

As for sectoral shifts, IMF (2018c), the third background paper to this *Regional Economic Outlook: Asia and Pacific*, shows that these were important in explaining some of the productivity slowdown for China but do not seem to have played a significant role as drivers of firm productivity in the other countries examined, possibly because the structural transformation was already more advanced in those economies.

Policy Implications

The above findings suggest that the productivity growth slowdown was not, in most economies, an inevitable product of macroeconomic trends, but rather was driven significantly by declining firm dynamism and by financial constraints, especially excess leverage. These are factors that can be influenced by policy, and the paper suggests that policymakers should focus on three areas in particular:

- *Fostering firm dynamism.* This would require supportive policies to foster an environment that is more conducive to innovation and to facilitate resource reallocation through the exit of nonviable firms. Entry and exit barriers should be eased, including by: (1) improving insolvency regimes and removing support schemes that keep distressed firms in operation; (2) lifting barriers to competition in goods markets; and (3) promoting increased labor market flexibility.
- *Addressing debt overhang and avoiding buildup of excessive leverage.* This could be achieved by: (1) facilitating judicious debt resolution and corporate restructuring plans to address weak balance sheets; (2) adopting the proper institutional frameworks and implementing supportive tax measures; and (3) introducing appropriate micro- and macro-prudential regulations to contain leverage. Tax and other policies that reduce firm leverage could stimulate firm dynamism and thus growth. By shifting the capital structure from debt to equity, an allowance for corporate equity would reduce leverage and

boost firm investment in both tangible and intangible capital.

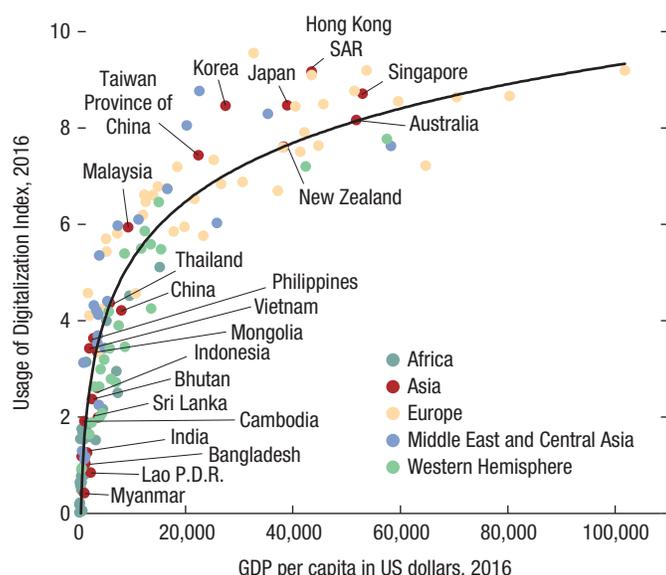
- *Fostering innovation and trade openness.* Fiscal incentives for R&D are already in place in some parts of Asia, and their scope could be broadened. Strengthening intellectual property rights regimes while avoiding undue limitations on competition could also incentivize R&D, as could competition for research grants. Separately, policymakers should continue to open their economies to international trade and foreign investment, as the stimulus from competition and knowledge transfer support higher TFP growth. In this respect, current trade tensions could dampen trends toward intangible capital deepening in Asia by increasing policy uncertainty for firms.

5. The Digital Revolution in Asia: Disruptor or New Growth Engine (or Both)?⁸

The final challenge for Asia addressed in this *Regional Economic Outlook: Asia and Pacific* is how to reap the potential benefits of the digital revolution while minimizing its costs. While digitalization and automation are not new, they have accelerated in recent years, and a new wave of innovation—triggered by advances in artificial intelligence, robotics, computing power, and cryptography, as well as the explosion of big data—is reshaping the global economy. More so than during past periods of innovation, including the spread of personal computers in the 1980s and the rise of the internet in the 1990s, today's technological advances are multiple and overlapping, creating synergies and accelerating outcomes. The digital revolution is affecting all sectors and activities of the economy, with a far-reaching social and economic impact. The new technologies are general-purpose in nature, with the potential—over time—to transform the global economy, substantially boost productivity, and fundamentally alter the way humans live and

