Introduction

Motivation

The COVID-19 pandemic has plunged the global economy into its deepest recession since the Second World War. Per capita incomes are expected to decline in about 90 percent of countries in 2020, the largest fraction in recorded economic history, and many millions will be tipped into poverty (World Bank 2020a). The pandemic is also likely to leave lasting scars through multiple channels, including lower investment, erosion of human capital because of unemployment and loss of schooling, and a possible retreat from global trade and supply linkages. These effects may lower productivity and limit the ability of economies to generate growth of real incomes in the long-term.

The likely adverse impact of the pandemic on productivity would be a worrisome outcome, as the growth of labor productivity is the main source of lasting per capita income growth, which in turn is the primary driver of poverty reduction. Most cross-country differences in per capita incomes have been attributed to differences in labor productivity.[1] Whereas the one-fourth of emerging market and developing economies (EMDEs) with the fastest labor productivity growth during 1981-2015 reduced their extreme poverty rates by an average of more than 1 percentage point per year, poverty rates rose in EMDEs with labor productivity growth in the lowest quartile (Figure 1).

The pandemic struck the global economy after a decade that witnessed a broad-based decline in productivity growth. The productivity slowdown, prior to the pandemic, affected around 70 percent of advanced economies and EMDEs. In advanced economies, the prolonged deceleration in productivity growth before the pandemic sparked an intense debate on how it would evolve in the future.[2] Some innovations that had held the promise of considerable productivity gains, including digital technologies and automation of production processes, seemed to have been disappointing in this regard.

Meanwhile, EMDEs experienced the steepest, longest, and most synchronized productivity slowdown over recent decades. In these economies, decelerating productivity growth has put at risk hard-won gains in terms of catch-up with advanced economies achieved prior to the 2007-09 global financial crisis (GFC). Labor

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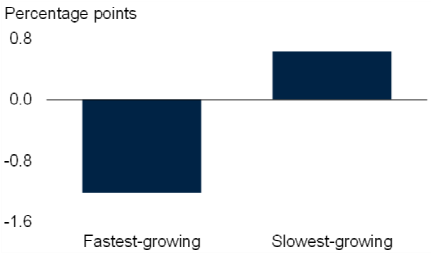
[1] Cross-country differences in growth outcomes have been attributed to differences in human capital, physical capital, and productivity (Caselli 2005; Hall and Jones 1999).

[2] Some have attributed the weakness in productivity growth to waning technological progress. Others argued that the slowdown reflects the delay of incorporation of new technologies in production processes. Another strand of the literature suggests it is due to deficient demand (for details, see Brynjolfsson, Rock, and Syverson 2020, Cowen 2011; Fernald 2015; Gordon 2016; Summers 2015).

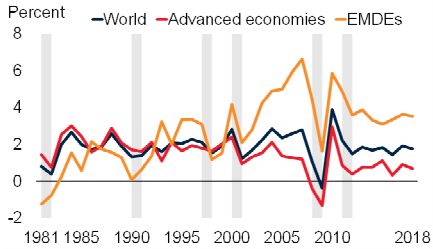
FIGURE 1 Productivity

Between 1981 and 2015 poverty declined in EMDEs with the fastest pace of productivity growth and rose in economies with the lowest pace. Since the global financial crisis there has been a broad-based slowdown in productivity growth. Productivity levels in EMDEs remain less than 20 percent of advanced-economy average. The productivity deceleration reflects smaller gains from sectoral reallocation, a slowdown in improvements in many drivers of productivity growth, and an increase in frequency of adverse shocks.

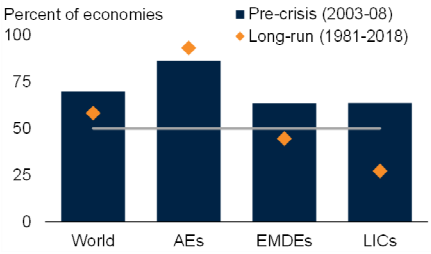
A. Annual change in the poverty rate



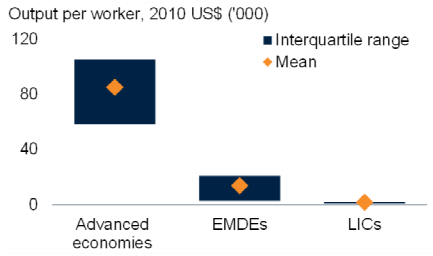
B. Global, AE, and EMDE productivity growth



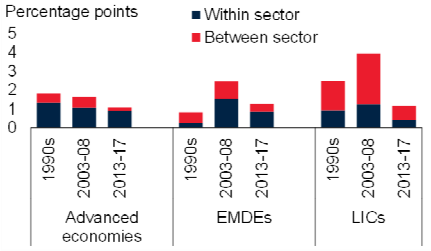
C. Share of economies with 2013-18 productivity growth below historical averages



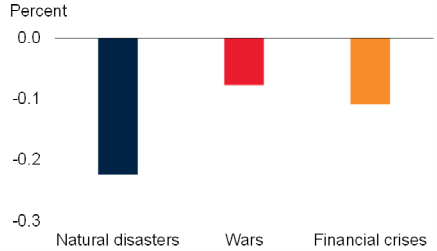
D. Labor productivity, 2010-18 average



E. Within and between sector contributions to productivity growth



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

Note: AEs = advanced economies; EMDEs = emerging market and developing economies. Productivity is defined as output per worker in U.S. dollars. GDP-weighted averages (at 2010 prices and exchange rates), unless otherwise noted.

A-C. Sample of 29 advanced economies and 74 emerging market and developing economies including 11 low-income economies.

A. Unweighted averages using annual data over 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).

B. Shaded areas indicate global recessions and slowdowns (1982, 1991, 1998, 2001, 2009, 2012), as defined in Kose and Terrones (2015) and Kose, Sugawara and Terrones (2020).

C. Share of economies for which average productivity growth during 2013-18 was lower than the long-run (1981-2018) average or the pre-crisis (2003-08) average. For advanced economies, pre-crisis growth is calculated as the average during 2003-07.

D. Simple average of sample that includes 35 advanced economies and 126 EMDEs, of which 27 are LICs.

E. Median contribution based on 54 countries during 1975-95, 94 countries during 1995-99, and 103 countries during 2003-17.

F. Sample of 133 emerging market and developing economies. The average impact of the event, i.e., the effect of an event multiplied by the probability of that particular event occurring in EMDEs.

Click here to download data and charts.

productivity gaps with advanced economies remain substantial, with workers in the average EMDE producing less than one-fifth of the output of those in advanced economies.

Against this backdrop, this book presents the first comprehensive study of the evolution and drivers of productivity growth and policy options to rekindle it. It makes several contributions to a large literature.

Comprehensive assessment. The book examines a wide range of topics that the literature has typically analyzed in isolated studies for smaller groups of countries: trends and prospects for productivity growth; global, regional, domestic and sectoral drivers of productivity, including factor reallocation and technological change; the effects of natural disasters and economic disruptions on productivity; and international productivity convergence.

EMDE emphasis. The literature focuses largely on productivity developments in groups of countries, such as advanced economies or OECD countries, or in specific economies or regions.[3] This book is the first to provide both an overarching global view of productivity developments as well as an in-depth view of productivity in EMDEs, including extensive regional analysis. It uses a comprehensive dataset that provides several measures of productivity growth for up to 35 advanced economies and 129 EMDEs, including 24 low-income countries, for 1981-2018. A new, comprehensive sectoral database for 103 economies allows a detailed analysis of sectoral productivity developments in six EMDE regions.[4]

Analysis of the implications of COVID-19. In analyzing the likely implications of COVID-19 for productivity, the book discusses the critical role of human capital accumulation, investment, and global integration in sustaining productivity growth—and documents how these factors were weakening already before the pandemic struck. It sheds light on the effects of COVID-19 on productivity by examining severe disasters (including epidemics, climate disasters, and wars) since 1960. While the current pandemic constitutes a truly exceptional shock, the book documents that even relatively milder health crises, such as past epidemics, were followed by lasting investment and labor productivity losses. The book also recognizes the possibility that the pandemic could unleash a boost to productivity and discusses the need for complementary policies to enhance potential productivity gains. Although the gains from such a boost may be unequally distributed, policy interventions can mitigate such unintended distributional consequences.

Multiple approaches. The book synthesizes findings from macroeconomic, sectoral, and firm-level data on productivity. Previous studies have typically focused on only one of

[3] For some recent studies considering specific groups of countries, see ADB (2017); Adler et al. (2017); Cusolito and Maloney (2018); Fernald (2012); Dabla-Norris et al. (2015); OECD (2015); and World Bank (2018b, 2019).

[4] The six regions are: East Asia and Pacific (EAP); Europe and Central Asia (ECA); Latin America and the Caribbean (LAC); the Middle East and North Africa (MNA); South Asia (SAR); and Sub-Saharan Africa (SSA).

these three dimensions.[5] It combines these dimensions with a comprehensive review of the literature in each area and state-of-the-art empirical methodologies that have in most cases previously been applied only to advanced economies.

Throughout the book, unless otherwise indicated, productivity refers to real GDP per worker. To ensure as large and comparable a sample as possible over time and across countries, this book uses the number of people employed rather than the number of hours worked as the measure of labor input. A second measure, total factor productivity (TFP), is also examined. TFP measures the efficiency with which factor inputs are combined; in "growth accounting" exercises, estimates of TFP growth are often used to proxy the rate of technological progress.

Key findings and policy messages

Using multiple data sets assembled expressly for this study, the book examines trends in productivity growth since the 1980s. The analysis shows that productivity growth has become more synchronized, with steeper declines and shallower recoveries, and that cyclical factors have played a large role in driving these trends. The study of cross-country sectoral data establishes that the slowdown in productivity growth after the 2007-09 global financial crisis has partly reflected fading reallocation gains due to the increased role of employment in some services sectors, where productivity tends to be lower than in the industrial sector. It concludes that labor productivity growth has been driven by innovation, better education, and investment in physical capital. It also finds that adverse shocks—such as natural disasters, epidemics, wars, and financial crises—have weakened productivity growth.

A recurring theme of the book is the long-standing and broad-based nature of the productivity growth slowdown that began before the COVID-19 pandemic. This highlights that any policy package to rekindle productivity growth needs to be similarly broad-based. A comprehensive approach is needed to facilitate investment in physical and human capital; encourage reallocation of resources toward more productive sectors and enterprises; foster firm capabilities to reinvigorate technology adoption and innovation; and promote an inclusive, sustainable, and growth-friendly macroeconomic and institutional environment. Within this comprehensive approach, specific policy priorities will depend on country circumstances.

A decade of slowing productivity growth

Prior to the outbreak of the COVID-19 pandemic, the global economy featured a broad-based decline in productivity growth. Global labor productivity growth slowed from its peak of 2.8 percent in 2007, just before the global financial crisis, to a post-crisis trough of 1.4 percent in 2016 and remained below 2 percent a year in 2017-18

[5] For macroeconomic analysis, see Adler et al. (2017) and Kim and Loayza (2019). For sectoral analysis, see McMillan, Rodrik, and Verduzco-Gallo (2014) and McMillan, Rodrik, and Sepulveda (2017). For firm-level analysis, see Cirera and Maloney (2017); Cusolito and Maloney (2018); and Fuglie et al. (2020).

(Figure 1). The post-crisis slowdown was widespread, affecting around 70 percent of advanced economies and EMDEs and countries including over 80 percent of the global extreme poor, and affected all EMDE regions. In EMDEs, which have a history of recurring multi-year productivity growth surges and setbacks, the productivity growth deceleration from peak (6.6 percent in 2007) to trough (3.1 percent in 2015) was the steepest, longest, and most synchronized multi-year slowdown in recent decades. Labor productivity in low-income countries was just 2 percent of the advanced-economy average over 2010-2018.

Estimates of the sources of labor productivity growth, based on the growth-accounting decomposition framework, suggest that the slowdown stemmed from both weaker investment and a deceleration in TFP growth, in approximately equal measures (Chapter 1). Most of the labor productivity growth decline in advanced economies and EMDEs over 2013-18 reflected lasting trends beyond cyclical factors.

As a result of the slide in productivity growth during the post-GFC period, the pace of catch-up to advanced-economy productivity levels slowed in ECA, and productivity fell further behind advanced-economy levels in Latin America and the Caribbean (LAC), the Middle East and North Africa (MNA), and Sub-Saharan Africa (SSA). In the regions that suffered the steepest slowdowns in productivity convergence, Europe and Central Asia (ECA) and SSA, they were affected by slowing investment growth, financial market disruptions, and a major commodity price slide.

