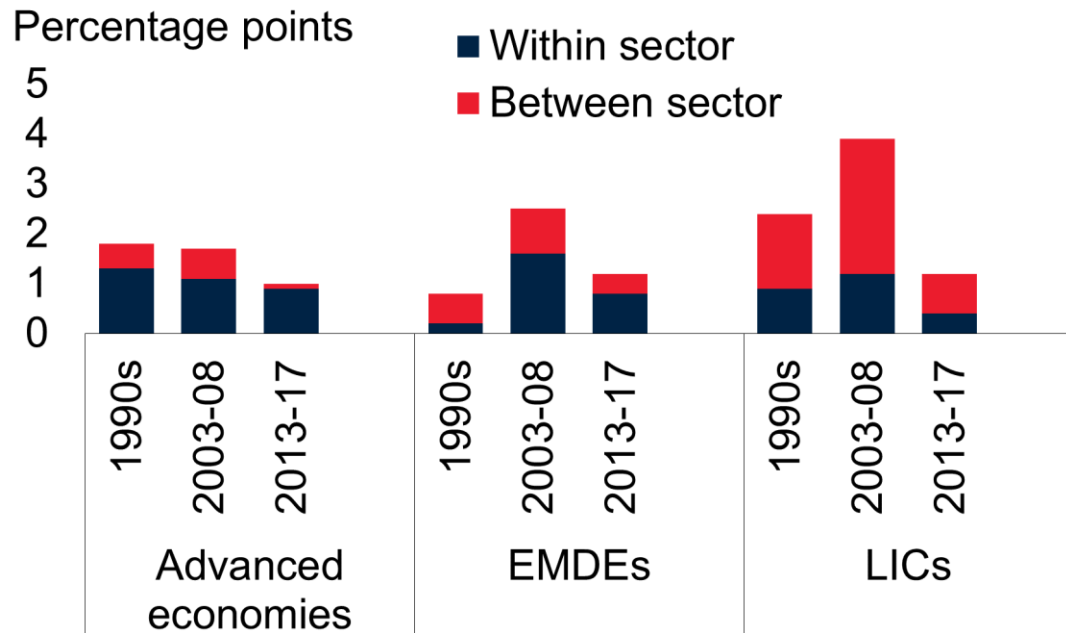

Source: World Bank.
LHS: Index of drivers created by weighting normalized levels of each potential driver by its estimated impact on productivity growth (Book Figure 2.9; Annex 2.2).Drivers include the ICRG rule of law index, patents per capita, non-tropical share of land area, investment as percent 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.
RHS: 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.
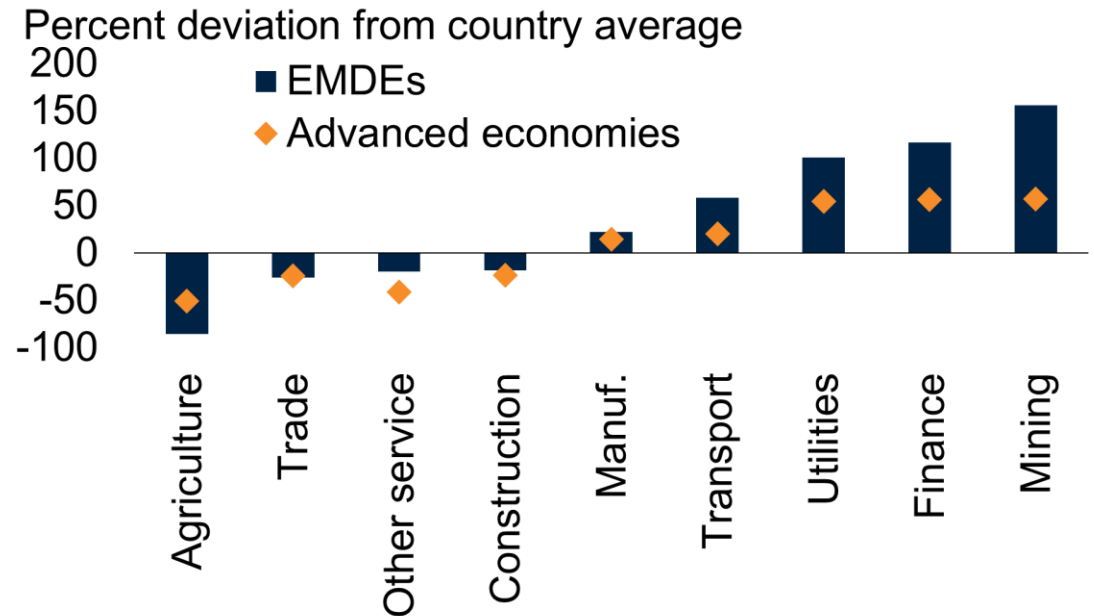
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Within and between sector contributions to productivity growth

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.

