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Productive Equity

The Twin Challenges of Reviving Productivity and Reducing Inequality

A report by the scholars at the Brookings Institution and the Chumir Foundation

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PRODUCTIVE EQUITY

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Contents

Foreword

The Dynamics of Productive Equity

In many countries, visible and growing disparities, both economic and political, have been fueling social discontent. As some employment opportunities disappear and income disparities grow in the face of modern automation and globalization—and, as wages, particularly for low-skilled workers, stagnate—fear about decent jobs is understandable, and the optimism needed for investing in one's future is undermined.

The discussion that follows focuses on the last few decades. It does not try to predict the future, although some trends are evident. Indeed, in late 2017 and early 2018, GDP growth in the world economy accelerated, due mainly to employment growth. Whether this acceleration will be lasting and bring with it the long awaited acceleration of labor productivity growth remains to be seen. However, as yet there are no significant signs that growth is becoming more inclusive, particularly in advanced economies. The increasing high incomes at the very top of the distribution and the stagnation in median incomes in many countries have become major political problems. This all could place a serious brake on deriving the full potential benefits of dramatic new technologies. The loss of societal cohesion and the erosion of trust in democratic institutions have led to significant hurdles for the kind of policymaking that could allow the benefits of frontier technologies to be reaped more rapidly and more equitably.

It is important to distinguish between income distribution across countries and income distribution within countries. Starting in the 1990s, a process of convergence began, with the per capita income of developing countries in the aggregate beginning to grow faster than those of advanced countries. While a large part of this convergence process was due to China, with its huge weight skewing the developing country average, it has not been just a "China phenomenon" but a more general trend, making the global income distribution less unequal. Nevertheless, there remain numerous countries not yet experiencing the narrowing of inter-country differentials, so this continues to be an international issue. At the same time, income distributions within major economies became more unequal. The political debate inside countries naturally deals primarily with this fact.

This foreword provides a brief outline of these issues and summarizes the dynamics affecting contemporary growth and distribution patterns. It is followed by an Introduction, "Technology, Productivity and Distribution: Framework for an Informed Dialogue," that sets out a framework as well as a discussion of observed market performance, analyses, and policy considerations regarding the identified constituent elements affecting the results. The chapters beyond report on the research to document and analyze the trends and their implications in more detail.

Technology and Competition as Determinants: New technologies have long been understood—and empirically observed—to be the fundamental driver of increased productivity and greater output from their application. Progressive dissemination of such advances under a competitive need to "keep up," to thrive, or even to survive, enhances cumulative output, aggregate productivity, growth, and living standards. Greater worker productivity, supply and demand for skills, and the ensuing growth all drive compensation, and with some public policy adjustment help where necessary, as frequently was the case in the past, it led, also, to wide sharing of the income gains.

Adjustment Policy: To facilitate the transition for those displaced by innovation—if they are not re-employed in a timely manner, often in higher paying jobs—some level of publicly provided adjustment and retraining support, social services, pensions, and similar public policies have smoothed the way toward sharing the gains. The absolute levels of such support are quite different by country, depending on the nation's state of development and industrialization as well as political processes. It is probable that displaced workers will be calling upon these considerations in significant numbers and with increased frequency in the contemporary world of technological change.

Technology Process, Economic Growth, and Income Distribution: Both the growth of output and the distribution of the value created vary across sectors and cycles of the economy. The economic sequence and our use of the terminology of the technological process starts with basic scientific research, then is followed by applied R&D, to produce new technologies. Subsequently, their productive application in the adoption of innovation requires investment that disseminates the new capacities. The sum of the uses aggregates to overall productivity of an economy. The dynamics produce economic output/growth and a pre-fiscal and social service distribution of the gains, evolving over each technology's life cycle. A new technology is typically launched in the market in which it was developed, deployed by early adopters at relatively high price levels, and later disseminated for more widespread adoption, larger scale, and lower cost production, including manufacturers/producers seeking out lower cost production locations, either at home or abroad. Reasonable incomes, distribution that funded demand, and the appeal of new goods and services have generally maintained demand and social support for the process despite there being winners and losers from the changes brought by new technologies—and, for that matter, by international rationalization and trade.

Growth and Distribution Performance: Measured performance of productivity, growth, and income distribution have changed materially over recent decades, generating less economic gain than possible and greater disparities of income within countries; and even more significant disparities of wealth. The magnitudes and trends are socially damaging, divisive, and destabilizing. These two developments, affecting both income distribution and output, affect all categories of the population—and output foregone reduces the resources with which to address income issues as well. This should command the attention of all segments of the citizenry in virtually all countries.

