ONE

Technology, Change, and a New Growth Agenda

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Global economic growth has been lackluster for more than a decade now. Growth slowed sharply after the global financial crisis of 2007–08, but the underlying growth trajectory had started to weaken in most major economies well before the crisis. Recovery from the shock of the crisis has been uneven and, in general, slow and weak. Growth appeared to pick up steam in a synchronized way across economies in 2017 and early 2018, but the acceleration proved short-lived and faded by late 2018.[1]

The persistent sluggish growth is happening at a time when the global economy has been exposed to important forces of change. Foremost among these has been technology. There has been a boom in new technologies, spearheaded by digital technologies. Technology-enabled innovation is a major spur to productivity growth, the key driver of long-term economic growth. Yet, paradoxically, productivity growth has slowed rather than accelerated in most economies. Among advanced economies

since approximately 2005, growth in productivity has averaged barely half of the pace of the previous fifteen years.[2]

There is much ongoing debate on this "productivity paradox"—why has productivity slowed amid a wave of technological advances?[3] Firms at the technological frontier have reaped major productivity gains from these advances, but the impact on productivity more widely across firms and the economy at large has been weak. The new technologies have tended to produce "winner-takes-most" outcomes. Market structures appear to have become less competitive, and performance gaps between dominant firms and other firms have become wider and persistent, dragging aggregate productivity growth lower. Looking ahead, restoring greater vigor to economic growth will depend crucially on harnessing the potential of the new technologies to produce stronger and more broad-based increases in productivity.

Investment, especially fixed capital formation, also has shown a persistent weakness. In most major economies, investment rates fell sharply after the global financial crisis but were already trending downward. A decade later, long after the crisis-related disruptions to investment waned, investment rates in most major economies remain below trend rates before the slowdown. Within this picture of subdued overall investment, the composition of investment has been changing, with "intangible capital," such as software and digital platforms, growing in importance.[4] The persistent weakness of investment despite historically low interest rates after the crisis and recovery in corporate profitability presents another puzzle—an "investment paradox"—and has prompted increased concerns about risks of "secular stagnation."[5]

The productivity and investment paradoxes have been interconnected and mutually reinforcing. Low investment contributed to subdued productivity growth by limiting capital deepening and by slowing the adoption of new technologies that typically are embodied in new capital when deployed into actual production. Weaker prospects for productivity growth, in turn, contributed to depressed investment. A weakening of competition in markets, mentioned above in relation to subdued productivity growth, appears to have been a factor behind subdued investment as well.[6]

Technology is having profound effects on labor markets. Automation and digital advances are shifting labor demand away from routine low- to middle-level skills to higher-level and more sophisticated technical and managerial skills. They are altering the nature and future of work. As the

demand for skills shifts, supply has been slow to respond. The education, training, and retraining of workers in skills that complement the new technologies have lagged. Mismatches between required and available skills have increased. On the one hand, growing ranks of workers face diminishing demand for their current skills. On the other hand, the supply of workers equipped with the new skills required by the digital economy has not been growing fast enough. The resulting skill shortages have constrained the broader diffusion of the new technologies within economies, limiting their impact on productivity and growth. How the technology-driven shifts in labor markets are managed will greatly affect the dynamics of jobs, productivity, and growth.[7]

Many major economies also face the challenge of aging populations, which means slower growth of labor input into production (this may be partly offset by longer working lives as more and more people opt to work longer). In advanced economies, this effect is reinforced by the leveling off of labor force participation and educational attainment. These trends put an even greater focus on productivity—and the technological innovations that drive it—to deliver economic growth as the impulse for growth from factor accumulation weakens.

Three basic ingredients drive economic growth—labor, capital, and productivity. As outlined above, all three are facing new issues that have been affecting growth dynamics and help explain the persistence of slower growth. Many of these issues revolve around the unfolding effects of rapid technological change and how it has interacted with markets and policies.