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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.*

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Frequent disasters
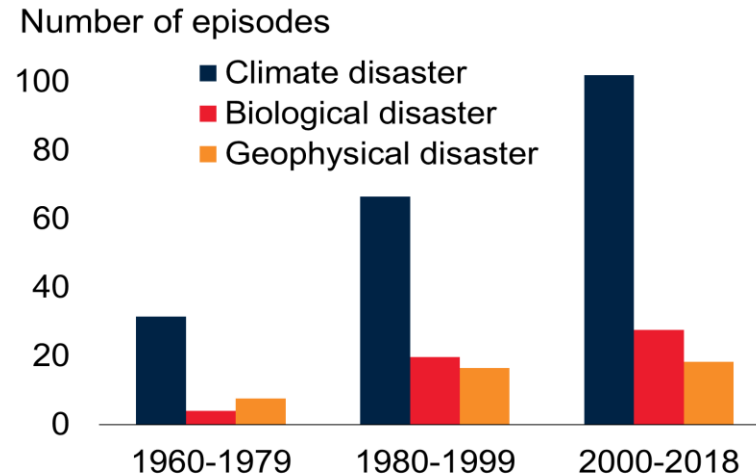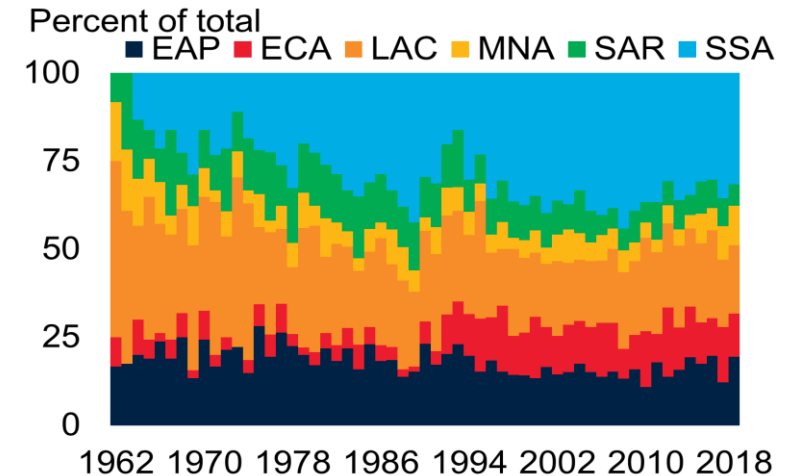## *increasing*

Average number of episodes per year

Number of episodes
- Natural disasters
- Wars
- Financial crises

200
150
100
50
0

1960-79   1980-99   2000-18

Average number of natural disaster episodes per year, by type

Number of episodes
- Climate disaster
- Biological disaster
- Geophysical disaster

100
80
60
40
20
0

1960-1979   1980-1999   2000-2018
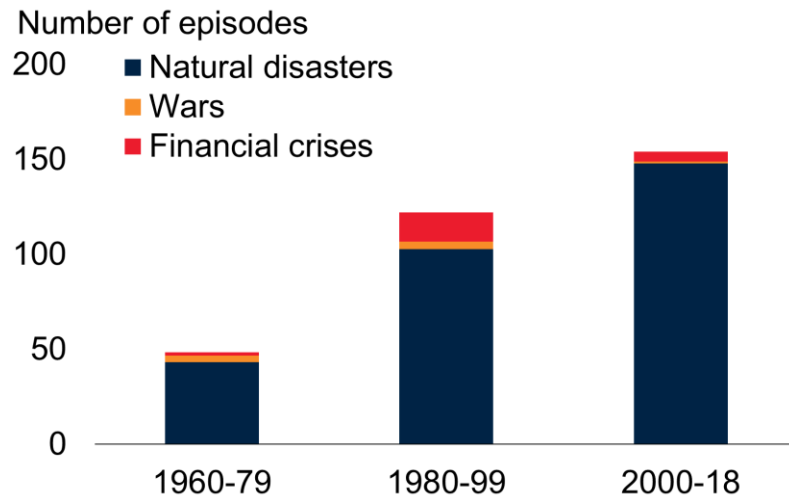
Share of natural disasters, by region

Percent of total

EAP ECA LAC MNA SAR SSA

100
75
50
25
0

1962 1970 1978 1986 1994 2002 2010 2018

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 (Leaven 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 distaster.
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.

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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.

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Frequent disasters
persistent effects on productivity