Many sources of the slowdown

Over the past decade, the global economy has been buffeted by a series of shocks that undermined productivity growth, of which COVID-19 is only the latest. These shocks have compounded the erosion caused by an undercurrent of weakening fundamental drivers of productivity growth, associated with slowing progress achieved in convergence toward advanced-economy productivity levels.

Weakening fundamental drivers of productivity growth

Since the global financial crisis, improvements in many key correlates of productivity growth have slowed or gone into reverse. Working-age population growth has decelerated, educational attainment has stabilized, and the pace of expansion into more diverse and complex forms of production has lost momentum as the growth of global value chains stalled (Chapter 2). A new finding is the increasing importance over time of economic complexity, urbanization, and innovation, as well as demographic factors, and that many drivers of productivity have been stabilizing or declining over time. In addition, technology-driven gains in productivity have tended to displace workers in the short run. The COVID-19 pandemic and associated severe recession have increased the risk of further slowing in the pace of improvements in the long-term correlates of productivity growth.

A major feature of the current global recession has been the collapse of global trade, at more than twice the rate of decline in global output in 2020. This may be followed by

an extended period of weak trade growth, particularly if concerns about the reliability of global supply chains lead countries to retreat from them. This would be particularly damaging to productivity growth prospects in EMDEs, where integration into global value chains has served to boost technological innovation and more effective management processes, and where export-oriented firms are usually the most productive. EMDEs would lose a critical engine of productivity growth if the loss of momentum of global trade growth were sustained.

Slowing reallocation within and between sectors

At the sectoral level, labor reallocation toward higher-productivity sectors has historically accounted for about two-fifths of overall productivity growth in EMDEs. This mechanism of structural change has also weakened since the global financial crisis. Fading productivity gains from labor reallocation have accounted for about one-third of the post-crisis productivity slowdown in EMDEs (Chapter 7). The COVID-19 pandemic may further compound this trend. Health crises, such as epidemics and pandemics, restrict the mobility of people, which slows geographical and sectoral labor reallocation.[6]

Adverse shocks to productivity growth

Natural disasters, wars, and major economic disruptions such as financial crises and deep recessions tend to be accompanied by a large and protracted decline in labor productivity. Natural disasters—70 percent of which are climate-related—account for the vast majority of these adverse events. The number of natural disasters in 2000-18 was nearly double that of the preceding two decades. Health crises, such as pandemics and epidemics, have occurred less frequently than climate disasters—during 2000-18, the world experienced four major epidemics in addition to the swine flu (2009-10) pandemic: SARS (2002-03), MERS (2012), Ebola (2014-15), and Zika (2015-16). Nonetheless, these epidemics–left lasting scars on labor productivity and output by 4 percent cumulatively after three years, mainly through their adverse effects on investment due to elevated uncertainty. (Chapter 3).

The COVID-19 pandemic has hit the global economy at a time of heightened vulnerability, with debt at record highs (Kose et al. 2020). This may further aggravate the productivity losses from the pandemic. In general, the long-term productivity losses associated with adverse shocks have tended to be larger and more protracted in economies with larger debt vulnerabilities (Chapters 3 and 6). This may have reflected highly indebted economies' constraints in supporting demand and activity through fiscal and monetary policies.

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[6] For earlier work on the sectoral effects, see Burda (2008); Cusolito and Maloney (2018); de Vries, de Vries and Timmer (2015); and Fuglie et al. (2020). In the context of COVID-19, specifically, restrictions imposed on the mobility of people affect some sectors more than others and can make it difficult for agricultural workers to move to other sectors (Brinca, Duarte, and Faria-e-Castro 2020; Hale et al. 2020; OECD 2020; Siu and Wong 2004).

Implications of COVID-19 for productivity

As noted above, there are multiple channels through which COVID-19 could have a negative impact on productivity.

- *Weaker investment and trade.* Uncertainty about the duration of the pandemic, and the global economic landscape that eventually emerges from it, may discourage investment (Bloom 2014). Concerns about long-term viability and resilience of operations may lead to a retreat from global value chains—which would choke off an important channel for international technology transmission—and discourage foreign investment that is often related to such production processes (World Bank 2019). Investment and trade play important roles in promoting productivity growth (Chapter 2).

- *Erosion of human capital and shifts in labor markets.* Steep income losses and disruptions to schooling, which have affected more than 90 percent of the world's children, could increase dropout rates and set back human capital accumulation for a generation of children (World Bank 2020b). Education remains a critical driver of productivity growth (Chapter 2).

- *Slowing momentum in labor reallocation.* Since 1995, the reallocation of labor from low-productivity to higher-productivity sectors has accounted for about two-fifths of overall productivity growth in EMDEs (Chapter 7). Mobility restrictions may slow the reallocation of workers away from low-productivity firms and sectors to higher-productivity ones, which often involves relocation from rural to urban areas (di Mauro and Syverson 2020). Pandemic-induced job losses may fall disproportionately on those previously employed in lower-paying services and informal sector jobs, possibly widening income inequality and eroding human capital.

- *Heavy debt burden.* Governments and corporations entered the COVID-19 pandemic with already-stretched debt burdens (Kose et al. 2020). Corporate balance sheets may eventually buckle in COVID-19-induced recessions, straining bank balance sheets to an extent that could trigger financial crises. This would lead to obsolescence of capital as well as large losses of employment (World Bank 2020c). Lasting productivity losses from financial crises are well-documented and confirmed in new event studies in Chapter 3.

Yet, the pandemic may also create offsetting productivity-enhancing opportunities—for those countries that employ complementary policies to seize them. While major natural disasters, wars, and financial crises were typically associated with lasting productivity losses, major recessions sometimes encouraged the adoption of new technologies in certain sectors. COVID-19 could accelerate the automation of production, particularly in manufacturing, as well as the incorporation of digital technologies more broadly. These productivity gains may be unevenly distributed, causing employment losses in some sectors (Chapter 6).

- *Organizational and technological changes.* The COVID-19 pandemic may trigger lasting organizational and technological changes to the way businesses operate if the pandemic becomes a source of "cleansing" effects that eliminate the least efficient firms and encourages the adoption of more efficient production technologies (Barrero, Bloom, and Davis 2020; Caballero and Hammour 1994; Foster, Grim, and Haltiwanger 2016).

- *Diverse and resilient supply chains.* Supply chains may be restructured in ways that increase their diversity and improve resilience. In countries with strong or credibly improving business climates and governance, this could be a new opportunity to join global value chains that promote trade, foreign direct investment, and knowledge transfer and ultimately support productivity growth (World Bank 2019).

- *Improvements in education.* Where reliable and widespread internet access exists but education systems are weak, the pandemic could improve utilization of higher-quality online schooling and training.

- *Financial development.* Digital technologies tested in the pandemic may expand access to finance in the poorest countries, enable more effective government service delivery and accelerate the trend toward the automation of some routine occupations.[7]

Profound implications for development outcomes

The broad-based productivity growth slowdown since the global financial crisis, potentially compounded by protracted productivity losses due to COVID-19, is likely to impede progress toward development goals (Sheiner and Yilla 2020). The acceleration of EMDE productivity growth prior to the global financial crisis reduced the gap between productivity levels in advanced economies and EMDEs; however, since the global financial crisis, the pace of convergence has slowed (Chapter 4). Output per worker in EMDEs remains less than one-fifth of that in advanced economies. In low-income countries (LICs), the corresponding figure is just one-fiftieth. At recent productivity growth rates, it would require over a century to halve the productivity gap between EMDEs and advanced economies.[8] If productivity losses materialize similar to those after past epidemics, convergence could be further set back by COVID-19.

Prior to the global financial crisis, a subset of EMDEs with a strong foundation of education provision, institutional strength, and deepening economic complexity transitioned to higher-productivity convergence "clubs," with rapid convergence to advanced-economy productivity levels. However, the manufacturing and export-led

[7] On how automation changed following recent recessions, see Hershbein and Kahn (2018); Jaimovich and Siu (2020); and Leduc and Liu (2020).

[8] While the pace of convergence has been slow, absolute growth in many LIC economies improved ahead of the crisis, resulting in falling global poverty rates in recent decades. This helped reduce the proportion of the world's population living in extreme poverty from 36 percent in 1990 to 10 percent in 2015 (World Bank 2018a).

approach to increasing productivity growth taken by many of these economies has been facing challenges because of increased automation and a retreat from global value chains. Even if improvements in production technologies drive a sustained boost to productivity, they can lower employment and increase income inequality in the short and medium term (Chapter 6).

No silver policy bullet

Immediate policy measures to address the challenges related to COVID-19 include support for health care systems and measures to mitigate the short-term adverse impact of the pandemic on activity and employment. These measures include fiscal, monetary, and financial sector policies to contain the devastating economic and social effects of the pandemic (Jackson et al. 2020; World Bank 2020b).

Yet it is also important to implement reforms that would enhance potential productivity gains as the pandemic recedes. The multiple sources of the broad-based labor productivity growth slowdown, combined with potential implications of the pandemic, suggest that a multi-pronged policy approach is needed to lift productivity.

First, policies to stimulate investment and improve human capital can raise labor productivity economy-wide. Boosting investment is particularly key in SAR and SSA, where infrastructure gaps remain large, and in LAC, where investment has been persistently subdued or contracting on a region-wide basis in recent years (Chapter 5). In terms of human capital development, initiatives that improve educational attainment could boost productivity in SAR and SSA. In East Asia and Pacific (EAP), ECA, LAC, and MNA, where educational attainment is already substantially closer to the level of advanced economies, productivity gains could be reaped from improving the quality of education and job training.

Second, policies can facilitate the mobility and reallocation of resources toward more productive and more diverse sectors. Given the vulnerability of energy and metals production to price declines in international markets that can have temporary and long-lasting impacts on productivity, economic diversification has long been on the policy agenda in regions with a large number of commodity-exporting economies (ECA, LAC, MNA, SSA). Sectoral reallocation could also be accelerated by strengthening competition (EAP, LAC), promoting intersectoral linkages such as from the information and communication technology sector to the remainder of the services sector (SAR), and reducing barriers to factor mobility (LAC, SSA).

Third, an array of policies could boost productivity growth at the firm level. The structural slowdown in TFP growth in EMDEs suggests a need to reinvigorate technology adoption and innovation. Among the EMDE regions, strengthening intellectual property rights (EAP), reducing state ownership (ECA), revamping rigid labor regulations (LAC); improving access to finance, especially for small and medium-size enterprises; and leveraging technology, digital or otherwise (SSA) could reduce bottlenecks to firm productivity. In regions that are relatively closed to trade (LAC,

MNA, SAR, SSA), reduction of formal trade barriers and further integration into global value chains could spur higher firm productivity. In all EMDE regions, productivity gains could stem from encouraging the formalization of informal firms, including through lowering barriers to entry or aligning tax systems with international standards.

Fourth, these policies should be supported with measures to manage technology-driven labor market disruptions. These measures need to ensure that workers possess skills that complement new production techniques and mitigate the negative effects on transitioning workers through adequate social protections. To be effective, these policies also need to be set in the context of a stable macroeconomic and growth-friendly institutional environment.

Building back better after the pandemic. Better education and more room for dynamic labor relocation could help spread the likely gains from pandemic-induced technology improvements more evenly. Where learning outcomes are poor, government investment in widespread internet access could broaden access to quality online schooling and training. Better-targeted social safety nets could prevent the school dropouts that are associated with long-term income losses (UNPD 2015; Wang et al. 2020). A better-educated labor force would be less likely to be replaced by automation (Chapter 6).

In addition, streamlined government regulations and insolvency systems that ensure prompt and efficient resolution of failing firms could strengthen incentives for, and reduce barriers to, labor reallocation from low-productivity firms and sectors to higher-productivity ones (Djankov et al. 2008; Leroy and Grandolini 2016; World Bank 2020a). These policies would also form part of a comprehensive package to address the challenges of informality that could, over time, shrink the large part of the economy that is particularly vulnerable to economic disruptions such as health and financial crises (World Bank 2019).

Within these broad strands, specific priorities will depend on country characteristics. For example, countries with large unmet public investment needs may want to prioritize expanding fiscal resources to achieve more and better public investment. Countries with anemic private investment may want to prioritize business climate and institutional reforms, reduce support for state-owned enterprises, and broaden access to finance. Countries with predominantly low-skilled workers may want to improve health care and the provision of education and training for workers and managers alike. Countries with lethargic innovation may want to expose their private sectors to foreign knowledge and technologies through greater openness to trade and foreign direct investment.