The growth picture is further complicated by other important trends. The growth challenge is not only to restore stronger growth but also to make it more inclusive. Income inequality has been rising over the past two to three decades within most major economies, and the increase has been particularly pronounced in some countries, such as the United States. Since the early 1980s, income inequality in the United States, as measured by the broadest indicator of inequality (the Gini index), has increased by more than 15 percent. The income share of the richest 1 percent has more than doubled, to around 22 percent, and their share of overall wealth has risen to around 40 percent.[8] Technological change has been a key factor influencing these income distribution dynamics.

The new technologies favoring capital and higher-level skills have contributed to a decline in labor's share of income and to greater wage inequality. These distributional effects have been reinforced by the rise of

dominant "superstar" firms characterized by a combination of supernormal profits and low labor income shares. Competition policy failures have added to the winner-takes-most dynamics of the new technologies in giving rise to more concentrated market structures with more market power and high economic rents.[9] The shift toward more monopolistic industry structures and greater market power of dominant firms worked to make the distribution of capital income also more unequal. The rise in overall income inequality thus has consisted of a shift of income from labor to capital and a more unequal distribution of both labor and capital income.

The political setting for policymaking has become more challenging. Rising inequality and growing anxiety about the future of work and jobs have contributed to increased social tensions and political divisiveness. Populism has surged in many countries. Nationalist and protectionist sentiment has been on the rise as well, with a backlash against globalization that, alongside technological change, is seen to have contributed to rising inequality through job losses and wage stagnation for lower-skilled workers.

While income inequality has been rising in many countries in recent decades, inequality between countries has been falling, thanks to the rise of faster-growing emerging economies that are narrowing the income gap with advanced economies. Technological change poses new challenges for this process of economic convergence. Manufacturing-led growth in emerging economies has been the dominant driver of convergence, propelled by the comparative advantage enjoyed by these economies in labor-intensive manufacturing based on their large pools of low-skilled, low-wage workers. This source of comparative advantage will matter less as automation of low-skilled work progresses, disrupting traditional pathways to development.[10]

In sum, the growth agenda is being reshaped by significant change in the world economy from technology and other forces. And transformative change continues as digital technologies push further with advances in artificial intelligence, robotics, the Internet of Things, and cyber-physical systems—advances that could unleash a "Fourth Industrial Revolution" (4IR). Globalization is going increasingly digital, a transformation that, analogous to 4IR, has been termed "Globalization 4.0."[11] As technology drives change, it creates both new opportunities and challenges. How policies and institutions respond is key to determining how this change translates into outcomes for growth, jobs, and income distribution.

Technological change recently has not delivered its full potential in boosting productivity and economic growth. It has pushed income in-

equality higher and generated fears about a "robocalypse"—massive job losses from automation.[12] Globalization also has contributed to rising inequality within economies, although technological change has been a bigger, more pervasive factor. The correct response to these challenges is not a Luddite retreat from technology or a slip back into protectionism. Ongoing advances in digital technologies hold considerable potential to lift the trajectory of productivity and economic growth and enhance human welfare. As much as two-thirds of potential productivity growth in major economies over the next decade could be related to the new digital technologies.[13] But technological change is inherently disruptive and entails difficult transitions. It also inevitably creates winners and losers, as does globalization. Policies have a crucial role to play in ensuring that the potential economic gains from these forces are captured effectively and inclusively. Unfortunately, policies and institutions have been slow to adapt to the challenges of change. With better and more responsive policies, better outcomes are possible.

The core of the forward policy agenda is to better harness the potential of the new technologies to produce more robust and inclusive economic growth. Reforms must seek to improve the enabling environment for firms and workers—to broaden access to opportunities that come from technological change and to enhance capabilities to adjust to the new challenges. Competition policies should be revamped for the digital age to ensure that markets continue to provide an open and level playing field for firms, keep competition strong, and check the growth of monopolistic structures. With the intangible asset of knowledge becoming an increasingly important driver of economic success, the innovation ecosystem (research and development policies, patent regimes) should be improved to promote wider diffusion of advances in knowledge embodied in the new technologies.[14] Infrastructure that supports digitization should be strengthened. Investment in skills must be boosted, with stronger and smarter programs for worker upskilling and reskilling and lifelong learning to respond to shifts in the demand for skills resulting from technological change—and from globalization. Labor market policies and social protection systems must be adapted to the realities of a more dynamic job market—as part of an overhaul of social contracts. Tax systems should be reviewed in light of the new tax challenges of the digital economy and the income distribution dynamics.