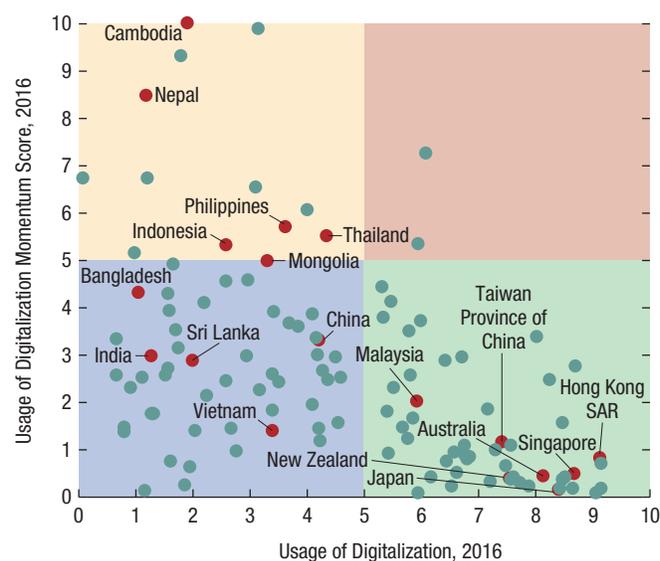
⁸This section is based on IMF 2018d.

Figure 17. GDP per Capita and Usage of Digitalization
(Index 0–10)



Sources: IMF, *World Economic Outlook*; International Telecommunication Union; and IMF staff calculations.

Figure 18. Digital Usage: Level and Momentum
(Index 0–10; Momentum change 2012–16)



Sources: IMF, *World Economic Outlook*; International Telecommunication Union; and IMF staff calculations.

work, much as the steam engine and electricity did. That said, history suggests that such benefits may be observed only with a delay—after a sufficient stock of the new technology and complementary innovations, as well as the capital investments to implement them, are built up. And by the same token, the substantial disruptions and dislocations that may occur may also take place only over time. It is likely that neither the opportunities nor the challenges related to digitalization have yet become fully apparent.

The Digital Landscape in Asia

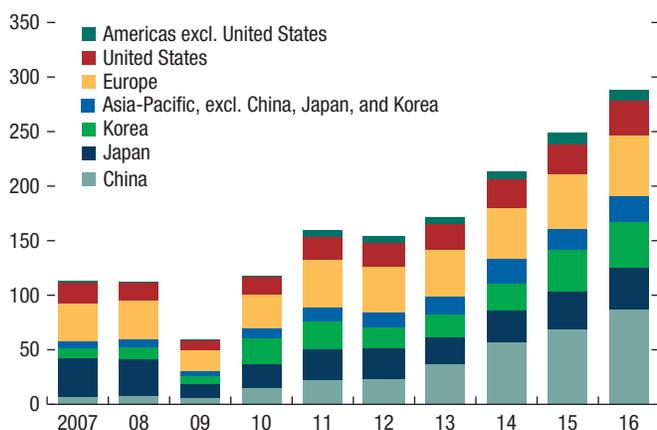
As discussed in the fourth background paper to this report (IMF 2018d), Asia has been at the forefront of the digital revolution, though with heterogeneity across the region. There are Asian players in the lead in nearly every aspect of digitalization, while some economies lag significantly behind. In fact, the region has the highest dispersion of economies in terms of the adoption of digital technologies—not surprising given that Asia covers the entire income spectrum.

Nonetheless, at any given income level, Asian economies are at the frontier relative to their global peers (Figure 17), and moreover, even for relatively poor Asian economies, digitalization is accelerating—as shown in Figure 18, several Asian economies that currently have low levels of digital usage are increasing those levels rapidly.