Given the low level of productivity in EMDE agricultural sectors, and agriculture's role as the primary source of jobs in LICs, policies to raise agricultural productivity, such as boosting infrastructure and land property rights, would likely pay significant dividends. Furthermore, many high-value-added service sectors—including finance, information and communication technologies, accounting, and legal services—provide opportunities for rapid productivity catch-up growth. Facilitating the reallocation of resources toward more productive and more diversified sectors and enterprises by reducing distortions that prevent the efficient allocation of resources can yield significant gains.

In addition to these policies to strengthen the underlying, long-term drivers of productivity growth, steps are needed to limit the long-term damage of adverse events. Countries with ample fiscal space and transparent governance are better able to pursue reconstruction activities, and to use policy efficiently and in a timely manner as well as to help vulnerable sectors that can in turn support productivity growth. Well-designed and enforced policies and regulations concerning the prudent management of financial institutions, construction, and environmental protection can help reduce the likelihood and impact of adverse shocks.

When pursuing these policy steps, it is important to keep in mind that their interactions, as well as the pre-existing policy frameworks, can lead to unintended consequences. For instance, on the one hand, trade liberalization can increase the exposure of private sector firms to foreign knowledge and frontier technologies, thus boosting productivity. On the other hand, however, trade liberalization could be associated with greater informality in the short-term if labor markets are not flexible, thus counteracting policies that aim at facilitating the reallocation of resources toward more productive sectors (Bosch, Goni, and Maloney 2007; Wu et al. 2019; World Bank 2019). Such potential interactions underscore how policy reforms complement each other, which needs to be taken into account when designing a country's appropriate policy mix.

Synopsis

The remainder of this introduction presents a summary of each chapter. After presenting the motivation of the chapter, each summary explains the main questions, contributions to the literature, and analytical findings. After these summaries, a brief discussion of future research directions is presented.

Part A: Productivity trends and explanations

Part A examines the evolution of productivity growth, as well as its main drivers and implications. Chapter 1 documents the evolution of productivity over the past four decades, globally and across various country groups. In particular, it highlights the broad-based productivity growth slowdown over the past decade. Chapter 2 explores the role of a large number of long-term correlates of productivity growth in this productivity growth slowdown. Chapter 3 focuses on the role of short-term adverse events in depressing productivity growth. Chapter 4 shows the implications of the productivity growth slowdown for income convergence.

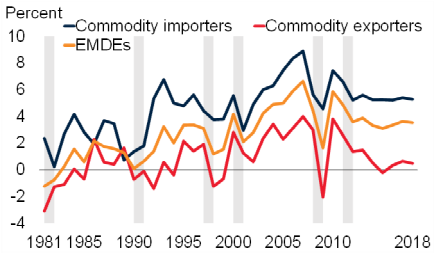
Chapter 1: Global productivity trends

In Chapter 1, Dieppe, Kilic Celik, and Kindberg-Hanlon show that a broad-based slowdown in labor productivity was already underway before the collapse in global activity due to the COVID-19 pandemic (Figure 2). In EMDEs, the slowdown that followed the 2008 global financial crisis set back progress toward Sustainable Development Goals. The pace of convergence slowed even as labor productivity gaps

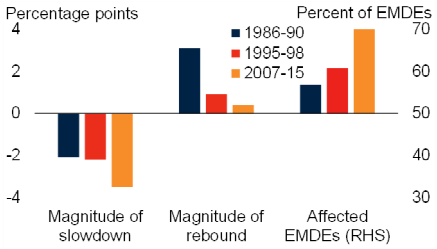
FIGURE 2 Productivity trends

Labor productivity increased in EMDEs prior to the global financial crisis, but during the crisis suffered the steepest, most broad-based and most prolonged decline yet. This slowdown reflected, in equal measure, investment weakness and slowing TFP growth.

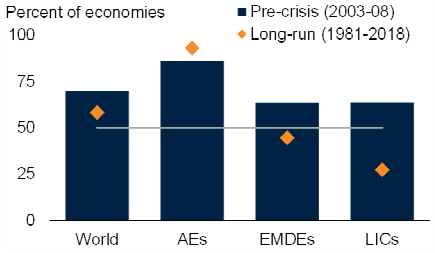
A. EMDE productivity growth



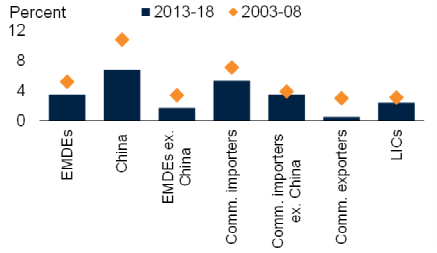
B. Magnitude and extent of multi-year productivity slowdowns and recoveries



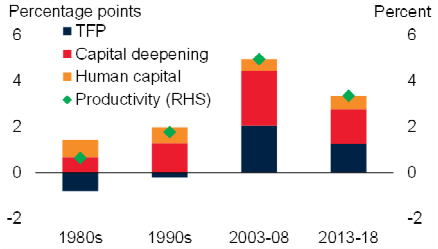
C. Economies with 2013-18 productivity growth below historical averages



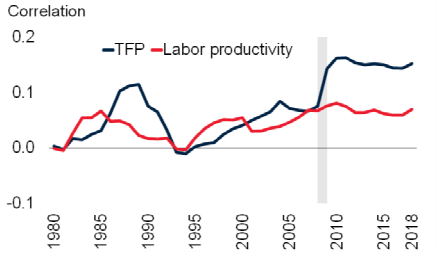
D. EMDE productivity growth, pre- and post-crisis



E. Contributions to productivity growth in EMDEs



F. Synchronization of productivity measures across EMDEs



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

Note: Productivity is defined as output per worker in U.S. dollars (at 2010 prices and exchange rates). Data is from a balanced sample between 1981-2018 that 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. GDP-weighted averages (at 2010 prices and exchange rates), unless otherwise noted.

A. Shaded regions indicate global recessions and slowdowns (1982, 1991, 1998, 2001, 2009, 2012), as defined in Kose and Terrones (2015) and Kose Sugawara and Terrones (2020).

B. "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.

C. Share of economies for which average productivity growth during 2013-18 was lower than the long-run (1981-2018) average or the pre-crisis (2003-08) average. For advanced economies, pre-crisis growth is calculated as the average during 2003-07, due to the earlier crisis-related impact on productivity growth (-0.4 percent in 2008, while EMDE productivity growth remained over 4 percent).

F. Figure shows 10-year rolling correlations. Simple average across all bilateral pairs of economies for each measure of productivity.

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with advanced economies remained substantial, with workers in the average EMDE producing less than one-fifth of the output of those in advanced economies.

The synchronized nature of the productivity slowdown over the past decade raises questions about the role of common factors or spillovers, and the extent to which they will again operate during the pandemic-driven recession in 2020. The nature of the slowdown of the past decade and its drivers have proved controversial. Some have attributed the weakness in productivity growth to waning technological progress as innovations regarded as "low-hanging fruit" have already been developed, leaving only innovations with lower marginal gains (Gordon 2012; Gordon and Sayed 2019). Others regard the slowdown in productivity growth as a "pause," given the time delay between radical new digital technologies being developed and then incorporated into production processes (Brynjolfsson, Rock, and Syverson 2020). A third argument is that the broad-based weakness has been driven by deficient demand (Summers 2015).

As context for the remainder of this book, Chapter 1 presents a comprehensive examination of the evolution of productivity over the past four decades, with an emphasis on developments over the past decade and ahead of what could be a major decline in global productivity growth due to COVID-19. Productivity growth is decomposed into contributions from factor inputs and TFP, as well as sectoral growth and reallocation. The productivity slowdown over the past decade, as well as synchronized nature of global productivity fluctuations, are attributed to demand and other factors.

Specifically, Chapter 1 addresses the following questions:

- How has productivity growth evolved over the last four decades?
- What factors explain developments in productivity, and in particular, the slowdown since the 2007-09 global financial crisis?
- How synchronized are productivity developments?

Contribution. The chapter makes several contributions to the literature and policy debate on labor productivity.

First, the chapter introduces an EMDE focus. Thus far, the literature has focused on trends in subsets of countries such as advanced economies, OECD economies, or specific regions. This chapter is the first to provide both an overarching global and in-depth EMDE view of productivity developments, with a particular focus on the decline in productivity growth over the past decade.

Second, the chapter systematically decomposes productivity into its cyclical and structural sources for the broadest sample of countries yet. This chapter also identifies the sources of the productivity growth slowdown over the past decade—capital deepening, human capital, and TFP—over a broad set of countries.

Third, this chapter is the first to assess the synchronization of productivity growth across a broad range of countries for multiple measures of productivity. It disentangles the role of cyclical productivity drivers in generating broad-based global productivity developments from other drivers. The existing literature has focused on advanced-economy synchronization, whereas this chapter study also considers EMDEs (Imbs 1999; Levchenko and Pandalai-Nayar 2018).

Main findings. The following findings emerge from the chapter. First, the chapter documents a diverse range of productivity trends. Global productivity growth has been resilient, in general, over the past four decades. While experiencing several surges and declines, global productivity growth averaged 1.8 percent in the 1980s and 1990s and the post-GFC period. However, this masks divergent trends among advanced economies and EMDEs. Advanced economy labor productivity growth has halved since the 1980s, in a declining trend that was accelerated by the GFC. In contrast, EMDE productivity growth accelerated rapidly in the runup to the GFC following the stagnation of the 1980s. The GFC ended a period of rising productivity growth, and the ensuing slump risks becoming an entrenched deceleration.

Second, global labor productivity growth declined sharply and the recovery was subdued following the GFC. The labor productivity growth decline following the GFC was the steepest, longest, and broadest multi-year productivity slowdown yet. The post-GFC slowdown has been broad-based, affecting 70 percent of economies and over 80 percent of the global extreme poor as well as reaching all EMDE regions. Commodity-exporting EMDEs—which account for almost two-thirds of EMDEs—have been the worst affected. Synchronized declines in productivity growth have become steeper, and recoveries shallower since 1980, pointing to risks ahead of what is expected to be the largest contraction in global output since World War II due to COVID-19 (World Bank 2020a).

Third, investment weakness accounted for the lion's share of the slowdown in productivity growth over the past decade in advanced economies but not in EMDEs. In EMDEs, subdued investment and slowing TFP growth accounted, in approximately equal measure, for the productivity growth slowdown since the global financial crisis. Fading gains from factor reallocation toward more productive sectors also played a role. The long-run consequences of weak investment growth on productivity point to a need for robust support from public investment and to create the conditions for increased private investment.

Fourth, there has been a large role for cyclical factors in cross-country productivity synchronization. The synchronization of productivity across countries increased sharply during the GFC. After removing cyclical factors from labor productivity growth, however, the correlation across economies was negligible during the global financial crisis. Common productivity developments are therefore largely a business-cycle phenomenon. This pattern is likely to be repeated as a result of the COVID-19 crisis, given the magnitude of the cyclical and demand-driven factors at play.

Having documented the productivity growth slowdown over the last four decades and established its main sources, the book examines the role of long-term drivers of productivity growth in Chapter 2. These have been identified in a large literature on the correlates of productivity.

Chapter 2: What explains productivity growth

Long-term labor productivity growth rates have varied enormously across EMDEs. In 1960, labor productivity—output per worker—in China was $423 in 2010 USD, slightly lower than Burkina Faso's $427. By 2018, productivity in China had increased to $13,919, eight times higher than Burkina Faso's $1,641. There are many differences between the two countries: for example, in 1960 the share of the population with primary school education was 26 percent in China compared to 0.7 percent in Burkina Faso. China also invested substantially more: gross investment in China averaged 37 percent of GDP over 1960-2018, about double that of Burkina Faso.

In Chapter 2, Dieppe, Kawamoto, Okawa, Okou, and Temple explore the drivers of long-term productivity growth and how their roles have varied over time, with a focus on the recent slowdown. Many factors have influenced productivity growth over the past 60 years. In the long term, labor productivity growth relies on innovation, physical capital investment, and investment in human capital. These proximate drivers are shaped by the environment in which firms operate: market structures, infrastructure, the institutional framework, and the quality of governance.