The politics of reform is inevitably complex. Reform may seem even more daunting in the current political climate. But one thing reform action should not be paralyzed by is continued trite debates about conflicts

between growth and equity. Research shows that this is a false dichotomy. The slowdown in productivity and economic growth and the rise in income inequality over the past couple of decades are linked by broadly common causes, chief among which is the interplay between technological change and policy and market failures. The agenda to reverse these trends, as outlined above, also is broadly common.[15] Policies to promote equity are often seen narrowly in terms of redistribution of the gains from economic growth through government taxes and transfers. But the interlinked dynamics of productivity, growth, and equity suggest that there is a much broader policy agenda of "predistribution" that can make the process of economic growth itself more inclusive—and more robust at the same time.[16]

Much of the attention of policymakers in major economies over the past decade has been focused on addressing the aftermath of the global financial crisis and the ensuing recession—issues relating to deficient aggregate demand, credit market disruptions, and financial sector repair. Major financial crises cast a long shadow.[17] Some legacies of the last crisis remain—notably high debt levels, public and private. Looking ahead, more attention needs to be devoted to deeper reforms in markets, policies, and institutions on which longer-term prospects for growth and shared prosperity will depend, and especially to how this agenda is being reshaped by technology.

Reforms are needed at the international level as well so that rules of engagement between countries in trade and other areas are fair. But the dominant part of the agenda to make globalization work better and for all rests with policies at the national level, such as those related to competition, upskilling/reskilling workers, and social protection mentioned above. With globalization going increasingly digital—cross-border digital flows are now the most dynamic element of global flows—an important area for international cooperation will be the development of necessary new disciplines for digital flows that support open access, fair competition, and well-balanced intellectual property rights that reward innovation but prevent intellectual monopolies.

The Changing Global Context for Growth

This book is the first in a series under a joint project of the Brookings Institution and the Korea Development Institute that aims to address how the growth agenda is evolving with change in the world economy, in par-

ticular from technological transformation. The project's title—*A New Growth Agenda*—reflects its motivation and focus. As the foregoing discussion indicates, this is a large topic, well beyond the scope of a single work to address exhaustively. Each book under the project will focus on a select set of issues in the changing growth agenda, with the aim cumulatively to develop a fuller exploration of the agenda.[18]

The project examines how the growth agenda is being reshaped both from global and from country perspectives. This book first analyzes, in Part I, how the global context for growth is changing. In Part II it addresses some new issues in the growth agenda from the perspective of an individual economy, Korea. Korea's case provides both a reflection of some of the trends observed at the global level and some interesting contrasts. This chapter includes an overview of Part I. Chapter 6 provides an overview of Part II.

The Challenge of Reviving Slowing Potential Growth

How are the forces of change affecting potential growth—maximum sustainable growth in the medium to long term as determined by the underlying productive capacity—in the world economy? In chapter 2, Celik, Kose, and Ohnsorge find that potential growth has declined across most economies and that it could fall further in coming years in the absence of policy reforms to counter the forces driving the slowdown. Their analysis presents a picture of a growth environment where a business-as-usual approach to policy risks a persistent slowing of growth but where policies that are responsive to the new challenges can reap sizable rewards in lifting growth.

Global potential growth in the five-year period 2013–17 is estimated at 2.5 percent a year, which is 0.5 percentage point below its long-term average over the past two decades (1998–2017). This includes a fall of 0.5 percentage point in advanced economies, to a potential growth rate of 1.4 percent, and a fall of 0.6 percentage point in emerging and developing economies (EMDEs), to a potential growth rate of 4.8 percent. The fall in potential growth is still larger when measured against the higher potential growth of a decade ago (2003–07): 0.9 percentage point globally, 0.8 percentage point in advanced economies, and 1.1 percentage points in EMDEs. The slowdown in potential growth is broad-based across advanced economies and EMDEs. Among the latter, it has been more pervasive in middle-income economies.