Turning to specific components of the digital economy, automation via industrial robots is one area in which some economies in Asia are clearly at the forefront. These robots are used almost exclusively in manufacturing, and with Asia being the “factory to the world,” it is perhaps to be expected that a full two-thirds of the world’s industrial robots are employed in the region. The use of these robots has accelerated since 2010: China is now the single biggest user (accounting for some 30 percent of the market), and in 2016 China, Japan, and Korea each employed more robots than the United States (Figure 19). But this is not merely because Asia does a lot of manufacturing. Robot density (the number of industrial robots per 1,000 workers) is high and rising fast in several Asian economies (Figure 20), attesting to their rapid and extensive adoption

Figure 19. Worldwide Destination of Industrial Robots, by Region

(Thousands of units)



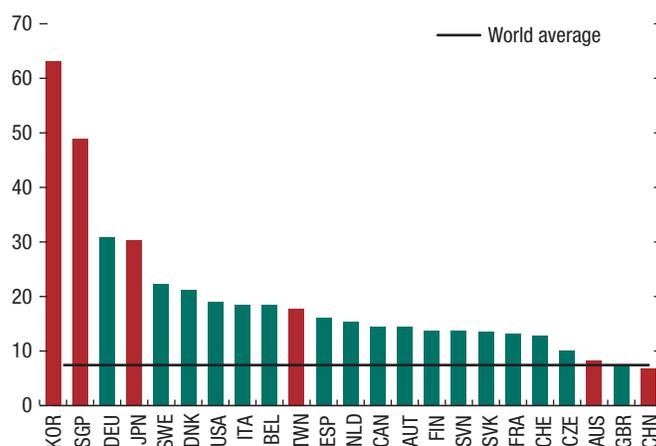
Sources: International Federation of Robotics 2017; and IMF staff calculations.

of these new technologies—indeed, Korea and Singapore are the global leaders in robot density, followed by Germany and Japan. Finally, Asia is a leader not only in the use of robots, but also in their production—Japan and Korea are the world’s top two producers, with market shares of 52 and 12 percent, respectively.

E-commerce and fintech are other areas in which Asia leads. For instance, China accounted for less than 1 percent of global e-commerce retail transaction value about a decade ago, but that share has grown to more than 40 percent, and the penetration of e-commerce (as a share of total retail sales) now stands at 15 percent, compared to 10 percent in the United States. E-commerce penetration is lower in the rest of Asia, but it is growing fast—Lazada, for example, offers millions of products to online shoppers in Indonesia, Malaysia, the Philippines, Singapore, Thailand, and Vietnam. In terms of fintech, Asian economies have made significant progress, in many cases leapfrogging into new types of technology. For example, in 2016, mobile payments made by individuals for consumption purchases totaled \$790 billion in China, 11 times the size of such payments in the United States. Finally, for better or worse, Asia has been a leader in cryptoassets, including initial coin offerings (ICOs). Before

Figure 20. Robot Density in Manufacturing, 2016

(Number of industrial robot stock, per 1,000 employees)



Source: International Federation of Robotics 2017.

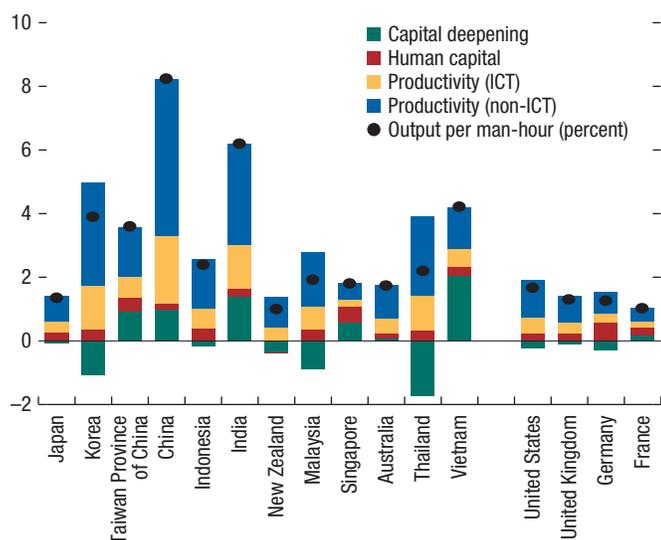
Note: Data labels in the figure use International Organization for Standardization (ISO) country codes.