Key drivers of productivity growth—such as investment in human capital through primary and secondary education—have seen major improvements over the last 60 years in EMDEs (Figure 3). They have even improved more than in advanced economies and contributed to strong productivity growth prior to the global financial crisis. Nonetheless, in many cases, wide gaps between EMDEs and advanced economies remain. At the same time, reflecting the structural changes that economies have undergone over the last 60 years, the roles of various drivers have changed, with some increasing in importance, and others decreasing.

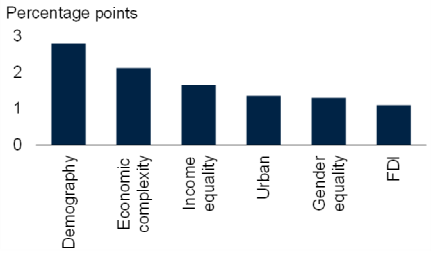
The recent evolution of these drivers helps to explain why global productivity growth has weakened over the past decade. Some changes can be linked directly to the crisis, such as increased uncertainty and slower investment growth. The COVID-19 pandemic will be a further blow to growth prospects around the world, disrupting trade and FDI, causing investments to be postponed or canceled, and weakening government finances. Other changes reflect separate, long-term trends. For example, the pace of improvement in some drivers of productivity in EMDEs has naturally slowed as the distance to the best-practice frontier has diminished.

The COVID-19 pandemic threatens to weigh on longer-run trends that could impede productivity growth in EMDEs. Over the past decade, the prospects for further trade integration have diminished, and the expansion of global value chains has lost momentum. Sharp declines in global trade and investment amid the pandemic could

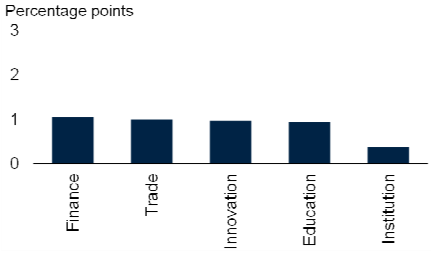
FIGURE 3 Productivity growth performance and initial conditions

Productivity growth was 1 to 3 percentage points higher in countries with strong macroeconomic fundamentals and favorable demographic trends. Gaps in drivers of productivity between advanced economies and EMDEs widened in tertiary education, life expectancy at age 50, financial development indexes, and global value chain (GVC) participation.

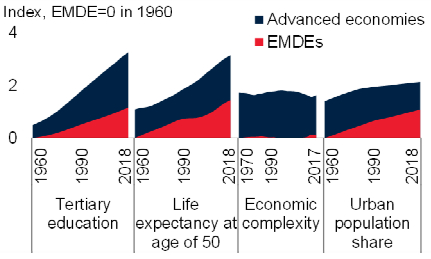
A. Improvement in productivity growth with favorable initial conditions



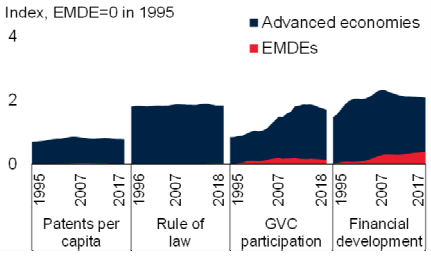
B. Improvement in productivity growth with favorable initial conditions, continued



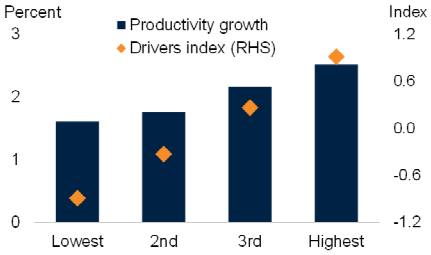
C. Average level of drivers over time



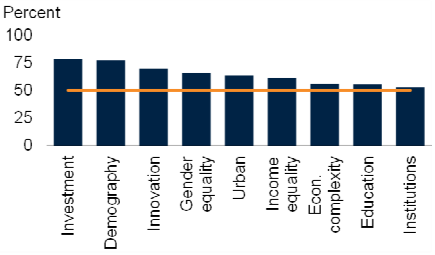
D. Average level of drivers over time, continued



E. Quartiles of productivity drivers and average EMDE productivity growth 1995-2008



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



Source: World Bank.

A-D. Unbalanced panel of 111 countries.

A.B. The difference in average labor productivity growth between the highest 25 percent and lowest 25 percent of the distribution of initial levels of key correlates of productivity growth. See Chapter 2 for details.

C.D. Simple average of drivers over time, by income level. Variables are normalized so that the average value for EMDEs in 1960 is zero and standard deviation is one. Data are five-year moving averages for economic complexity, and are three-year moving averages for patents per capita, rules of law, GVC participation, and financial development.

E. Average level of productivity growth and "index of drivers" in each quartile over 1995-2008. "Index of drivers" created by weighting normalized levels of each potential driver in panels A and B by its estimated impact on productivity growth. The samples include 30 advanced economies and 61EMDEs.

F. Share of economies where improvements in each driver of productivity during 2008-18 was lower than those in the pre-crisis period of 1998-2007. Variables corresponding to each concept are (sample in parentheses): Investment (69) = investment to GDP ratio, Demography (75) = share of working-age population, Innovation (27) = patents per capita, Gender equality = ratio of years of schooling of female to male, Urban (75) = Urban population (percent total), Income equality (73) = (-1)*Gini coefficient, Econ. complexity (56) = Economic Complexity Index as defined in Hidalgo and Hausmann (2009), Education (52) = years of schooling, Institutions (75) = WGI Government Effectiveness Index.

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accelerate these trends. For many countries, they will mean subdued activity, instability, and new pressures on governments.

In the latter decades of the 20th century, many countries benefited from a rising share of the working-age population. This is now leading to aging populations and at least a partial reversal of the earlier "demographic dividend." In other areas, past improvements will be difficult to replicate. Further progress in health and education can contribute to growth, but it will be hard to match the major gains of the last 60 years. Meanwhile, investments could be further damaged by the lasting impacts of COVID-19. On a more positive tone, new technologies could yet reinvigorate productivity growth, and some of the improvements in drivers already achieved should continue to support growth over the next few decades.

Against this backdrop, Chapter 2 examines four questions:

- What have been the main factors associated with long-term productivity growth?
- How much have the main factors individually contributed to long-term productivity growth?
- What are the factors behind recent trends in productivity?
- What policy options are available to boost productivity?

Contributions. The chapter makes several contributions to the literature and policy debates. First, the chapter reviews past research on the correlates of productivity growth, motivating the selection of drivers for investigation. It explores the channels through which various drivers operate, while recognizing that they cannot be considered in isolation. As some previous research acknowledges, drivers can interact in ways that strengthen or weaken their effects. The chapter also reviews the literature on sources of growth in total factor productivity (TFP) at the firm level.

Second, the chapter presents new empirical findings that go beyond previous work, partly by examining a range of potential drivers over a longer time period, using a Bayesian approach to combine information from many different models. The analysis allows the importance of drivers to change over time, while the choice of priors recognizes that several candidate variables may represent the same underlying driver.

Third, the chapter presents new stylized facts on developments in key productivity drivers: whether drivers in EMDEs have been converging with those in advanced economies over the long run, their paths over the past decade, and the prospects for improvement. The chapter also discusses policy options to support the main drivers, and thereby raise productivity growth.

Main findings. The following findings emerge. First, historically, labor productivity growth has been driven by innovation, better education, and investment in physical capital. Innovation and private sector investment require a growth-friendly

environment, with supportive institutions and policies, including policies that promote macroeconomic stability and the rule of law. Productivity growth also seems to benefit from expertise in producing relatively complex and sophisticated exports, which is associated with international technology diffusion. This finding complements past research and supports the argument that "what you export matters" (Hausmann, Hwang, and Rodrik 2007).

Second, the effects of different drivers on productivity growth have changed over time. Innovation and experience with economic complexity, related to participation in global value chains and cross-border technology transfer, seem to have increased in importance. So have demographic factors, notably changes in population age structures. In contrast, the importance of urbanization, related to the sectoral shift from agriculture to manufacturing and services, has weakened. These findings complement those of Bruns and Ioannidis (2020), as well as recent evidence on the changing effects of economic complexity, urbanization and innovation.

Third, many productivity drivers in EMDEs fall short of advanced-economy conditions, despite remarkable improvements over the last 60 years in key human capital indicators such as the provision of primary education and infant mortality rates. The chapter documents these gaps in a systematic way. For some productivity drivers, including ones that are essential to innovative economies—tertiary education, financial development, and patents per capita—the gaps have widened. Improvements in other drivers, such as institutions and economic complexity, have stalled. In addition, many drivers of productivity growth have faltered, including those which had previously supported strong productivity growth. Working-age population growth has slowed, along with growth in average educational attainment. As the expansion of global value chains has lost momentum, so has the movement toward more diverse and complex forms of production.

Fourth, the COVID-19 pandemic has made the near-term outlook for productivity growth even more challenging. Weaker investment and trade, erosion of human capital, slower labor reallocation, heavier public and private debt burdens, and widening inequality could push down on productivity growth. Yet, the pandemic may also create productivity-enhancing opportunities such as lasting organizational and technological changes for business and education, diversifying global value chains, and changing social norms.

Fifth, the recent slowdown in productivity growth has multiple sources and, hence, action on a range of fronts will be needed. Governments seeking to raise productivity growth can increase public investment and stimulate private investment; improve human capital; foster firm productivity, partly through on-the-job training and upgraded management capabilities; increase the exposure of firms to international trade and foreign investment; enable the reallocation of resources toward more productive sectors; and, seek to diversify production. The benefits of many productivity-friendly policies could be enhanced by improving the macroeconomic and institutional environment.

Chapter 2 has explored the long-term drivers of productivity. However, the past decade has been buffeted by a series of adverse shocks. Chapter 3 examines the implications of such shocks for productivity.

Chapter 3: What Happens to Productivity During Major Adverse Events

As Chapter 1 showed, the global economy has witnessed a broad-based slump in labor productivity growth over the past decade. In Chapter 3, Dieppe, Kilic Celik, and Okou show that this follows a typical pattern associated with adverse events such as natural disasters, wars, and financial crises. These events often result in protracted economic losses through declines in both the level and growth rate of output, as well as persistent losses in labor productivity. Among natural disasters, the COVID-19 pandemic—a major epidemiological disaster—is an adverse event on a massive global scale that could have a large and persistent impact on global productivity.

The damage from adverse events comes through a variety of channels. Natural disasters and wars may damage key infrastructure and disrupt value chains (Acevedo et al. 2018; Cerra and Saxena 2008). Financial crises increase uncertainty, damage confidence, impede access to finance, and lower corporate earnings—all developments that are likely to reduce investment. More generally, adverse events can dampen labor productivity by causing a loss of skills, reducing the efficiency of job matching, as well as by disrupting knowledge creation, transfer, and acquisition. The growth of labor productivity is therefore likely to be impeded by declines in both the growth of TFP and capital deepening.

Severe global biological disasters such as COVID-19 can damage labor productivity by affecting both supply and demand. Adverse supply-side effects can occur through the depletion of labor force; the tightening of financial conditions; and the disruption of supply chains, which are an important measure for the diffusion of innovation. The COVID-19 pandemic is also weighing sharply on aggregate demand, by depressing consumer demand for goods and services, eroding business confidence and investment, and raising financing costs (Baker et al. 2020; Ludvigson, Ma, and Ng 2020; Ma, Rogers, and Zhou 2020). Weaker aggregate demand can reduce the incentive for product innovation, quality improvement, slow technological progress, and lower productivity. Furthermore, these negative impacts can be amplified by other factors such as cross-border spillovers, lingering financial vulnerabilities, and the compounding effects of recessions. An analysis of economic developments around previous, smaller-scale epidemiological disaster can provide a framework for understanding the channels through which productivity could be affected by COVID-19, and the potential persistence of its effects.

The productivity losses that result from adverse events in EMDEs can reduce the rate of convergence to the advanced-economy technology frontier. However, the effects of adverse events on labor productivity and output hinge not only on their magnitude, duration, and frequency, but also on country characteristics and circumstances, including the policy response and the pre-shock buffers established by policy makers.

Large-scale and severe disasters are typically more damaging to labor productivity and output. LICs and countries that are already affected by fragile and conflict-affected situations (FCS) have generally been less able than other countries to cope with wars and climate disasters such as droughts. If sufficiently severe, natural disasters can trigger financial crises—particularly in countries with high levels of debt—or lead to conflicts and wars.