The analysis finds that the slowdown in global potential growth reflects persistent weaknesses in all three major drivers of growth: physical capital,

workforce and human capital, and productivity. Roughly half of the slowdown is estimated to be on account of weaker investment and capital accumulation. Just under a quarter is estimated to result from slower growth of labor input related to demographic trends such as aging and changes in labor force participation rates. More than a quarter reflects slower growth in total factor productivity.[19] Weaker capital accumulation and productivity growth, to varying degrees, are common factors in most economies. The picture with respect to growth in workforce varies, with aging an increasingly important factor in advanced economies and some mature emerging economies, in contrast to many developing economies, such as those in South Asia and sub-Saharan Africa, which have more favorable demographics.

Global potential growth could slow further if these trends in the fundamental drivers of growth continue. The business-as-usual scenario developed in chapter 2 indicates that global potential growth could decline further by 0.2 percenage point over the ten-year period 2018–27, including a 0.1 percentage point fall in advanced economies and 0.5 percentage point fall in EMDEs.

Fortunately, these outcomes are not inevitable. Chapter 2 concludes on a positive note that responsive policies can help reverse the current negative growth dynamics. It sets out a range of options that policymakers could consider. Investment could be boosted by improving the policy and institutional environment for private investment and creating room in public finances to increase complementary public investments, such as addressing shortfalls in key infrastructure. Productivity growth could be stimulated by policies to spur innovation, enhance competition, and promote broad diffusion of technological advances. Advancing an open international trade system would help as well. Education and training could be strengthened to raise the quantity and quality of human capital and build skills demanded by the new technologies. Labor force participation rates could be boosted by labor market reforms, encouragement of participation by women, and mitigation of the effects of aging through retirement policy reform, lifelong learning, and migration. Scenarios developed in chapter 2 indicate that a combination of such reforms could lift potential growth over the period 2018–27 by 0.7–0.8 percentage point in advanced economies and EMDEs.

How Technology May Alter Future Growth Paths

One major source of uncertainty about future growth is technology. There is an active debate about how the digital revolution may affect the future

path of productivity. "Techno-pessimists" believe that today's digital technologies are much less consequential than past major technological breakthroughs, such as the internal combustion engine and electrification, in their ability to drive rapid and sustained increases in productivity. They expect the weakness in productivity growth to persist. "Techno-optimists," on the other hand, believe that the digital revolution is truly transformative but that the realization of its full potential to spur productivity growth has been held back by the inevitable adoption and diffusion lags facing new technologies. They are of the view that productivity growth will accelerate and will be greatly boosted by the next wave of innovations—notably, advances in artificial intelligence and cyber-physical systems—that can take the digital revolution to a new level. These alternative futures for technology and its impact on productivity have very different implications for global growth and the global economy.[20]

In chapter 3, McKibbin and Triggs explore alternative technology-enabled productivity growth scenarios and analyze their implications for growth, jobs, and flows of trade and capital, and what they mean for policymakers. One scenario is that the weak productivity growth of recent years persists into the future, as predicted by the techno-pessimists. The other scenarios explore a future takeoff in productivity growth, as envisaged by the techno-optimists, ranging from a global surge in productivity to surges in productivity favoring advanced economies and sectors that have invested more in digital technologies.

The exploration of these scenarios provides important analytic and policy insights. In a scenario where the technological frontier and productivity in advanced economies grow slowly and depress economic growth there, the potential for technology catch-up in EMDEs remains large, which could underpin continued strong growth in these economies. Indeed, these economies could gain from increased capital inflows as the relative return on investment there rises. Capturing this potential for stronger growth would depend on supportive policies within these economies and openness in international markets to flows of trade, capital, and technology. A scenario where rapid technological advances produce a surge in productivity globally would lift growth in all economies, advanced and emerging. A variety of constraints could keep economies from reaping the full benefits of a technology-driven productivity boom in the form of stronger and inclusive growth. Flexibility in markets will be key to facilitating adjustments in the face of disruptions from technological transformation. It will be

important to maintain strong competition in product markets, promote depth and flexibility in financial markets to manage the reallocation of capital that goes with structural shifts, and ensure that labor markets support labor mobility and enable workers to share in the gains of the productivity boom. The insights from the scenarios reinforce many of the policy messages of chapter 2 on boosting potential growth.