China tightened regulations, more than 90 percent of Bitcoin trading volumes were against the renminbi, and some small states in the region have even been approached by private investors to adopt cryptoassets as legal tender, causing serious legal and regulatory concerns.

Asia’s Growth: From Perspiration to Digital Inspiration

All of these technological advances may eventually lead to a dramatic boost in productivity and GDP growth, just as happened—albeit with a lag—during earlier industrial revolutions. But the fact is that Asia has already benefited immensely from digitalization. As shown in IMF (2018d), the diffusion of global innovation was the key driver of growth in Asia over the past two decades, with digital innovation alone accounting for about 28 percent of per capita growth (Figure 21). The digital component of GDP, proxied most narrowly by the share of the information and communications technology (ICT) sector, is relatively large in many Asian economies. Asia is home to seven of the world’s top 10 economies in terms of the ICT share of GDP. The sector has also been growing substantially faster than overall

Figure 21. Sources of Economic Growth
(Percentage points; 1995–2016)



Source: IMF staff estimates.

Note: ICT = information and communication technology.

GDP—twice as fast in India and Thailand, and nearly four times as fast in Japan. Digitalization can also boost the productivity of non-ICT sectors. IMF (2018d) finds, for instance, that a 1 percent increase in the overall digitalization of the Chinese economy is associated with a 0.3 of a percent increase in GDP growth. Innovation in Asia is tilted toward the digital sector, further highlighting the potential of digitalization to boost growth.

Automation and the Future of Work

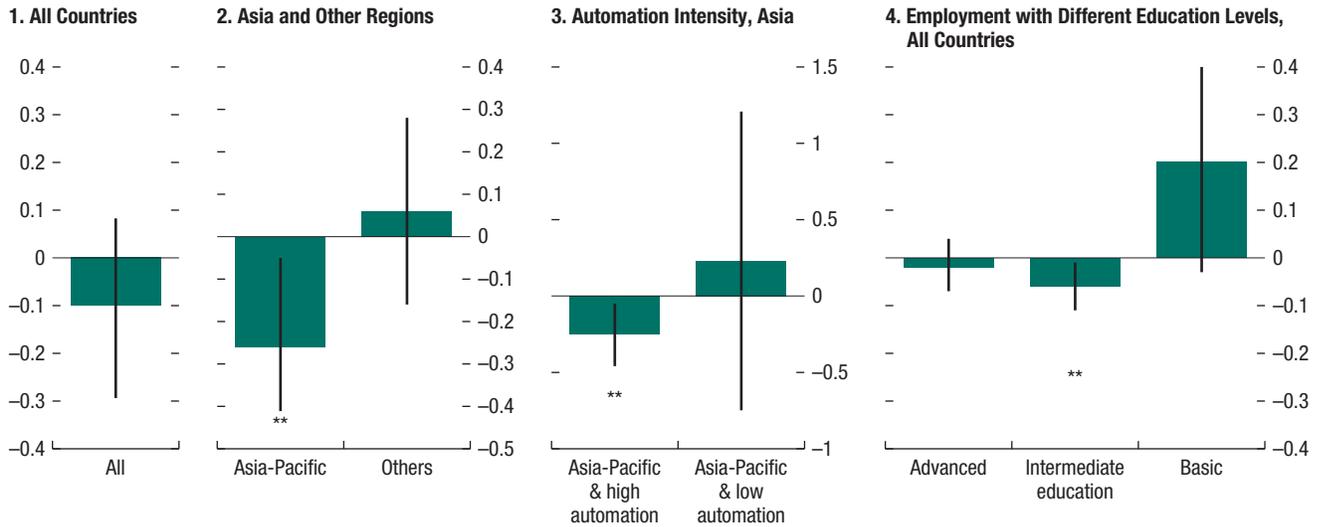
As noted above, digitalization can bring disruption as well as higher growth, and one of the main areas of concern is the labor impact of automation. Using an approach pioneered by Acemoglu and Restrepo (2017), IMF (2018d) analyzes the impact of robot usage on manufacturing employment across a large sample of economies in Asia, Europe, and the Americas. Contrary to some observers' worst fears, the paper finds no evidence that robots destroy jobs on net—that is, the productivity-enhancing (and thus job-creating) effects of industrial robots have offset the displacement effect (in other words, the