Policies should be geared toward both reducing the likelihood of adverse shocks and alleviating their impacts. Depending on available policy space, countercyclical macroeconomic policies can help counter negative effects on investment and labor markets. Successful examples include the fiscal and monetary stimulus undertaken in the global financial crisis and, in 2020, in the COVID-19 pandemic by many advanced economies and EMDEs and the international assistance provided for reconstruction in the aftermath of recent natural disasters in some FCS countries. Structural policy frameworks—such as the quality of governance and business climates—can facilitate faster adjustment, protect vulnerable groups, and mitigate long-lasting damage to productivity.

Chapter 3 examines a wide range of adverse events to assess the extent to which they have had protracted effects on labor productivity and TFP. The chapter aims to shed light on the following questions:

- How frequently and through what channels have adverse events affected productivity?
- How have adverse events differed in the scale of their impact on productivity?
- What policies can help to mitigate the impact of adverse events on productivity?

Contributions. This chapter makes several contributions to an expanding literature on the impact on productivity of adverse events. First, it is the first to undertake a systematic study of the effects of a broad range of adverse events—natural disasters (with a focus on large epidemics), wars, and financial crises—on alternative productivity measures across a wide range of advanced economies, EMDEs, and LICs.

Second, it explores both short-term and long-term effects of these events on productivity. One key aspect of the effects of adverse events on productivity is their persistence. Several studies have documented protracted losses in output or productivity following business cycle downturns, recessions or financial crises. This chapter builds on and broadens previous work (Kilic Celik et al. forthcoming; Easterly et al. 1993; Mourougane 2017; Noy 2009) by assessing the channels, the magnitude of the losses, and the speed of recovery across a wide range of different types of adverse event.

Third, it offers a comprehensive discussion of supportive policy frameworks. This chapter analyzes feasible policies to mitigate the corrosive effects of negative shocks. It discusses the role of structural policies and reforms that can support productivity following adverse shocks. It also highlights the importance of fiscal space in building a cushion that can be used to counter productivity losses in a country hit by adverse events.

Main findings. The estimated results, broadly consistent with the literature, include the following. First, natural disasters have occurred more often than wars or financial crises and their frequency has increased since 2000 (Figure 4). Natural disasters can be subdivided into several distinct types: climate disasters such as floods and cyclones, biological disasters such as epidemics or insect infestations, and geophysical disasters such as earthquakes and volcanoes. During 1960-2018, the number of episodes of natural disasters was 25 times that of wars and 12 times that of financial crises. Climate-related events were the most frequent type of natural disaster, with a doubling of their frequency after 2000. LICs, and particularly SSA, were most affected by natural disasters. Biological and geophysical episodes are less frequent and are often more geographically contained.

Second, severe disasters have lasting effects on productivity. While wars inflict particularly severe and long-lasting damage to both capital and total factor productivity, the high frequency of climate disasters increases their importance as a source of damage to productivity. On average during 1960-2018, climate disasters reduced annual contemporaneous labor productivity by about 0.5 percent—about one-fifth of the impact of a typical war episode. However, climate disasters have occurred 25 times as frequently as wars, meaning their cumulative negative effects on productivity are larger. Moreover, severe disasters have strong negative effects on productivity. After three years, severe climate disasters lower labor productivity by about 7 percent, mainly through weakened total factor productivity. Severe disasters can also trigger other types of adverse events such as financial crises and wars, thus compounding the corrosive effects on productivity.

Third, severe biological disasters can cause persistent damage to productivity. Four epidemics since 2000 (SARS, MERS, Ebola, and Zika) had significant and persistent negative effects on productivity. They lowered productivity by 4 percent after three years. Amid elevated uncertainty, epidemics have reduced labor productivity through their adverse effects on investment and the labor force. The COVID-19 pandemic may be significantly worse than most past disasters because of its global reach and the unprecedented social distancing and containment measures put in place to slow the spread of the virus.

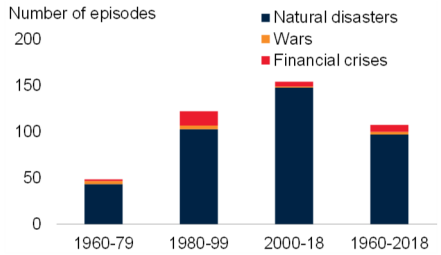
Fourth, productivity is highly vulnerable to financial stress, especially when accompanied by a rapid build-up of debt. Financial crises weigh heavily on productivity growth through a wide range of channels. During debt accumulation episodes associated with financial crises, cumulative productivity gains three years into the episode were 2 percentage points lower than in episodes without crises in EMDEs. The rapid build-up of debt in EMDEs over the past decade increases vulnerabilities to financial crises and limits the ability of countries to cope with other types of adverse events. The current COVID-19 pandemic is likely to exacerbate those vulnerabilities by further stretching public and private balance sheets.

Fifth, policies can help to prevent and to mitigate the effects of adverse events. A rapid policy response to adverse events, including countercyclical macroeconomic policies and

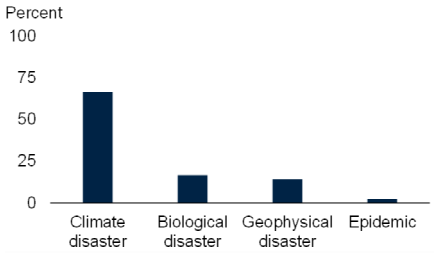
FIGURE 4 Productivity after major adverse events

In 1960-2018, natural disaster episodes occurred 25 times more frequently than wars, and 12 times more frequently than financial crises. Climate disasters accounted for nearly 70 percent of all disasters. However, natural disasters were typically shorter than financial crises or wars. Previous epidemics (SARS, MERS, Ebola, and Zika) caused lasting labor produc-tivity losses of around 4 percent after three years, mainly through weakened investment.

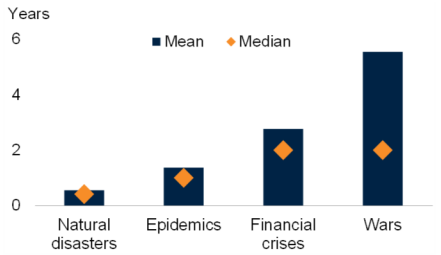
A. Average number of episodes per year



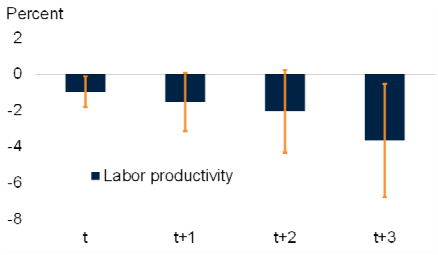
B. Episodes by type of natural disaster, worldwide, 1960-2018



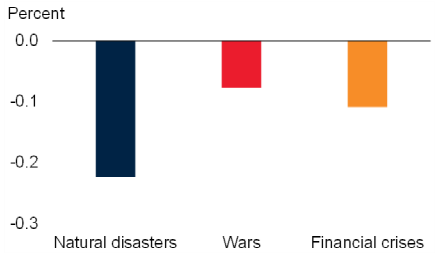
C. Average duration of adverse events



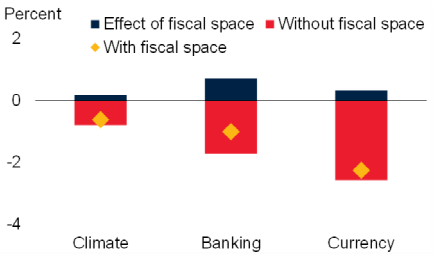
D. Effects of epidemics on labor productivity



E. Contemporaneous impacts of adverse events episodes on labor productivity, scaled by frequency of event types



F. Contemporaneous impacts of climate, banking and currency episodes 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). 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, of which 35 are advanced economies and 135 are EMDEs, including 27 LICs.
A. Average number of episodes per year for each type of adverse event.
B. Biological disasters include epidemics.
C. The five pandemics and epidemics are SARS (2002-03), Swine flu (2009), MERS (2012), Ebola (2014-15), and Zika (2015-16).
D. Bars show the estimated impacts of the four most severe biological epidemics on labor productivity levels relative to non-affected EMDEs. The four epidemics considered are SARS (2002-03), MERS (2012), Ebola (2014-15), and Zika (2015-16). See Chapter 3 for details. The sample includes 116 economies, of which 30 are advanced economies and 86 are EMDEs.
E. The average impact of the event, which is the effect of an event multiplied by the probability of the event occurring in EMDEs.
F. 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).
Click here to download data and charts.

reconstruction spending when appropriate, can help to mitigate the negative effects on productivity. Improving institutions and the business climate can also help increase the pace of recovery following an adverse event. Appropriate policies and regulations with respect to finance, construction, and environmental protection can help reduce the frequency of adverse events. Fiscal space allows economies to fund recovery efforts after natural disasters, and sound fiscal policies tend to limit the likelihood of a financial crisis. Fiscal stimulus also helps cushion the severity of large adverse events such as severe biological disasters.

Chapter 4: Productivity Convergence: Is Anyone Catching Up?

In Chapter 4, Kindberg-Hanlon and Okou show that labor productivity in EMDEs is less than one-fifth of the level in advanced economies, while in low-income countries (LICs), it is just 2 percent of advanced economy levels. The unconditional convergence hypothesis states that productivity catch-up growth will tend to occur where productivity differentials exist and that these will decline over time. However, this type of convergence may fail to occur for reasons such as the existence of international barriers to technology transfer and differences in saving and investment behavior. Conditional convergence is more restrictive, as catch-up productivity growth may depend on characteristics of economies beyond their initial productivity levels. For example, only economies with characteristics such as high institutional quality or education levels may be able to converge to the frontier.

The large productivity gap between EMDEs and the frontier implies that there is a potential for substantial income gains in EMDEs if either of these two hypotheses holds. Historically, productivity gaps have remained stubbornly ingrained, with the bulk of evidence pointing away from unconditional convergence (Johnson and Papageorgiou 2020). However, falling global poverty rates in recent decades have been an encouraging sign that economies near the bottom of the distribution have made productivity and income gains, helping reduce the proportion of the world's population living in extreme poverty from 36 percent in 1990 to 10 percent in 2015 (World Bank 2018a). Most of the fall is concentrated in SAR and in EAP, the two regions with the highest rates of productivity growth among EMDEs.

Faster EMDE productivity growth in recent decades does not itself imply convergence toward the advanced economy frontier, which has also continued to expand. In addition, if the unconditional convergence hypothesis holds, the gains in productivity should be broad-based. More complex dynamics of productivity growth could instead support the convergence club hypothesis, with different clubs of economies converging toward different productivity levels depending on their characteristics.

Finally, productivity growth has slowed following the global financial crisis in EMDEs and faces headwinds from the COVID-19 crisis. The pandemic-driven global recession is occurring during a period of heightened debt vulnerabilities, while previous epidemics and other major natural disasters have been followed by prolonged declines in labor productivity growth and investment. Commodity prices have also collapsed, adding

negative pressure on investment in the large number of commodity-reliant EMDEs, and will remain weak in the event the global recovery is drawn out. There are further risks to EMDE convergence if countries adopt inward-looking policies that result in the fragmentation of global trade—integration into global value chains has been a key vehicle for the adoption of more advanced production processes in EMDEs.

Against this backdrop, this chapter examines the following questions.

- How has productivity convergence evolved over the past five decades?
- Are there "clubs" of economies following different convergence trajectories?
- What separates those economies in successful and unsuccessful clubs?
- What are the policy implications?

Contribution. This chapter makes several contributions to the literature. First, it expands a reinvigorated literature on *income per capita* convergence by examining *labor productivity* convergence. The existing literature, which began empirically assessing income convergence in the mid-1980s, has generally found broad-based support for convergence that is conditional on country characteristics, but little support for the unconditional convergence hypothesis. The surge in EMDE growth in the 2000s has reignited this debate (Patel, Sandefur, and Subramanian 2018). The majority of the literature has focused on convergence in income per capita (Barro 2015; Caselli 2005; Mankiw, Romer, and Weil 1992). In contrast, the focus in this chapter is on labor productivity convergence, the main driver of lasting per capita income convergence.

Second, this chapter highlights important nonlinearities captured by "convergence clubs" following different convergence paths. The existing literature on convergence clubs thus far has not taken account of the large increase in EMDE productivity growth since 2000 (Battisti and Parmeter 2013; Pesaran 2007; Phillips and Sul 2009). This chapter updates this literature and identifies important changes in the membership of convergence clubs that have occurred in recent decades.