Scenario simulations show that rapid technological change may not be inimical to workers, contrary to prevalent fears about large job losses. Higher productivity and growth resulting from technological advances support higher employment and wages, with new jobs replacing those no longer needed. While this transition may be challenging, it can be eased by policies that re-equip workers and support their mobility.

A scenario in which productivity surges only in advanced economies that invest more in digital innovation, such as the United States and other major economies, highlights the potentially crucial importance of such investment in tomorrow's economy. These economies reap most of the growth dividends in this scenario. Other economies with strong export links to these economies can benefit from spillover effects, but the rest, including many among EMDEs, risk losing out on the productivity boom.

The eurozone presents an interesting case in the context of such an asymmetric productivity growth scenario. A productivity boom in the eurozone's core economies (Germany and France) while productivity lags in economies in the periphery could put a particularly strong strain on the latter, given the group's common monetary policy and exchange rate, and threaten the eurozone's stability. This implies the need for productivity-enhancing reforms in the periphery plus building more flexibility into the eurozone's macroeconomic frameworks and considering deeper integration.

Shifting Dynamics in Global Manufacturing

Technology is transforming the growth dynamics in manufacturing, a sector that historically has played a key role in economic advancement of countries. Since the Industrial Revolution, manufacturing has powered the economic rise of economies—first the rise of today's advanced economies and, more recently, that of China and other successful emerging economies of East Asia. In a development paradigm that came to be known as the "flying geese" model, as economies moved up the manufacturing ladder and wages there rose, lower-skill manufacturing tasks shifted to economies with

lower wage costs.[21] This process over time helped economic convergence between the early industrializers and those that followed. But as Coulibaly and Foda discuss in chapter 4, the digital revolution is disrupting this development paradigm.

The new technologies are shifting production toward higher capital and skill intensity, with routine lower-skill production tasks increasingly being automated. As a result, comparative advantage based on low-cost, low-skilled labor is eroding. Manufacturing tasks in global value chains (GVCs) that were previously offshored to low-wage-cost developing economies could be reshored to advanced economies. The expected shedding of low-skill tasks by China (the world's largest manufacturer, accounting for about a quarter of global manufacturing output) to other economies as its own labor costs rise may not happen as these tasks become automated and remain in China (the country has already emerged as a leader in investment in robots). China and other successful manufacturing economies in East Asia are also increasing the domestic value-added component of their manufacturing output by building domestic supply chains that provide intermediate inputs that previously were imported. The growth of GVCs in manufacturing may slow, and the bar for entering them may rise. These trends are already in evidence and will likely intensify as the 4IR technologies advance. Contrary to the paradigm of convergence, these trends could strengthen and consolidate the position of existing major manufacturing hubs in North America, Europe, and East Asia.

Technology is also leading to an increasing servicification of manufacturing. Along the manufacturing value chain, the contribution of services is growing as the value added by upstream and downstream activities rises relative to that of production and assembly. These upstream and downstream activities—such as research and development, design, branding and marketing, and user services embedded in products—are intensive in higher-level and specialized skills and digital infrastructure and technologies. Services trade has been expanding much faster than goods trade, and GVCs are becoming more service-intensive.[22]