destruction of old jobs). Restricting attention to Asia, however, there is a slight negative impact on overall manufacturing employment, and particularly so in certain heavily automated sectors like electronics and automobiles (Figure 22, panel 1 to 3). Furthermore, like other research, IMF (2018d) finds that workers with medium-level education are more vulnerable to displacement than those with either low or high education levels (Figure 22, panel 4). Interestingly, however, in Japan, with its aging population and declining labor force, increased robot density in manufacturing is associated not only with greater productivity, but also with local gains in employment and wages (IMF 2018d). Japan's experience suggests that other Asian economies such as China, Korea, and Thailand, which will face similar demographic trends in the future, may also benefit from automation.

E-commerce as a Growth Driver

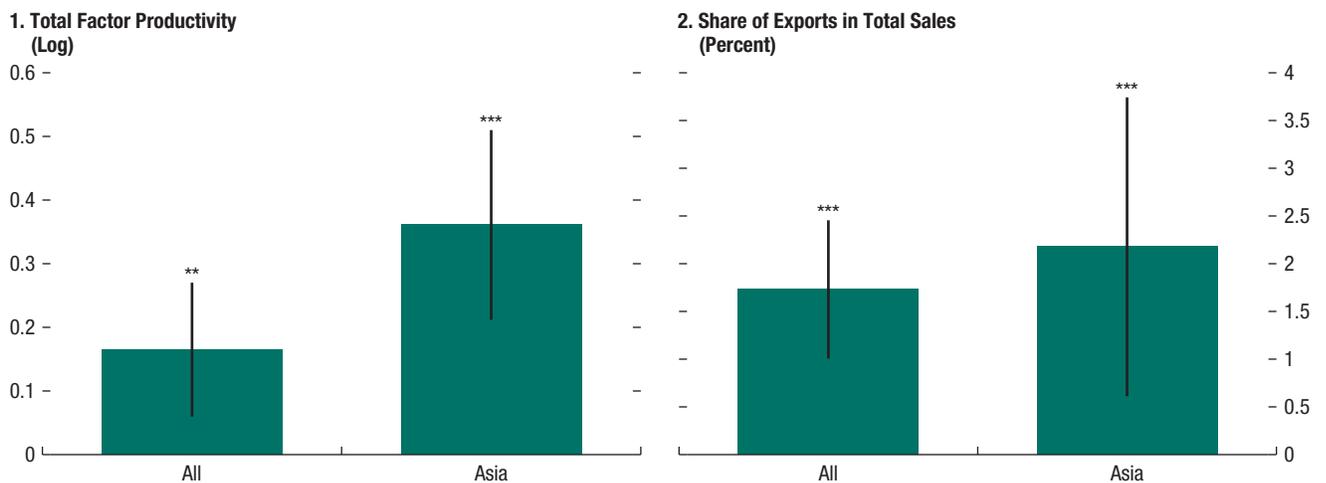
Another fast-growing and important digital area is e-commerce. E-commerce has the potential to support growth and rebalancing. For consumers, e-commerce may translate into better access to a wider range of products and services at lower prices, ultimately boosting consumption. A study by McKinsey (Dobbs and others 2013) shows that while 60 percent of internet spending in China represents purchases diverted from traditional retail to the online channel, close to 40 percent represents incremental (new) consumption—in other words, e-commerce can substantially bolster aggregate consumption. For firms, e-commerce could also provide new business opportunities and access to larger markets and may thus support investment. The econometric analysis in IMF (2018d) shows that participation in online commerce is associated with more than a 30 percent increase in total factor productivity at the firm level in Asia, and a 50 percent increase in exports (Figure 23). Interestingly, e-commerce seems to be especially beneficial for small firms in Asia.