Third, this chapter utilizes multiple methodologies and common datasets—previous studies have been hampered by data differences that have made conclusions non-comparable (Johnson et al. 2013). It is also the only recent study of convergence that measures labor productivity at market exchange rates as opposed to PPP-adjusted measures, noting that the latter can be problematic in assessing club convergence.

Fourth, this chapter is one of the few studies examining the drivers of convergence-club membership and transitions, and the only one applied to a global set of economies. Existing studies either focus on European economies (Bartkowska and Riedl 2012; Von Lyncker and Thoennessen 2017) or regions within China (Tian et al. 2016) and do not assess the causes of changing club membership over time. In contrast, this study identifies the drivers of convergence club membership and transitions between clubs among 97 economies during 1970-2018.

Main findings. The following findings emerge from the analysis in this chapter. First, there are large gaps between EMDE and advanced-economy productivity. On average since 2010, labor productivity in EMDEs was just under one-fifth of that in advanced economies, and in LICs it is a mere 2 percent (Figure 5). EMDE productivity gaps relative to advanced economies widened during the 1970s, 1980s, and 1990s but began to narrow in the 2000s.

Second, there has been some convergence in productivity levels since 2000. Examples of economies converging from low levels of labor productivity all the way to the frontier were rare in the latter-half of the 20th century. Since 2000, productivity growth has exceeded the advanced economy average in around 60 percent of EMDEs. However, the productivity gap declined at just 0.5 percent per year, on average, and convergence rates have begun to slow. Even at this peak rate, it would take more than 100 years to halve the initial productivity gap between economies. While the average rate of convergence has been low, convergence rates for economies with good characteristics are substantially higher—new evidence suggests that the conditional convergence rate has accelerated in recent decades.

Third, since 1970, countries have fallen into five distinct convergence clubs. The first club of countries, converging to the highest productivity levels, includes all advanced economies and several middle-income EMDEs that have experienced sustained long periods of robust growth since the 1990s. The second club includes the majority of upper-middle-income EMDEs, while the third through fifth clubs include lower-middle and low-income countries.

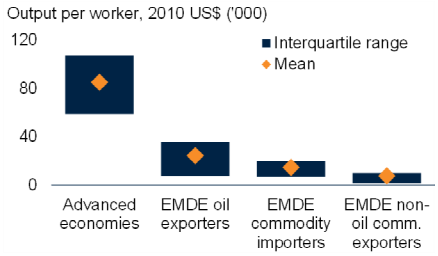
Fourth, transitions to higher-productivity convergence clubs has been associated with successful policies. Increasing numbers of EMDEs have moved into the highest-level productivity club in recent decades, in contrast to older assessments of club convergence that found few positive convergence club transitions. These countries are found to have had a foundation of systematically better initial education levels and greater political stability, which has helped them deepen the complexity of their economies, with diversified production across a broad range of sectors outside of their original comparative advantage. Several country case studies highlight the importance of export-promotion, global value chain integration, and foreign direct investment in transitioning to higher-productivity convergence clubs.

Fifth, the environment for switching to higher convergence paths is becoming more challenging. EMDEs that have successfully shifted into higher-level productivity clubs have often relied upon manufacturing-led development—efforts to enhance the complexity and diversity of exports can prove to be high-reward but have also frequently been costly failures. This strategy faces increasing challenges due to falling global manufacturing employment and slower trade growth. In addition, a weak outlook for commodity prices and slow improvements in many key covariates of productivity growth, such as institutional quality, urbanization, and educational attainment pose further headwinds to both new and continuing transitions to high productivity levels. The global recession due to COVID-19 has the potential to amplify many of these

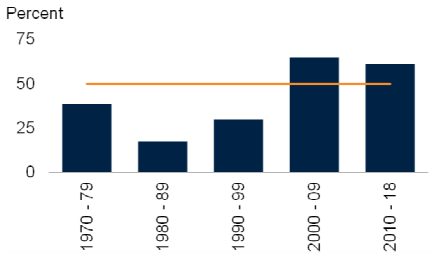
FIGURE 5 Unconditional, conditional, and club productivity convergence

On average, labor productivity in EMDEs is less than one-fifth of the advanced-economy average. These EMDE productivity gaps widened during the 1970s, 1980s, and 1990s but narrowed from 2000 onwards. Since the late 1990s, productivity growth has been higher in economies with lower initial levels of productivity. However, the implied pace of convergence is small, suggesting that it will take more than 100 years to halve the gap (on average). Sixteen EMDEs have transitioned to the highest-productivity convergence club since the 2000s and made the largest productivity gains. Those transitioning EMDEs benefitted from high average levels of education, diverse and complex production capabilities, strong institutions, and above-average FDI inflows.

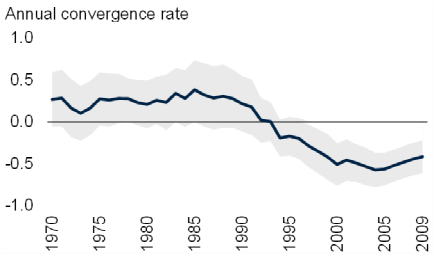
A. Labor productivity in EMDEs by commodity exporter status, 2010-18 average



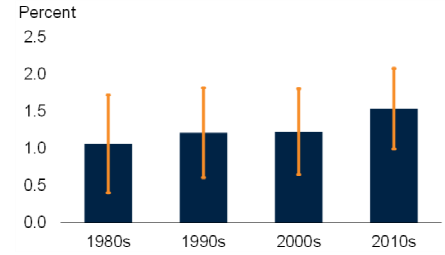
B. Share of EMDEs with a narrowing productivity gap with advanced economies



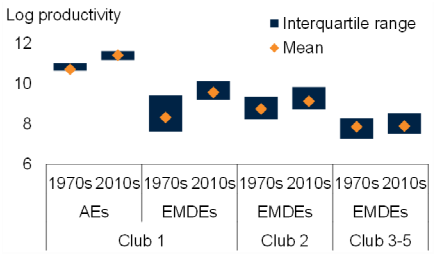
C. Unconditional convergence rate



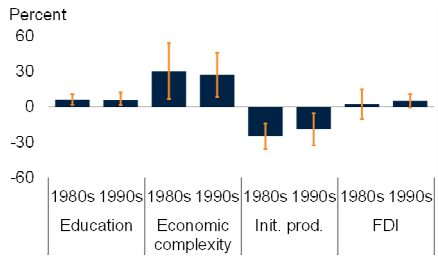
D. Conditional annual convergence rate: all economies



E. Productivity, by convergence club, 1970s-2010s



F. The effect of covariates on the probability of EMDE joining high-productivity convergence club



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

Note. Productivity defined as output per worker in U.S. dollars (at 2010 prices and exchange rates). See Chapter 4 for details.

A. Simple average of sample that includes 35 advanced economies and 126 EMDEs, of which 27 are oil exporters, 47 are commodity-importing EMDEs, and 52 are non-oil commodity-exporting EMDEs.

B. 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.

C.-F. Based on 29 advanced economies and 69 EMDEs. Sample excludes 6 EMDE oil exporters.

C. Gray shaded area indicates 95 percent confidence intervals.

D. Annual convergence rate implied by a cross-sectional β-regression in each decade.

E. 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.

F. Marginal effect of a one-unit increase in the covariates on the probability of an EMDE joining the fast productivity growth convergence Club 1. Init. prod = initial productivity.

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headwinds. Risks include persistently subdued commodity prices, global value chain fragmentation if governments pursue inward-looking policies, and lasting damage to human capital development from the widespread closure of education institutions due to social distancing measures and erosion of skills due to unemployment.

Part B. Regional dimensions of productivity

As Part A established, the productivity growth slowdown over the past decade was broad-based and reached all EMDE regions. That said, its extent, its sources and drivers, and its implications for convergence differed considerably across EMDE regions. Part B explores these regional differences.

Chapter 5: Regional productivity

In Chapter 5, Vorisek, Kindberg-Hanlon, Steinbach, Taskin, Vashakmadze, Wheeler, and Ye draw out differences in regional productivity trends and policy priorities. Specifically, it addresses the following questions:

- How has the evolution of productivity varied across the six EMDE regions?
- What factors have been associated with productivity growth?
- What policies should be prioritized in order to boost productivity growth?

Contributions. The chapter makes several contributions to the literature and policy debate on productivity at the regional level:

First, the chapter uses a larger, more diverse sample of EMDEs relative to previous studies and to other chapters in this book.[9] It starts with a discussion of the evolution, sources, and bottlenecks of productivity growth across the six EMDE regions.

Second, for each of the six regions, the chapter decomposes productivity growth into contributions from human capital, physical capital, and total factor productivity (TFP). For some regions, this analysis is extended to include natural capital.

Third, using a nine-sector database, the chapter measures within-sector and between-sector contributions to productivity growth in each region and calculates the contribution of each sector to productivity growth, employment, and value added.

Fourth, the chapter contains a detailed discussion of the policy options for boosting productivity growth, including some of the policies that may be effective in offsetting the adverse effects of the COVID-19 pandemic on productivity.

Main findings. The chapter offers several key findings. First, although the post-GFC productivity slowdown affected all EMDE regions, it was most pronounced in East Asia

[9] This chapter uses a sample of 129 EMDEs, compared to 74 EMDEs in other chapters. Unless otherwise indicated, region-wide productivity statistics are GDP-weighted averages.

and Pacific (EAP), Europe and Central Asia (ECA), and Sub-Saharan Africa (SSA) amid slowing investment growth, financial market disruptions, and a major commodity price slide. The recent productivity growth slowdown occurred in the context of already weak productivity growth in some regions (Figure 6). Productivity growth in Latin America and the Caribbean (LAC) and the Middle East and North Africa (MNA), already sluggish before the global financial crisis, was stagnant in the post-GFC period, reflecting political uncertainty, episodes of financial stress in major economies, falling commodity prices, and ongoing market distortions.

Second, as a result of the productivity growth slowdown during the post-GFC period, the pace of catch-up to advanced-economy productivity levels slowed in most EMDE regions, and fell further behind advanced-economy levels in LAC, MNA, and SSA. This means that in these regions, it will now take longer to reach the level of productivity, or GDP per worker, observed in advanced economies, all else equal. In MNA, labor productivity averaged 40 percent of the advanced-economy level in the post-GFC period, down from 49 percent pre-GFC. In SSA and LAC, productivity relative to that in advanced-economies stalled at 12 and 22 percent respectively.

Third, while the contribution of human capital to productivity growth was relatively stable, capital deepening contributed less to productivity growth in the post-GFC period compared to the pre-GFC period in all regions except SSA. All regions experienced a weaker contribution from TFP—especially LAC and SSA, where TFP contracted post-GFC.

Fourth, productivity gains from the reallocation of labor between sectors faded in four regions (EAP, ECA, LAC, and SSA) during the post-GFC period. LAC and SSA were particularly affected. Yet within-sector productivity enhancements also slowed. Only one region, EAP, achieved within-sector productivity gains during the post-GFC period.

Fourth, a well-targeted reform agenda is needed to reignite productivity growth, especially in light of the possible persistent effects of COVID-19 on productivity. In particular, policies are needed to address key obstacles common across multiple regions, such as lack of economic diversification, weak governance and institutions, widespread informality, shortcomings in education, and lack of integration through trade.

Part C: Technological change and sectoral shifts

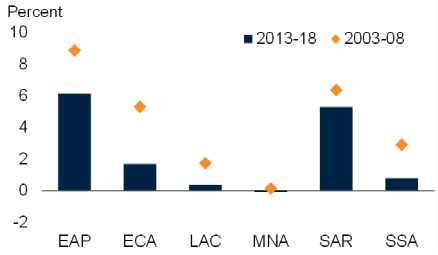
Having established the broad productivity trends, drivers, and implications across the world, large country groups, and EMDE regions in Parts A and B, Part C delves into specific long-term drivers of productivity: technology and structural transformation.

Chapter 6 disentangles long-term shocks, which are interpreted as technology shocks, from short-term shocks, which are interpreted as demand shocks, to productivity. It documents that both types of shocks have long-term consequences for productivity. Chapter 7 moves away from shocks and instead focuses on structural transformation, in particular the productivity gains that can be derived from reallocation of factors of

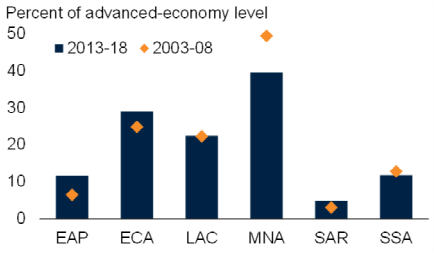
FIGURE 6 Regional productivity developments

The slowdown in productivity growth following the global financial crisis (GFC) affected all regions, but was particularly severe in EAP, ECA, and SSA. Productivity levels fell further behind advanced-economy levels in some regions during the post-GFC period. In all regions, TFP contributed less to productivity growth in the post-GFC period. Since the global financial crisis, productivity gains from sectoral reallocation have faded in most regions.