Estimated effects of natural disasters, wars and financial crises on output per capita
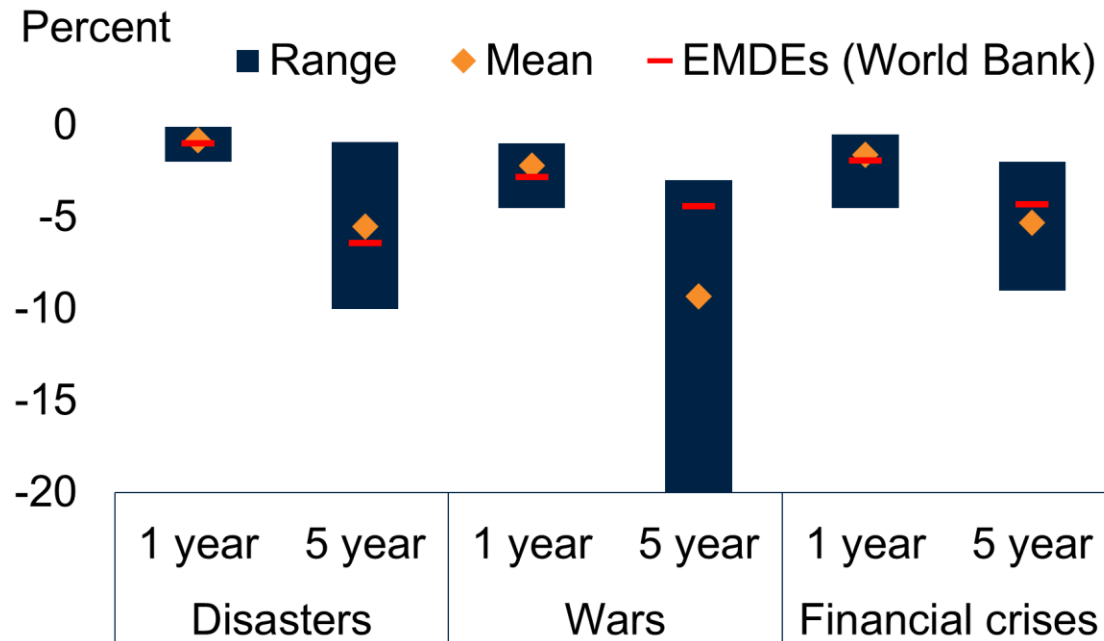
Decline in labor productivity in EMDEs, after natural disasters, wars, and financial crises
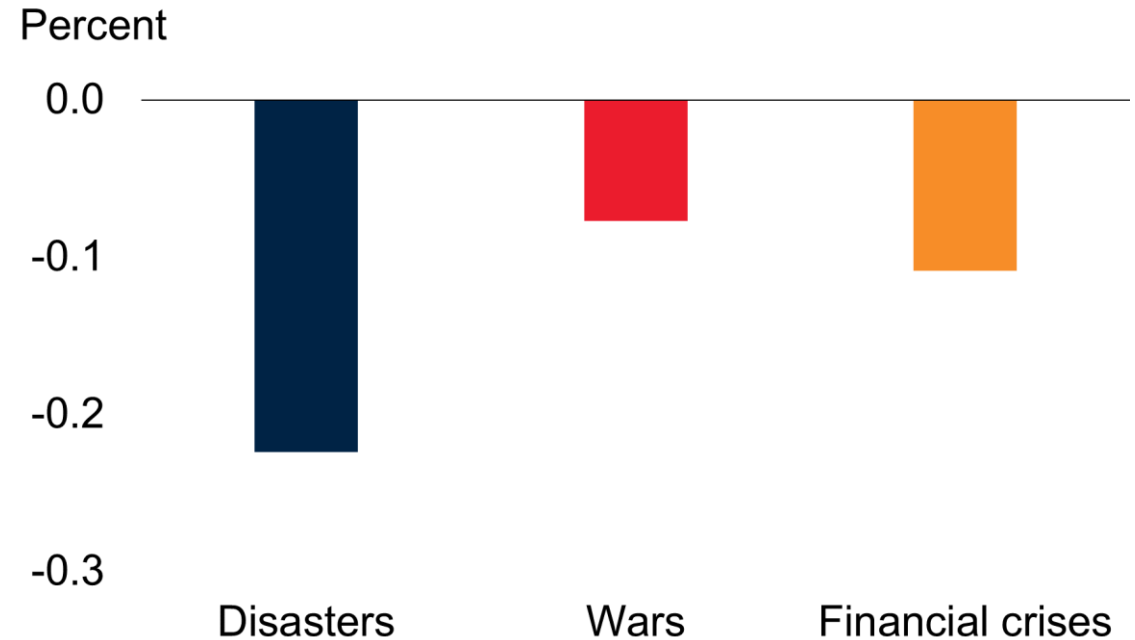
Source: Correlates of War (COW); EM-DAT; Laeven and Valencia (2018); Peace Research Institute Oslo (PRIO); World Bank.
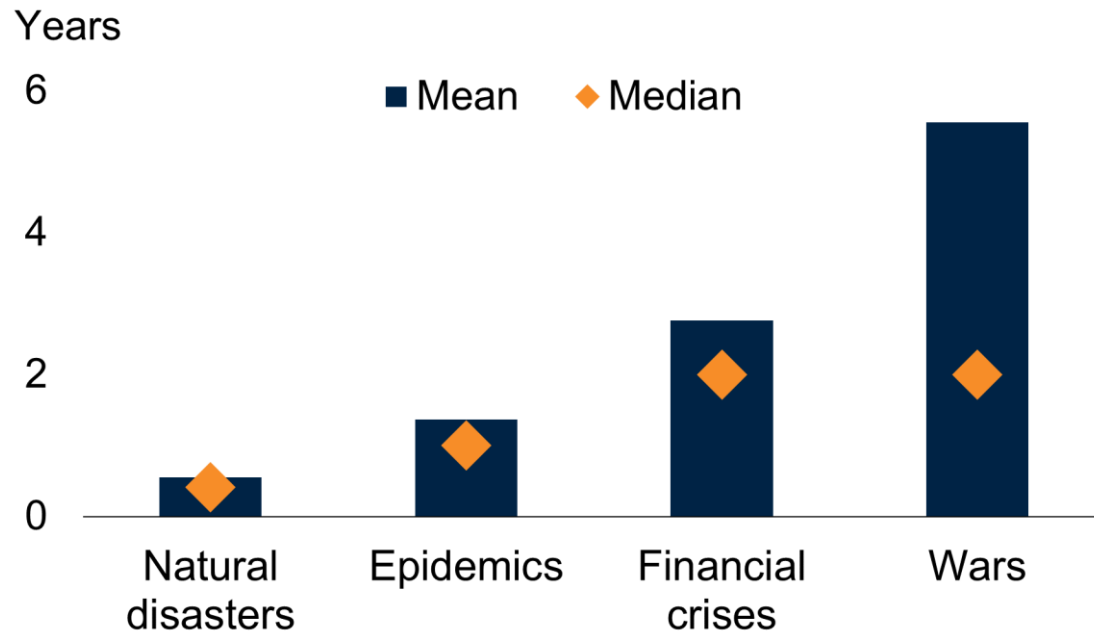Note: Natural disasters include climate, biological, and geophysical disasters (EM-DAT). Wars include intra-state and external (extra-state and inter-state) wars (COW and PRIO). Financial crises include banking crisis, currency crisis, and sovereign debt crisis (Leaven and Valencia 2018). Definitions 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.
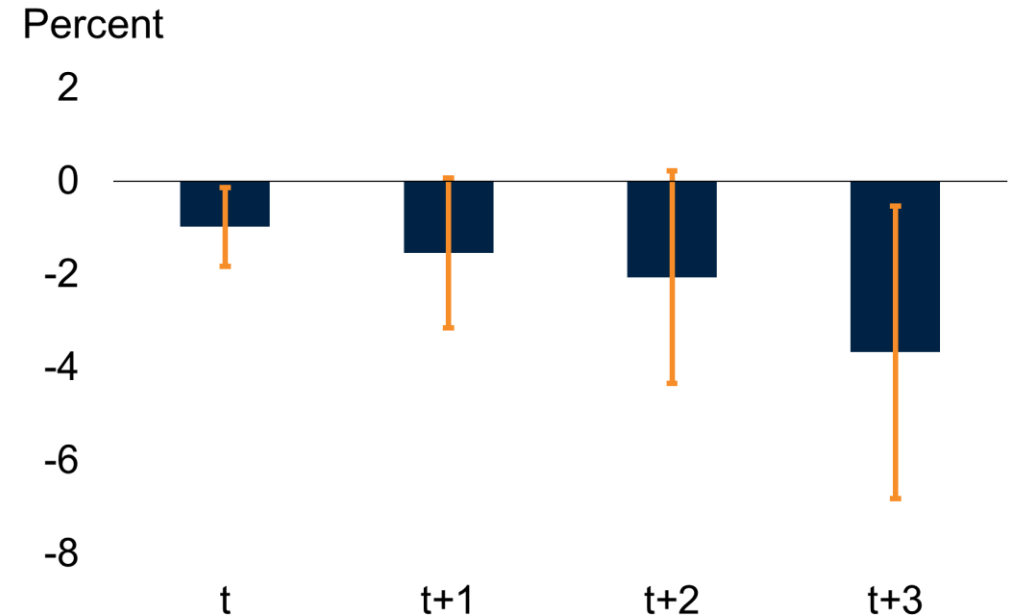
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Prospects for productivity growth
Past epidemics lowered productivity for many years