Figure 22. Estimated Effect on Manufacturing Employment Growth
(Percentage points, associated with one more robot per 1,000 workers, 2010–14)



Sources: International Federation of Robotics 2017; World Input-Output database; International Labor Organization; and IMF staff calculations.
 Note: Figure is based on regressions of the changes in manufacturing employment on the changes in robots per 1,000 employees during the period 2010–14. Panels 1 to 3 are based on 14 manufacturing subsectors in 40 countries, and panel 4 is based on countries for which education breakdown of employment data are available. Intermediate education refers workers with upper secondary and postsecondary non-tertiary education. Bars show the estimated total effects calculated based on the estimated coefficients for each specified group in the horizontal axis. Error bars refer to the 95 percent confidence interval.
 ** $p < 0.05$.

Figure 23. Estimated Impacts of E-commerce Participation on Productivity and Export



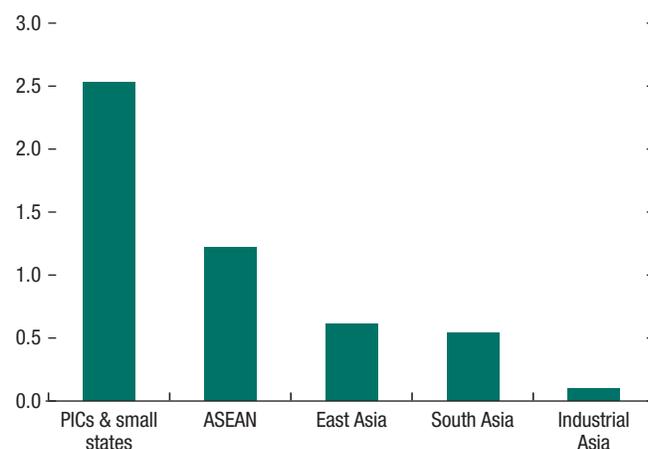
Sources: World Bank, Enterprises Surveys; and IMF staff calculations.
 Note: Panels 1 and 2 illustrate coefficients and confidence intervals from two firm-level estimations: (1) the impact of e-commerce participation on total factor productivity controlling for firms' age, size, foreign ownership, and export status; and (2) the impact of e-commerce participation on the share of exports in total sales controlling for firms' size, age, and foreign ownership. The error bars refer to the 95 percent confidence intervals around the estimated coefficients. For Asia, the estimated coefficients imply that participation in e-commerce is associated with more than a 30 percent increase in total factor productivity and an increase in the share of exports to total sales by about 2 units, corresponding to a 50 percent rise.
 ** $p < 0.05$; *** $p < 0.01$.

Digitalization of Finance

Turning to the financial sector, fintech can support potential growth and poverty reduction by strengthening financial development, inclusion, and efficiency. By leveraging the widespread increase in access to cell phones, fintech can help millions of individuals and small and medium enterprises, particularly in poor Asian economies, leapfrog access to financial services at an affordable cost, for example, through the development of fintech-enabled micro loans and accessible tools for bookkeeping and accounting. Fintech may also drive substantial efficiency gains by enabling the financial sector to provide more efficient cross-border payments and remittances, and in turn reducing counterparty risk and decreasing costs for market participants.

At the same time that fintech offers efficiency and inclusion benefits, however, it also poses risks to the financial sector if its applications undermine competition, monetary policy transmission, financial stability and integrity, and consumer and investor protection. These technologies may disrupt the business models of established financial institutions and lead to a migration of activities outside the regulated sector. IMF (2018d) finds that economies with a greater propensity for technological leapfrogging have also tended to see falling levels of traditional financial infrastructure, particularly bank branches. Unlike US tech companies, which face a different regulatory environment, Asian tech giants, such as Alibaba, Tencent, and Baidu in China and GO-JEK in Indonesia, have become important providers of financial services, putting competitive pressures on traditional financial institutions. Cryptoassets may pose risks related to money laundering, tax evasion, circumvention of capital controls, and other forms of illicit activity. As the financial system goes digital, cyber risks will increase further.