For developing economies, given these trends, the traditional route to development through manufacturing based on low to moderately skilled labor will become much tougher. Industrialization as a development path for these economies, however, is certainly not foreclosed. Economies that proactively adapt to the new challenges can continue to carve out comparative advantage and build viable manufacturing industries to help drive

their growth and create higher-productivity jobs for their growing labor force. Success will depend increasingly on upgrading the workforce and developing skills complementary to new technologies, building stronger infrastructure in support of digitization and trade logistics, and improving the business environment for innovation and investment, including regulatory frameworks suitable for the digital age. As discussed in chapter 3, there is large potential in these economies for productivity growth and improved competitiveness through technology catch-up. Improved capabilities through such efforts would enable these economies to take advantage of increasing domestic demand fueled by growing populations and rising middle classes. By 2030, EMDEs could account for more than half of all global consumption, with EMDEs excluding China accounting for 35 percent.[23] The faster growth of demand within these economies could also attract more investment from outside that aims to locate production closer to points of growing consumption. For example, increasingly, Chinese manufacturing firms relocating to Africa primarily serve local markets.

The same technologies that limit opportunities in traditional manufacturing can open new avenues for growth. Digital platforms and logistics technologies are lowering transaction costs to connect to global markets. They are increasing opportunities for countries to tap into the burgeoning trade in services facilitated by digitization. Countries rich in natural endowments can move up the value chain from simple commodity exporting to agricultural and food processing and horticulture and can better exploit tourism possibilities. African economies, for example, may have sizable potential for growth in industries that depart from the traditional smokestack manufacturing model of industrialization.[24] The new technologies offer leapfrogging possibilities in development, such as in finance and communications; African economies have seen rapid growth in mobile telephony and pioneered innovations in digital finance to link large populations to financial markets and the formal economy. Technology does disrupt job markets, but such disruptions may not inevitably lead to large numbers of technologically unemployed workers. As some jobs disappear or are reshaped in traditional manufacturing or other sectors, demand for new and modified jobs rises: witness the rise of 4 million app developers in India.[25]

Technology is reshaping the global manufacturing landscape, and indeed disrupting many other sectors. It will alter traditional pathways to growth and development. But it also offers multiple new pathways for

countries that demonstrate responsiveness and skill in managing the transition.

Globalization Going Digital

The digital revolution is ushering in a new phase of globalization. While growth in traditional trade flows has slowed in the past decade, globalization overall has not. With soaring cross-border flows of data and information, globalization is going increasingly digital. In chapter 5, Meltzer examines this transformation. Between 2005 and 2015, cross-border data flows rose 45-fold, and they are expected to grow another ninefold by 2020. In addition to transmitting valuable streams of data, information, and ideas, digital flows facilitate the movement of goods, services, finance, and people. Virtually every type of cross-border transaction now has a digital component. All considered, digital flows might already be exerting a larger impact on global economic growth than traditional flows of traded goods.[26]

The digital transformation of globalization creates new opportunities for boosting trade, productivity, and economic growth from which all economies can benefit. Advanced economies and successful emerging economies, such as China, at the leading edge of the new technologies have had a head start. Boosted by first-mover advantages and scale and network economies associated with digital technologies, their companies, such as Facebook and Google, have rapidly acquired dominant positions in the global digital space. Services trade has been in the vanguard of digital globalization. Digitally deliverable services, including those embodied in goods, now exceed one-half of total U.S. exports. But digitization of international flows is creating opportunities more widely across economies. Digital platforms such as Alibaba, Amazon, and eBay are making it easier for enterprises in developing economies, including small and midsize enterprises, to connect to the global marketplace. They are facilitating entry into GVCs for trading goods and services. Cloud computing is broadening access to digital software and storage. Two-sided digital platforms, such as Uber and Airbnb, are creating new microentrepreneurs in an expanding "crowd-based capitalism."[27] Digital platforms for professional services are beginning to create a more global labor market. Individuals around the world are using the internet and global digital platforms to learn, research, and build networks.

Not all countries are making the most of this potential. Digital globalization increases the premium on enhancement of national capabilities in

terms of building worker skills for the digital economy and strengthening infrastructure to enhance digital access and international connectedness. Also important is a policy environment that supports openness, competition, and business dynamism. This is not an agenda exclusively for developing economies. Advanced economies are better connected to international digital networks, but they too must exert greater effort to help workers reskill and transition to tomorrow's jobs and adapt regulatory frameworks to the digital age to address new issues relating to competition policies, patent regimes, and management of data that drive the digital economy (data ownership, access, privacy, security). The gains from digital globalization and how inclusively they are shared, between and within economies, will depend greatly on policymakers' responsiveness to these challenges.