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 (Leaven 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.

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Prospects for productivity growth
Dim in the short-term, with upside potential
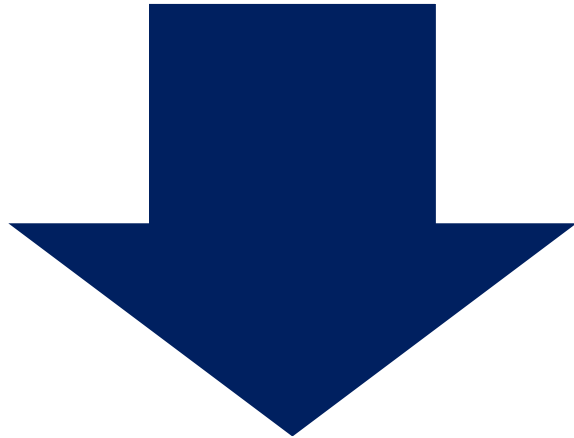
- Weaker investment and trade
- Erosion of human capital and shifts in labor markets
- Slowing momentum in labor reallocation
- Heavy debt burden

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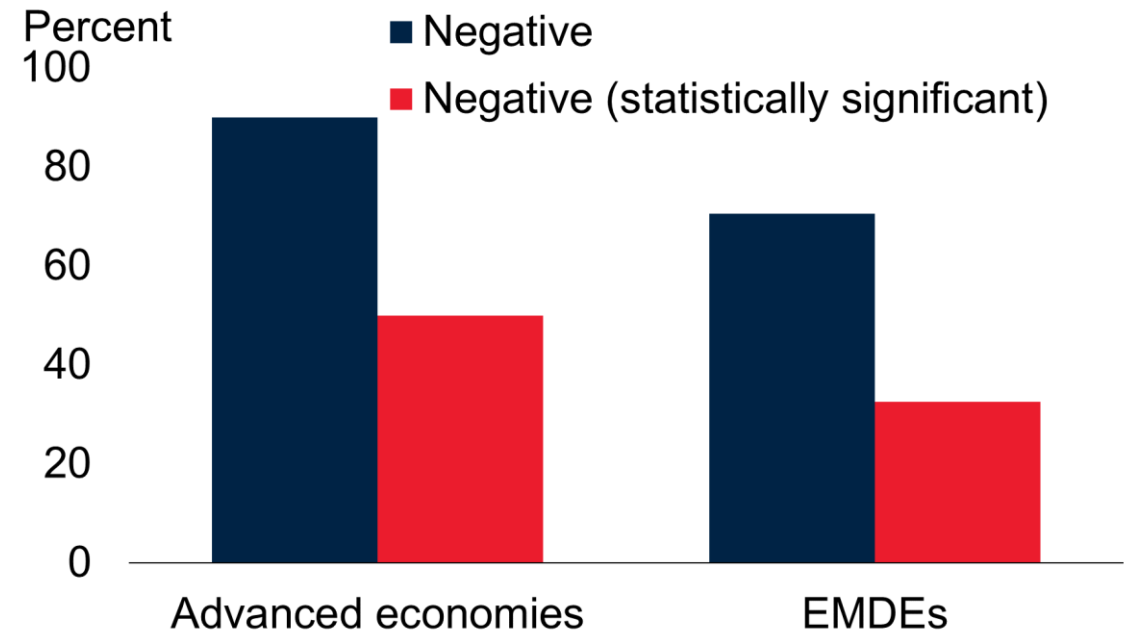- Improvements in education
- Financial development