Figure 24. Potential Import-VAT Revenue Gains from Closing Half the Distance to the Digitalization Frontier, 2016
(Percent of GDP)



Sources: IMF, *Fiscal Monitor*, and IMF staff calculations.
Note: ASEAN = Association of Southeast Asian Nations; PICs = Pacific island countries; VAT = value-added tax.

Digitalization to Strengthen Public Finance

Finally, digitalization—which is correlated with good institutions and performance—presents opportunities for improving public finance in Asia. While there are risks of erosion of the tax base, these can be addressed with policies to enhance data sharing and withholding mechanisms. Indeed, by improving reporting of transactions, the adoption of digitalization by governments should facilitate increases in value-added tax (VAT), tariff, and other revenues. Moreover, if Asian economies were to move halfway to the global frontier, import VAT revenue could rise by 0.6 of a percent of GDP, and for Asian small states, which are typically further from that frontier, estimated revenue gains are on the order of 2½ percent of GDP (IMF 2018d) (Figure 24). Digitalization can also enhance public financial management and improve the efficiency of public spending, including via the targeting of social assistance, thus making fiscal policy more inclusive, fair, and ultimately sustainable.

Policies for the Digital Age

While the digital revolution is inevitable, the outcome—utopian or dystopian—will depend partly on policies. To realize the potential of the digital revolution, comprehensive policies, and fresh thinking are needed. For policymakers, the first hurdle is to accept that the digital revolution is inevitable. Policy responses will need to strike the right balance between enabling digital innovation and addressing digitalization-linked risks. Policies to harness digital dividends include revamping education to meet the demand for more flexible skill sets and lifelong learning, as well as new training, especially for the most adversely affected workers; reducing skill mismatches between workers and jobs; investing in physical and regulatory infrastructure that spurs competition and innovation; and addressing labor market and social challenges, including income redistribution and safety nets.

Policy priorities differ across Asia (and the world), as economies' initial conditions are different. But considering the inherent global reach of these technologies, regional and international cooperation will be key to developing effective policy responses, and the IMF can play an important role in this regard.

Policies to soften the labor market impact of new technologies can improve welfare. The more willing society is to support the necessary transition and provide support to those who are left behind, the faster will be the pace of innovation that society can accommodate while still ensuring that the outcomes improve welfare, with all members of the society better off. With the right policies, the digital revolution could be a new engine of growth and prosperity for Asia and the world.

6. Keeping Asia at the Forefront

Asia is the world's most dynamic economic region. But it faces a number of serious challenges over the medium to long term—that its trade-reliant growth strategy will no longer be viable (at least in its current form), that population aging will weigh on many dimensions of economic performance, that productivity growth may not accelerate again, and that the ongoing digitalization of its economies may lead to major disruptions even as it boosts productivity over time.

What these forces will mean for the region's future is squarely in the hands of Asian policymakers. Global trade tensions may well persist, and opportunities to export to advanced economies may be diminished. But Asia can offset this and create a new source of regional growth by liberalizing its relatively restrictive trade and investment regimes—particularly in services—and thus boosting intraregional trade. Productivity growth may be lagging, but policies to improve entry and exit and to help firms resolve their debt situation will help address some of the key micro-level drivers of the slowdown. And in terms of the digital economy, as discussed above, there is an important role for policymakers to play in developing education, infrastructure, and regulatory environments to allow their economies to reap the full benefits of digitalization and ensure that it can be a key growth engine, while taking steps to soften the accompanying labor market and other adjustments. While addressing these specific challenges, Asian policymakers will also need to do their part in ensuring continued regional and global policy collaboration, including via their engagement with, and governance of, global institutions.

To sum up, Asia's growth may face serious challenges, but with continued sound policymaking, the region should have good prospects for staying at the forefront over the coming decade and beyond.