Making globalization work better and for all will also require greater cooperation at the international level. Not only must past gains in establishing a rules-based international system be protected from the recent rise of nationalist and protectionist sentiment but new rules and cooperative arrangements must be devised to underpin the new phase of globalization driven by digital transformation. This includes adequate disciplines for digital trade, including cross-border data flows and the fast-growing digitally deliverable services. Digital protectionism, such as data localization measures with a protectionist intent and other restrictions on cross-border data flows and market access for digitally deliverable services, has been on the rise. Data protection and cybersecurity require stronger international cooperation in regulation and enforcement. Competition policy needs to become more global to address cross-border business practices that restrict competition. The superstars of the digital economy—the tech giants—typically are multinationals that affect market concentration and competition in many countries. In a more knowledge-intensive globalization, appropriate frameworks governing intellectual property take on added significance. Digital globalization, involving an increasingly intangible nature of cross-border business, will also require enhanced international cooperation in tax matters.

Global policymaking and institutional frameworks have not kept pace with the advance of globalization, and this gap could widen as digital technologies transform international flows of goods, services, finance, skills, knowledge, and innovation. Up-to-date global rules that support an open

and fair framework for these flows as they evolve will be an important complement to reforms at the national level to ensure that advances in globalization and technology produce better outcomes for productivity, growth, and inclusiveness. Greater international cooperation may appear daunting in today's political environment of ascendant nationalist populism. Eventually, however, there will be a need to adapt international frameworks to the demands of the twenty-first century.

Conclusion

Technology and other forces are reshaping the global growth agenda in major ways. Growth paradigms are shifting with markets and the future of work and business. The only constant in the economic landscape, it seems, is change. And change may only accelerate as artificial intelligence and other innovations drive the digital revolution further. Today's technological advances hold much promise for boosting productivity, growth, and human welfare. But the realization of these gains is not automatic. Policies have a crucial role to play in determining what outcomes are achieved. Change is creating both opportunities and challenges. Economies with more flexibility in markets and greater responsiveness in policies will be better positioned to capture the opportunities and meet the challenges.

The era of smart machines demands smarter policies. Technological innovation is creating the need for policy innovation as it transforms markets. New thinking and policy adaptations will be needed in areas such as competition policies, innovation systems and knowledge diffusion, infrastructure underpinning the digital economy, upskilling and reskilling of workers, social protection regimes, and tax policies. At the international level, new rules will need to be established as globalization goes increasingly digital. There is currently active research and debate in many of these areas, which should help guide policymakers.

Both technological change and globalization have contributed to the recent rise in income inequality in many economies—and the associated rise in social discontent and political tumult. But such distributional consequences of change are not preordained. Much depends on policy responses. Notwithstanding the fact that change is inevitably disruptive and creates

winners and losers, more inclusive outcomes are possible. Effective responses will require policies that help people adapt to the change and take advantage of the future opportunities it brings.

NOTES

1. The IMF's World Economic Outlook, April 2018 (International Monetary Fund 2018) presented an outlook of "synchronized acceleration" of global growth. In the World Economic Outlook, April 2019 (International Monetary Fund 2019), the assessment of the outlook for global growth shifted to one of "synchronized deceleration."

2. See Organization for Economic Cooperation and Development (2015, 2018) for data on, and analysis of, productivity trends in major economies.

3. Some argue that the "productivity paradox" may simply reflect mismeasurement since current statistical methods do not fully capture improvements in the quality of goods and services and the value created by new goods and services, especially those in the digital space. Research finds that these factors do lead to an underestimation of productivity growth but that this can explain only a relatively small part of the measured slowdown in productivity growth (Byrne, Fernald, and Reinsdorf 2016; Syverson 2016). For the most part, the productivity slowdown and the related paradox are real, not illusory.