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Prospects for productivity growth
Jobless recovery?

Response of employment to technology shock that boosts labor productivity by 1 percent
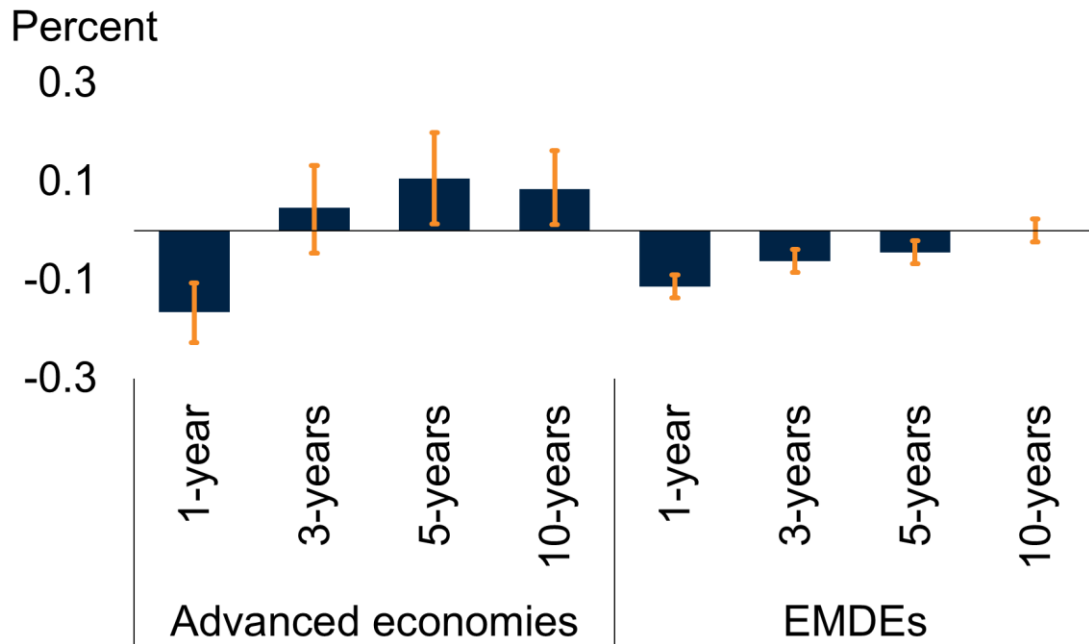
Proportion of economies with negative employment impact in year 1: AE and EMDEs

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.

Four Questions

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

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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**
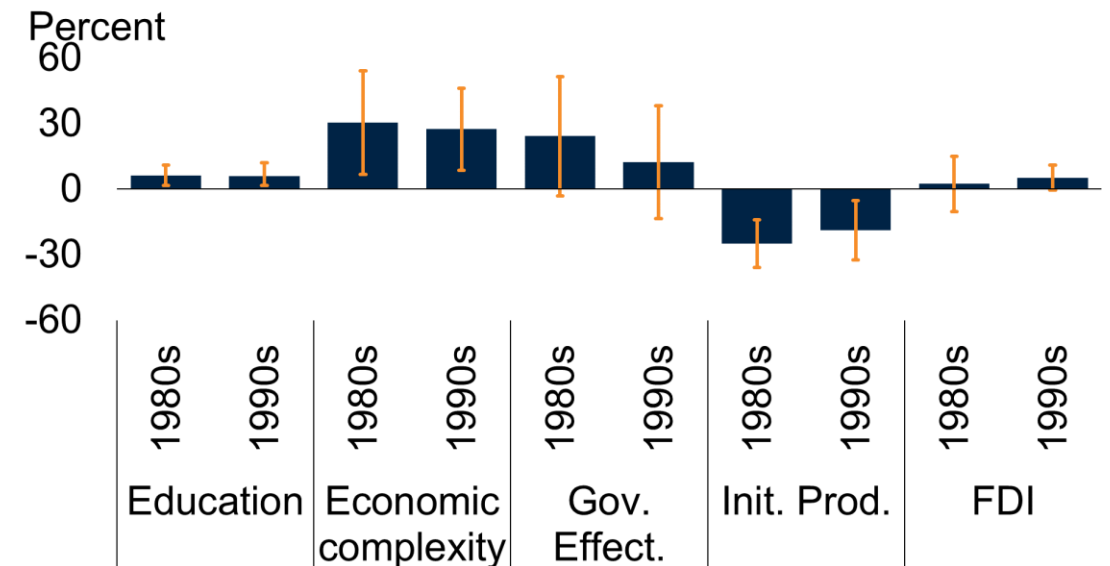
Building back better after the pandemic