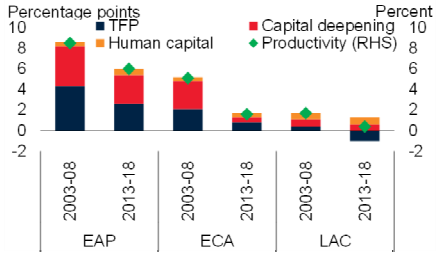
A. Productivity growth



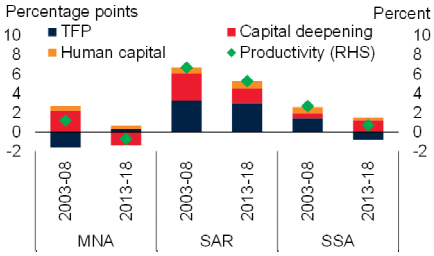
B. Productivity levels



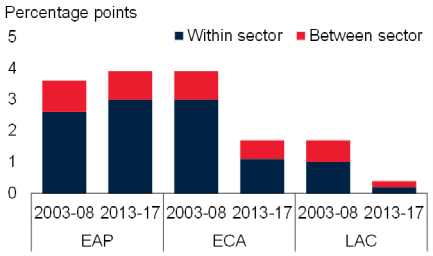
C. Factor contributions to regional productivity growth: EAP, ECA, LAC



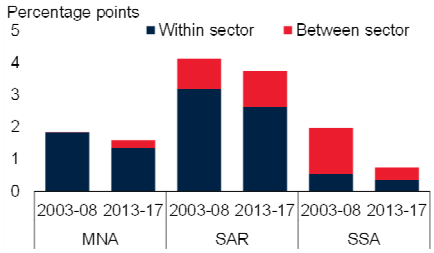
D. Factor contributions to regional productivity growth: MNA, SAR, SSA



E. Within- and between-sector contributions to regional productivity growth: EAP, ECA, LAC



F. Within- and between-sector contributions to regional productivity growth: MNA, SAR, SSA



Source: APO productivity database; Barro and Lee (2015); The Conference Board; Groningen Growth Development Center database; Haver Analytics; ILOSTAT; International Monetary Fund; OECD STAN; Penn World Table; World KLEMS; World Bank (World Development Indicators).

Note: Productivity is defined as real GDP per worker (at 2010 market prices and exchange rates). Country group aggregates for a given year are calculated using constant 2010 U.S. dollar GDP weights. Data for multiyear spans shows simple averages of the annual data. 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.

A.B. Sample includes 35 advanced economies and 129 EMDEs, including 16 in EAP, 21 in ECA, 26 in LAC, 14 in MNA, 7 in SAR, and 45 in SSA.

C.D. Sample includes 93 EMDEs, including 8 in EAP, 21 in ECA, 20 in LAC, 12 in MNA, 2 in SAR, and 30 in SSA.

E.F. Median contribution for each region. "Within sector" shows the contribution of initial real value added-weighted productivity growth rate of each sector and "between sector" shows the contribution arising from changes in sectoral employment shares.

Sample includes 69 EMDEs, of which 9 are in EAP, 11 in ECA, 17 in LAC, 6 in the MNA, 4 in SAR, and 22 in SSA.

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production from lower-productivity to higher-productivity sectors. The chapter shows that this process has been an important source of productivity gains since the 1990s that has recently begun to fade.

Chapter 6: Technology, Demand, and Employment Trade-offs

In Chapter 6, Dieppe, Francis, and Kindberg-Hanlon show the many surges and declines that productivity growth has historically gone through, usually coinciding with economic upswings and slowdowns respectively. Such short-term swings often reflect cyclical fluctuations in labor and capacity utilization (Basu, Fernald, and Kimball 2006; Fernald and Wang 2016).

The COVID-19 pandemic, for example, is likely dealing a severe blow to labor productivity growth by triggering the deepest global recession since the Second World War. If past recessions are any guide, labor productivity is likely to rebound in a cyclical upturn as the global economy recovers but remain below the pre-pandemic trend for many years to come.[10] The global recession resulting from the shock of the COVID-19 pandemic in 2020 is likely to drive a larger decline in productivity growth even than that experienced in the wake of the global financial crisis (World Bank 2020a).

The COVID-19 pandemic may trigger lasting organizational and technological changes to the way businesses operate. These could adversely affect productivity growth if they erode capital or disrupt the accumulation of physical or human capital. However, pandemic-induced structural changes could also have productivity-enhancing effects, such as a "cleansing" effect, eliminating the least efficient firms and encouraging the adoption of more efficient production technologies (Caballero and Hammour 1994). While such effects could result in faster overall per capita income gains, they might well increase income inequality, especially if they reduce the need for labor.

Against this backdrop, this chapter reports research that disentangles long-term productivity changes from short-term, cyclical productivity fluctuations using structural vector auto-regressions (SVAR). Throughout this chapter, the long-term drivers of productivity growth will be referred to as "technology," as is common in the literature, and encompass changes to total factor productivity as well as investment that embeds new technologies.[11] Changes in technology, in this sense, may occur not only as a result of technical innovations but also when there are organizational or institutional changes to the production process.

This chapter addresses the following questions:

- How much do long-term changes and business cycle fluctuations each contribute to changes in labor productivity growth?

---

[10] More specifically, they are referred to as "technology shocks," or unanticipated changes in labor productivity. For example, changes in taxation could persistently alter the degree of capital deepening, leading to higher or lower productivity over long horizons. See also Chen and Wemy (2015), Fisher (2006), and Francis and Ramey (2005).

[11] Previous studies have focused on a small subset of advanced economies. For example, Rujin (2019) and Galí (1999) apply long-run restriction-identified SVARs only to G7 economies.

- What are the effects of long-term changes in labor productivity growth on employment?
- What are the lasting effects of demand-driven cyclical fluctuations in labor productivity growth?
- What are the policy implications?

Contribution to the literature. This chapter makes various contributions to a literature which has primarily focused on advanced economies.

First, this chapter is the first study to identify "technology" drivers of labor productivity growth in a comprehensive cross-country sample of 30 advanced economies and 96 EMDEs.[12] Other studies have restricted themselves to a decomposition of labor productivity growth into its growth accounting components, or have only examined the role of cyclically-adjusted TFP growth or econometrically identified measures of changes in technology in a small number of advanced economies.[13]

Second, this chapter is the first study to estimate the effects of technological change on aggregate employment across a broad range of EMDEs and advanced economies. It is also the first to examine the extent of technology-driven job losses outside the G7 economies (Canada, Japan, France, Germany, Italy, United Kingdom, United States) and to determine the correlates of their scale and persistence, in contrast to earlier studies that focused on a narrower set of advanced economies.[14]

Third, this chapter is the first study to illustrate the persistent effects of demand shocks on labor productivity and its components in a wide range of EMDEs and advanced economies. Previous studies have examined a smaller subset of productivity growth drivers over shorter time horizons or have used data for fewer and mostly advanced economies (Aslam et al. 2016; Dabla-Norris et al. 2015; Fornero, Kirchner, and Andres 2014). This complements the analysis of Chapter 2, which explores a set of specific adverse events, some of which also constitute demand shocks.

Main findings. The chapter reports several novel findings.

First, long-term, "technological" drivers of productivity accounted for a large portion of labor productivity variation in the period 1980-2018: for about 40 percent of the one-year-ahead forecast error variance of labor productivity and 60-75 percent of the five- to

[12] Many studies have documented the persistent negative output effects of financial, currency, and political crises (Cerra and Saxena 2008; Jordà, Schularick, and Taylor 2013; Reinhart and Rogoff 2009).

[13] See Coibion, Gorodnichenko, and Ulate (2017); Fernald (2014); Goodridge, Haskel, and Wallis (2018); OECD (2015); and World Bank (2018c).

[14] Some studies have examined the link between productivity growth and employment growth in a reduced-form framework in a broad set of economies including some EMDEs, but have not separately identified the differential impact of technology and demand-driven changes in productivity (Beaudry and Collard 2003; Boulhol and Turner 2009). An alternative approach has been to identify cyclical fluctuations as the part of TFP growth that is driven by changing factor utilization (Basu, Fernald, and Kimball 2006; Imbs 1999).

ten-year-ahead forecast error variance of labor productivity (Figure 7). The cyclical, non-technological component of productivity growth accounts for the remainder and largely reflected volatile total factor productivity growth.

Second, in around 75 percent of EMDEs and 90 percent of advanced economies, employment fell initially after technology-driven productivity improvements. These employment losses were larger but less persistent in advanced economies than in EMDEs. Such employment losses were also larger in economies with larger increases in industry's share of employment since the 1990s, possibly because industry is particularly amenable to labor-saving innovations such as automation.

Third, this chapter highlights the persistent effects that cyclical developments driven by demand shocks can have on productivity. While such developments may unwind faster than technology shocks, their impact on productivity can last well beyond the typical 2-8 year duration of a cyclical upswing or downswing. Demand-driven fluctuations in productivity growth have historically been considered to be neutral in the long run, with rising efficiency of production in cyclical upswings reversed in downswings. This chapter's contrasting finding is in line with a growing literature uncovering persistent effects on productivity in advanced economies from a range of demand-side developments.[15]

Fourth, policy options are available to promote the equitable sharing across the economy of gains from technology-driven productivity growth. These include measures to ensure that technological change does not lead to prolonged unemployment and measures that encourage diversification of skills. Training and retraining can encourage the accumulation of worker skills that complement new technologies, including in sectors conducive to automation. Adequate social protection provisions can help temporarily displaced workers transition to new sectors.

Chapter 6 complements the production function decomposition employed in Chapter 1 with a decomposition of long-term and short-term shocks to productivity that is agnostic about its sources in human or physical capital or total factor productivity. Chapter 7 explores yet another angle of labor productivity—a sectoral decomposition.

Chapter 7: Sectoral sources of productivity growth

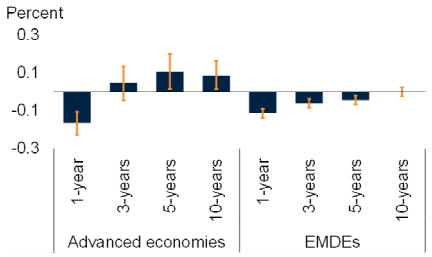
Factor reallocation towards higher-productivity sectors has long been recognized as one of the most powerful drivers of aggregate productivity growth (Baumol 1967). It has been identified as an important driver of productivity growth in EMDE regions as diverse as Sub-Saharan Africa and East Asia (Cusolito and Maloney 2018; de Vries, de Vries, and Timmer 2015). Especially in East Asia, the move out of agriculture into higher-productivity industry and services has been credited with rapid productivity growth (Helble et al. 2019).

[15] Bachmann and Sims (2012) and Jordà, Singh, and Taylor (2020) find evidence that monetary and fiscal policy-induced expansions and contractions have had long-lasting effects on advanced-economy productivity, in contrast to traditional assumptions of neutrality at long horizons.

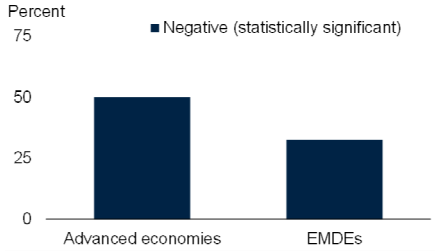
FIGURE 7 Employment and technological change

Innovations in production technologies lead to higher income but can come at the cost of lower employment, particularly in the short term. This effect is found in over one-third of economies. Economies with higher productivity levels and higher industrial employment shares since 1990 have experienced larger employment losses from new production technologies. Demand-driven changes in labor productivity are generally less persistent than those driven by new production technologies.