4. For more on the rise of "intangible capital" and its economic implications, including for investment, see, for example, Haskel and Westlake (2017), and Crouzet and Eberly (2018).

5. See, for example, Summers (2016).

6. A growing body of research in OECD economies documents a trend toward a decline in competition in markets and finds that it may be hurting both growth (innovation, productivity, investment) and income distribution. See, for example, De Loecker and Eeckhout (2017, 2018); Gutiérrez and Philippon (2017); Eggertsson, Robbins, and Wold (2018); Furman and Orszag (2018); Rajan (2019); Stiglitz (2019); and Tepper (2019).

7. Several recent studies examine the labor market implications of the digital economy (changing demand for skills, future of jobs) and what they mean for policy. See, for example, Acemoglu and Restrepo (2018); World Bank (2018); and Organization for Economic Cooperation and Development (2019).

8. For trends in income and wealth distribution in major economies, see, for example, Alvaredo and others (2018).

9. For an analysis of the rise of "superstars" and its implications, see, for example, Autor and others (2017) and McKinsey Global Institute (2018a).

10. Rodrik (2015) develops the changing dynamics of manufacturing's role in growth under the theme of "premature deindustrialization." See also Hallward-Driemeier and Nayyar (2018).

11. See Schwab (2016); Baldwin (2018); and World Economic Forum (2019) for more discussion on the nature and scope of the change captured in the terms "4IR" and "Globalization 4.0."

12. "Robocalypse" is a term used by Autor and Salomons (2017) to capture the threat to jobs from automation.

13. See McKinsey Global Institute (2018b).

14. Several recent studies have focused on the role of overly broad and stringent patent systems as a factor limiting innovation and its wide diffusion and weakening competition. "The copyright and patent laws we have today look more like intellectual monopoly than intellectual property" (Lindsey and Teles 2017). See also Baker, Jayadev, and Stiglitz (2017).

15. For more discussion on the nexus between technology, productivity, and income distribution, the shared dynamics between the slowdown in productivity growth and the rise in income inequality, and the interconnected agenda to revive productivity growth and reduce inequality, see Brookings Institution and Chumir Foundation (2019). See also Tyson and Spence (2017).

16. The term "predistribution," coined by Jacob Hacker (2011), embodies the idea that the state should try to prevent high income inequality from occurring in the first place rather than reducing it through the tax and transfer system once it has occurred, as happens under redistribution. Ricardo Hausmann (2015) draws a similar distinction between policies for redistribution and inclusion (in the growth process).

17. See, for example, Reinhart and Rogoff (2014) on the depth and persistence of the macrofinancial impacts of major financial crises and the long process of recovery.

18. To keep the scope of the work manageable, the project does not specifically address climate change and its implications for the growth agenda. Though beyond the scope of this work, harmonizing climate action and economic growth is clearly a key part of change in the future growth agenda. For a detailed discussion of the links between climate and growth, see Global Commission on the Economy and Climate (2018), especially the chapter entitled "The New Growth Agenda."

19. Growth in total factor productivity (also referred to as multifactor productivity) represents output growth not accounted for by increases in factor inputs—capital and labor. It therefore captures growth in output resulting from improvements in how these inputs are allocated and used in production, as a result of technological innovation, higher-quality managerial and worker skills, and more efficient business organization and processes.

20. For a techno-pessimistic view, see, for example, Gordon (2016). For a techno-optimistic view, see Brynjolfsson and McAfee (2014) and Nordhaus (2015). For a synthesis of the debate, see Qureshi (2016).

21. See Akamatsu (1962).

22. See, for example, McKinsey Global Institute (2019).

23. McKinsey Global Institute (2019).

24. See Newfarmer, Page, and Tarp (2019).

25. See, for example, Acemoglu and Restrepo (2018) and World Bank (2018) for how this dynamic adjustment process of old jobs and tasks giving way to new ones as technology shifts has played out during previous major episodes of technological change and how it may evolve in this era of the digital revolution.

26. See McKinsey Global Institute (2016) and Lund and Tyson (2018).

27. Sundarajan (2016). See also Brynjolfsson and McAfee (2017).

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