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Policies to lift productivity growth
Decades of improvements needed for success

Productivity by convergence club, 1970s-2010s
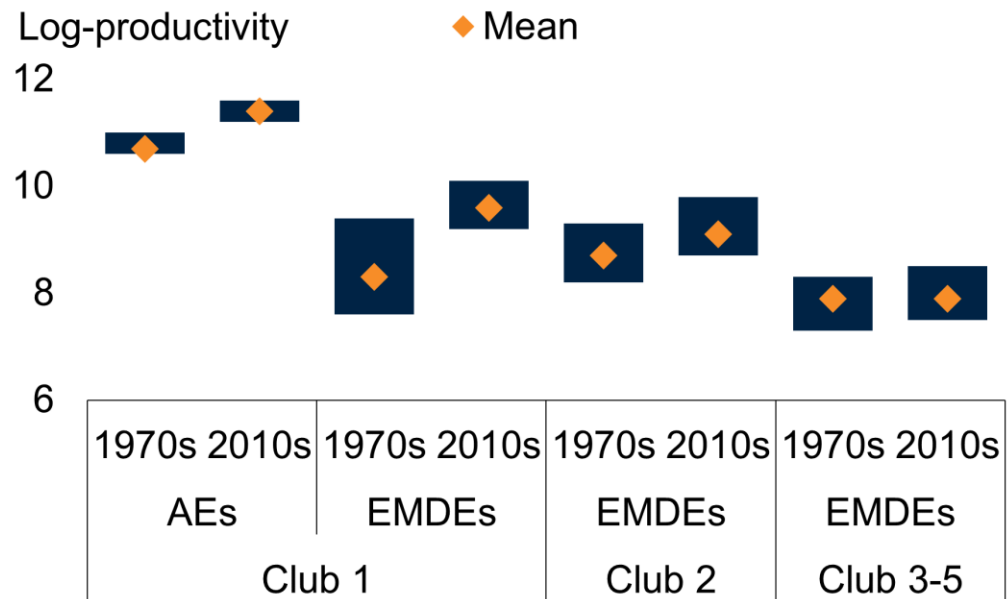
The effect of covariates on the probability of EMDE joining high-productivity convergence club

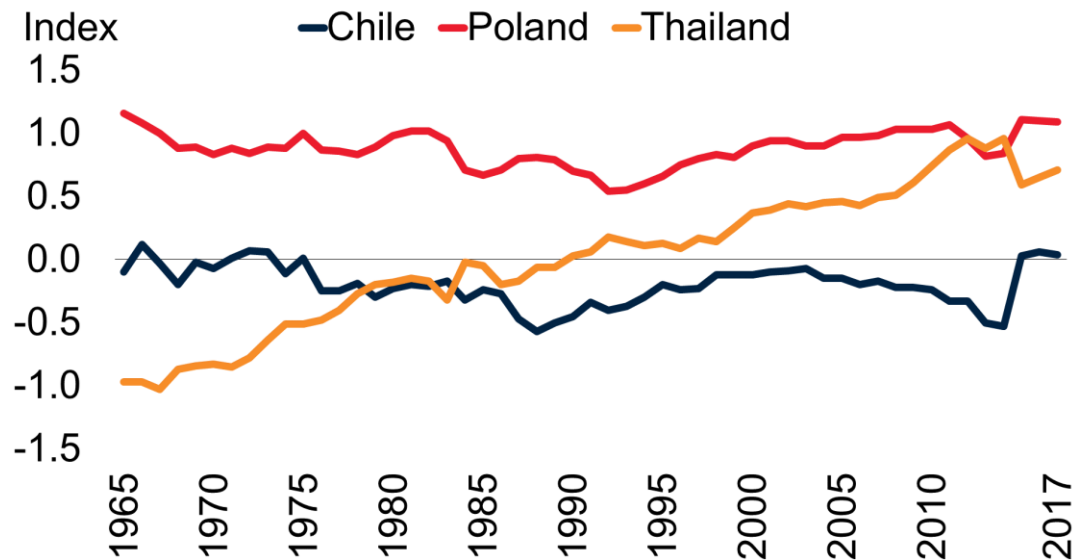Source: Barro and Lee (2015); Hausmann and Hidalgo (2009); World Bank, World Development Indicators.
Left: Based on convergence clubs estimated as in Phillips and Sul (2009). Unweighted average log-productivity levels during 1970-79 and 2010-18. Blue bars show interquartile range.
Right: Marginal effect 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.