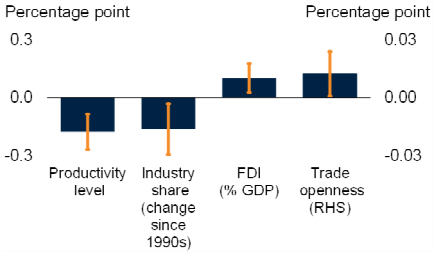
A. Response of employment to technology shock that boosts labor productivity by 1 percent



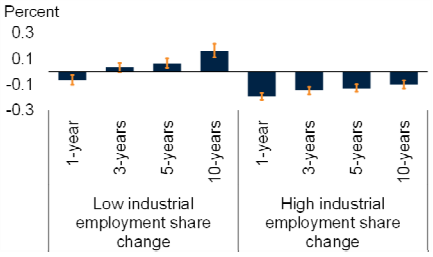
B. Share of economies with negative employment impact in year 1



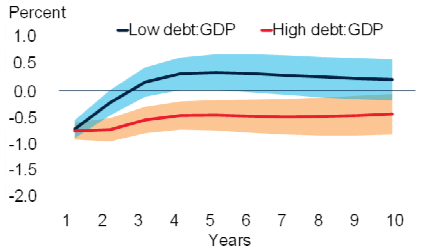
C. Covariates of employment impact in year 1



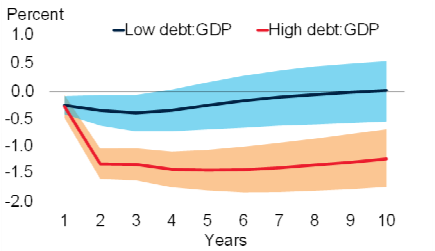
D. Employment impact of technology in EMDEs



E. The response of labor productivity to demand shocks: Advanced economies



F. The response of labor productivity to demand shocks: EMDEs



Source: World Bank.

Note: See Chapter 6 for details. AEs=advanced economies, EMDEs=emerging market and developing economies.

A. Panel-VAR estimates of impulse response functions (IRFs) from a technology shock identified using the Spectral VAR methodology. Panel estimations with fixed effects are performed separately for advanced economies and EMDEs. IRFs are scaled to the size of the impact on labor productivity.

B. Based on individual VAR estimations. The share of economies where the 84th percentile is below zero in year 1.

C. Coefficient estimated in a regression of the correlates of the employment impact of a technology innovation at the 1-year horizon. Productivity level is measured in log-units of output per worker measured in U.S. dollars at 2010 prices and exchange rates, industry share shows the effect of a 10-percentage-point increase in the share of industrial sector employment between 1990-99 and 2010-18.

D. Panel VAR estimation of the employment impact of a technology innovation in two separate groups. "High industrial employment share change" are EMDEs in the top quartile of changes in employment share in industry between 1990-99 and 2010-18, while "Low industrial employment share change" are those in the bottom quartile. IRFs are scaled to reflect the employment impact per percentage point increase in the level of labor productivity at each horizon.

E.F. Sample includes 30 AEs and 95 EMDEs, using the top and bottom quartile for the 1990-2018 average government debt-to-GDP ratio. The panel VAR is estimated for each group, producing an IRF of the level of labor productivity in response to the dominant driver of business-cycle frequency investment fluctuations. Shaded areas reflect 68 percent confidence bands.

Click here to download data and charts.

After several decades of sectoral reallocation away from agriculture, only 30 percent of EMDE employment is accounted for by agriculture—compared with 50 percent of employment less than two decades earlier—and less than 10 percent of value-added. LICs, however, are an exception as agriculture still accounts for over 60 of employment. This partly explains the low aggregate productivity observed in LICs (Caselli 2005; Restuccia, Yang, and Zhu 2008).

The services sector has been the main source of productivity growth over the past decade, accounting for almost two-thirds of productivity growth in the average EMDE (compared with one-fifth accounted for by industry) and more than nine-tenths in the average LIC (Figure 8). Despite this rapid growth, it still only accounts for about 40 percent of employment in EMDEs compared with 75 percent of employment in advanced economies.

Productivity gains through such factor reallocation between sectors have slowed over the past decade, contributing to the steepest and most prolonged slowdown in productivity growth since the 1980s (Chapter 1). The COVID-19 pandemic may slow this process further. In addition, the widespread restrictions that have been introduced to combat the COVID-19 pandemic may damage within-sector productivity through its impacts on health, business models, and workplace practices (World Bank 2020a).

Against this backdrop, this chapter addresses the following questions:

- How large are productivity gaps across sectors?
- What has been the role of sectoral reallocation in aggregate labor productivity growth?
- How might government policies help raise sectoral productivity growth?

Contributions. This chapter extends the literature in two dimensions.

First, the chapter employs the most comprehensive dataset of sectoral labor productivity available, with data for nine sectors. Past analysis had limited country or time coverage.[16] The updated time coverage also allows for an analysis of developments since the global financial crisis more than a decade ago.

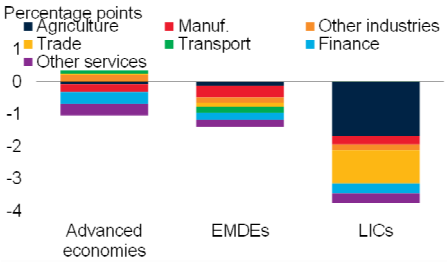
Second, the rich sectoral detail allows an analysis of the heterogeneity of industrial and services subsectors within and across countries, as well as within-sector and between-sector developments that are sensitive to aggregation bias (de Vries et al. 2012; Üngör 2017). This sectoral analysis is complemented by firm-level analysis that points to drivers of within-sector productivity growth.

[16] McMillan, Rodrik, and Verduzco-Gallo (2014) and Diao, McMillan, and Rodrik (2017) employ 38 and 39 countries; Martins (2019) use seven sectors and 169 countries; IMF (2018) use ten sectors and 62 countries; and (McCullough 2017) have 16 sectors for the United States and ten European Union members.

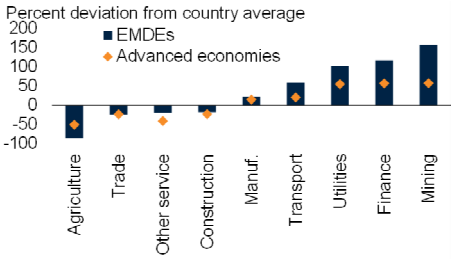
FIGURE 8 Sectoral productivity developments

During the post-crisis period, aggregate productivity growth slowed among the EMDEs, reflecting weakness in manufacturing, finance, and agriculture in LICs. EMDEs are characterized by large, albeit narrowing productivity gaps across sectors. Agriculture remains the largest source of employment in LICs. Sectoral reallocations to more productive sectors have accounted for a sizable proportion of EMDE productivity growth, but have been fading since the global financial crisis.

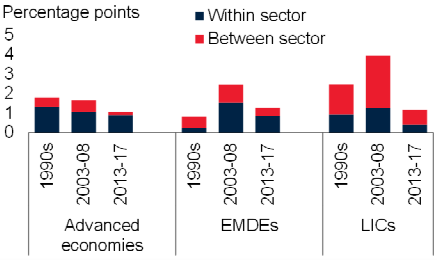
A. Contributions to productivity growth between 2003-08 and 2013-17



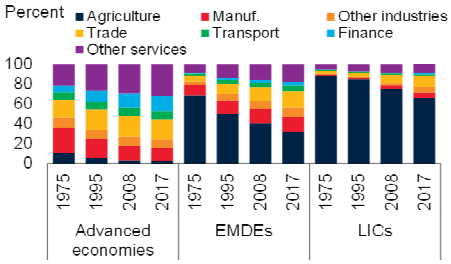
B. Average productivity gap: AEs and EMDEs



C. Within and between sector contributions to productivity growth



D. Employment share



Source: APO; EASD; GGDC; ILO; KLEMS; National sources; OECD; United Nations; World Bank.

A. Based on samples of 54 countries during 1975-1995, 94 countries during 1995-1999, and 103 countries during 2003-2017. "Other industries" includes mining, utilities, and construction; "Finance" includes business services; "Other services" includes government and personal services.

B. Average labor productivity is value-added per worker in 2017, based on 103 countries. "Finance" includes business services; "Other service" includes government and personal services.

C. Median contribution based on 54 countries during 1975-1995, 94 countries during 1995-1999, and 103 countries during 2003-17.

D. Based on samples of 94 countries during 1995-1999 and 103 countries during 2003-17.

Click here to download data and charts.

Findings. The chapter offers several novel findings:

First, the chapter documents large productivity gaps across the nine sectors and also across countries within each of the nine sectors. In the average EMDE, productivity in agriculture, the lowest-productivity sector, is 85 percent lower than the average productivity. In advanced economies, the corresponding difference is considerably narrower. Agriculture accounts for less than 10 percent of value-added and around 30 percent of employment in EMDEs. The gap between EMDE and advanced-economy productivity is particularly wide in agriculture, with EMDES less than 20 percent of advanced economies. This partly reflects slow technology adoption in the agriculture

sector in some of the poorest EMDEs. Within manufacturing, productivity is highest among firms with a high share of exports in output. Those that operate in a conducive business environment are also closer to the global technology frontier .

Second, sectoral reallocation accounted for two-fifths of overall productivity gains between 1995-2017. This shift lost momentum after the GFC. This slowing sectoral reallocation accounted for two-fifths of the productivity growth slowdown in EMDEs between 2013-2017. By curtailing labor mobility as well as economic activity, the COVID-19 pandemic may further slow sectoral reallocation.

Third, policies can both rekindle sectoral reallocation and boost productivity in low-productivity sectors. Policies to support labor mobility and capital investment include: improving the quality of, and access to, education; promoting good governance and reducing the costs of doing business; strengthening institutional and managerial capabilities; reducing distortions, such as anticompetitive regulations and subsidies; supporting research and development; and removing infrastructure bottlenecks. Given the low productivity of EMDE agricultural sectors and agriculture's role as the primary employer in LICs, policies to raise productivity in this sector, such as actions to strengthen infrastructure and improve land property rights, could pay particularly significant dividends.

Future research directions

The study presents new analytical work on productivity but also points toward several avenues for future research.

Adverse shocks and the COVID-19 pandemic. Evidence that adverse events are likely to cause lasting productivity and output losses opens new research avenues for a more in-depth analysis of propagation channels and socioeconomic impacts (Chapter 3). This is particularly important in light of the COVID-19 pandemic. Future research could refine the analysis of the intensity of the adverse events by constructing severity indexes for different types of events. In addition, a more detailed empirical assessment of the transmission channels is warranted. This could be explored by studying the effects of adverse shocks on different economic sectors as well as on consumption, investment, and FDI. This can also enable an assessment of the distributional and developmental implications of adverse events. Finally, more in-depth analysis of how policies explain differences in impacts, responses, and resilience to adverse shocks across countries would help prevent and mitigate future disasters.

Medium-term drivers of productivity growth. The broad-based slowdown of productivity growth has raised many questions on what is causing it. The research highlighted in Chapter 2 has shown there are many drivers and correlates of productivity but that the main long-term drivers have changed over time, with some becoming more prominent while others have become less prominent as the structure of economies evolve. The analysis could be expanded to better understand the medium-term dynamics of productivity, and how they may vary both within and across countries. Medium-term analysis can also help quantify the implications of COVID-19 on productivity growth.

Understanding convergence club transitions. Additional scrutiny of the drivers of transitions of economies into convergence clubs with higher productivity convergence trajectories can provide useful insights for policymakers about the conditions necessary for faster productivity growth. However, methodologies to isolate the period of transition, used in Chapter 4, are currently underdeveloped and generally rely on comparing results over different estimation samples. Future research could place more focus on estimating more precise transition points between convergence clubs. Further research is required into strategies that could be used by EMDEs to develop capabilities in more advanced and complex sectors while safeguarding employment.

The future of automation in EMDEs. The analysis of the loss of employment from new productivity-improving technologies in Chapter 6 is based on historical trends, during a period in which automation has primarily been concentrated in certain sectors in advanced economies. Future research could examine the role of cross-country wage differentials in limiting the adoption of these technologies in EMDEs. In addition, future research should examine the extent to which jobs in the service sector, which have increasingly driven EMDE productivity growth and job creation, are at risk.

Underlying drivers of sectoral reallocation. Chapter 7 employs a detailed shift-share approach that decomposes aggregate labor productivity growth into within- and between-sector components. However, this approach does not fully account for the endogeneity of sectoral allocation. For example, within-sector growth could also directly affect sector reallocation—an improvement in agricultural productivity could reduce agriculture's share of employment and facilitate between-sector productivity growth, and hence, the contribution of the agricultural productivity could be larger and that of sectoral reallocation could be smaller. Further research using the nine-sector database could take into account endogeneity and provide greater insights into which underlying forces are driving sectoral contributions to productivity growth and convergence.

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