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 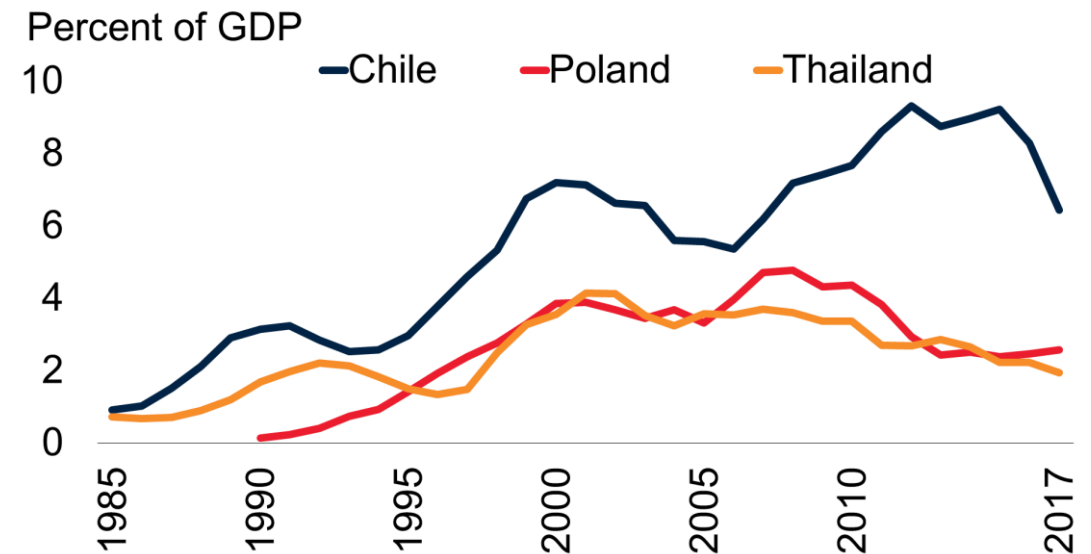a logit model. Detailed results in Annex 4.5. Average years of schooling for males and females from Barro and Lee (2015). Economic complexity index of Hidalgo and Hausmann (2009). FDI is measured in percent of GDP. Government effectiveness survey from the World Bank's Worldwide Governance Indicators. 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.
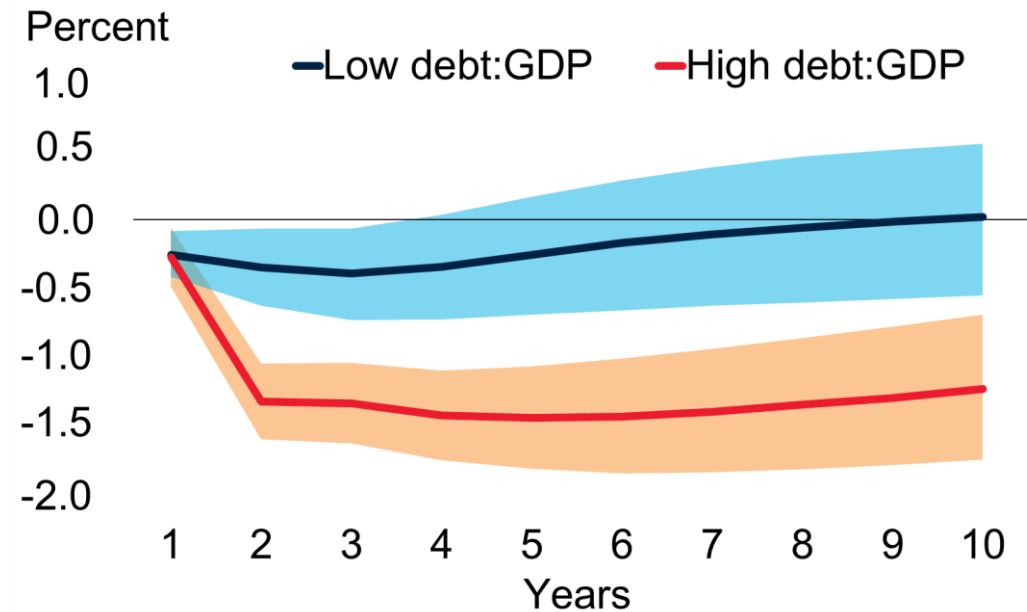
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Fiscal space
counters the adverse effects of shocks

Contemporaneous impacts of climate, banking and currency episodes on labor productivity
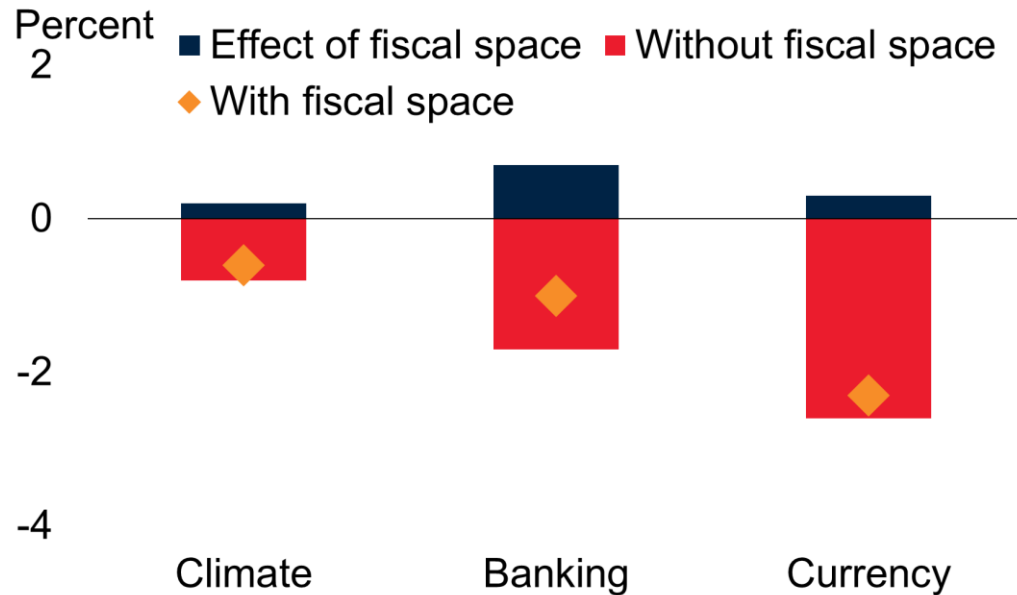
Debt-to-GDP and response of labor productivity to demand shocks: EMDEs
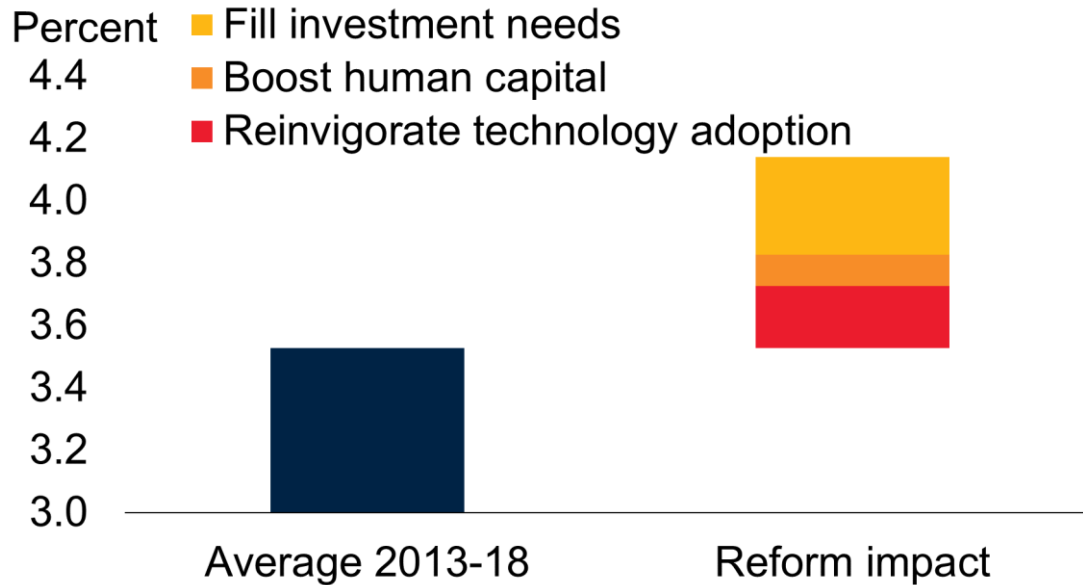

Source: EM-DAT; Laeven and Valencia (2018); Peace Research Institute Oslo (PRIO); World Bank.

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.

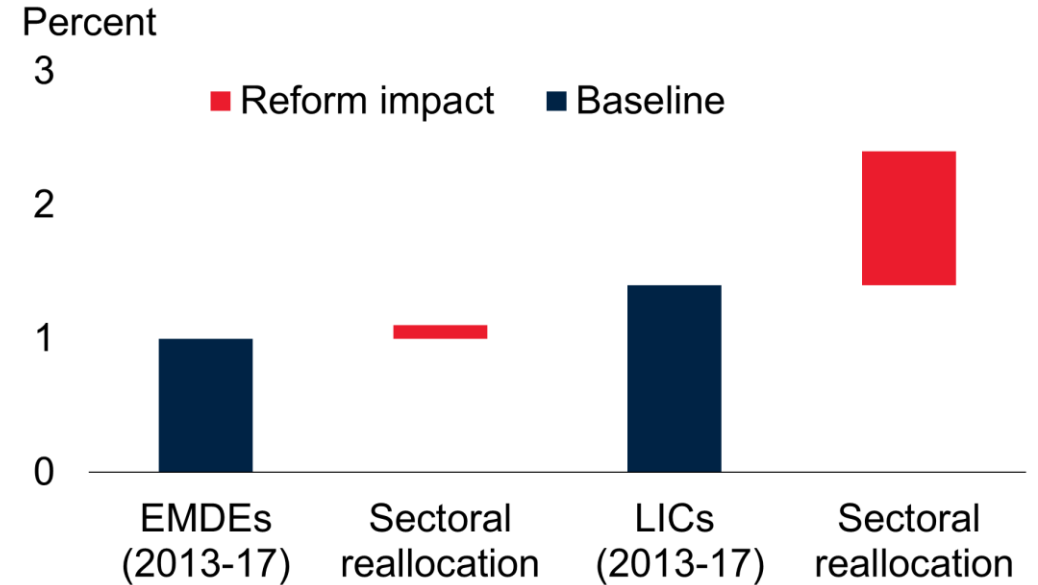RHS: 30 advanced economies and 95 EMDEs are grouped into a top and bottom quartile by their average government debt-to-GDP ratio during 1990-2018. The panel VAR is estimated for each group, producing an impulse response of the level of labor productivity in response to the dominant driver of business-cycle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

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Policies to lift productivity growth
can provide a substantial boost

Simulated Policy Impact

Legend:
- Fill investment needs
- Boost human capital
- Reinvigorate technology adoption

Sectoral reallocation scenario

Legend: Reform impact | Baseline

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.

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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*

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

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Thank you,

Alistair Dieppe

Questions and Comments