Common Principal Causes: The two broad performance and policy issues addressed here—economic advance/output and socio-political satisfaction and stability from the distribution of its benefits—have important determinants in common; and several of the same policy provisions would enhance output and produce less extreme disparities than those seen over recent periods. A challenge lies in the fact that the correctives must come from the societal institutions and actors that gave rise to the current conditions. But it is worth noting that it does not take long for otherwise foregone productivity and output, if captured and compounded, to benefit all, despite some costs being made to be borne by the "winners" to offset the impacts on the "losers" and to remedy the displacement of those who are faultless and unable to recoup the loss.

There are some characteristics of the sequence from R&D, to economic output, and income distribution that are noteworthy for the discussion.

Regarding R&D, the government's direct role in expenditure and selection has declined (from 1.2 percent of GDP in the early 1980s to 0.6 percent in 2015 in the United States), as has basic scientific research. Private sector R&D has increased. Its objectives and greater product focus involve fewer development ramifications and more legal defense of intellectual property rights and the market power those rights support. R&D selection influences are shifting, and the results are less productive. Tax incentives support this activity. Being responsible for setting defense and space sector demand and the development of some health technologies—as well as procurement for defense, space, and some social services—means that governments directly influence significant R&D selection and technology deployment processes.

Related to economic output, productive new technology is very much in evidence, but overall average productivity growth has fallen by half in advanced economies, from just over 2 percent annually from 1990 to 2004 to approximately 1 percent from 2004 to 2016. Within this, the most productive firms have improved their productivity growth at around 3 percent a year from 2001 through 2013 compared to around 0.5 percent for all other firms. This pattern of limited dispersion of innovations across firms reflects low investment and, hence, low aggregate productivity improvement, since investment is a principal driver and vehicle of dissemination. There are some separate questions about investment, including: timing; de-motivation caused by excessive savings/low return/low interest rate environments; and impediments or risks affecting the willingness of the decision makers to invest in some higher yielding locations. But it remains the case that markets with low levels of competitive forces do little to drive investment and dissemination of innovation, dynamics that directly adversely affect the rate of growth.

It is instructive to note that the underlying investment decline in the deployment of productivity enhancing technologies predates the recent financial crisis and continues today. Also, significantly increased market concentration, super profits for the leading firms, and reduced market entry coincide with the period of deteriorating productivity performance and these would appear to diminish competitive motivation to develop and deploy new technologies and innovation. It is also clear that reduced competition and dominance by a few firms are reinforced by intellectual property protection (or by a greater exploitation of these rights).[1]

Additionally, some new digital technology-based services have "winner-takes-most" quasi-natural monopoly characteristics. Wide dissemination of a service or product innovation to end users, at user pricing that reflects market power, does less to advance desired performance. It is diffusion of the technology among competitive service providers or goods manufacturers that accomplishes wider access to the technology that leads to measured productivity improvement and more widely-distributed gains.

National governments are effectively less able to oversee global companies in the wider public interest with regulatory alternatives to competition. International trade now, increasingly, moves between national entities of the same company, enhancing corporate market power. It is inter-company transfers that increase dissemination and competition; and such transfers now are lagging.[2]

Finally, nationalistically driven international agreements tend to protect the signatory countries' dominant companies rather than implement joint governance, thereby further reinforcing corporate power.

The causes of lower economic performance also contribute to distribution disparities, and vice versa. Further, economic power accentuates the political influence responsible for the policies that impact economic growth, income distribution, as well as the social advantages, such as education, that perpetuate economic disparities. There are significant linkages.

First, as noted, the market power of dominant firms retards investment by others, hence, delaying dissemination of technological advances and their impacts on productivity and growth. The leading firms capture a growing share of the productivity gains in national income, favoring capital relative to labor; and the share to capital accrues to wealth, which is held disproportionately by a very small percentage of the population. This economic disparity is perpetuated by the socio-political advantages of wealth—which include a good education from earliest ages and the ability to benefit more from some public services. Education is linked, of course, to premium compensation paid to the more skilled, particularly by the leading firms. There is a growing wage gap, generally between sectors but even between leading and other firms in the same sector, which has widened by 12 percent in the United States between 2001 and 2012. This polarization of incomes reduces demand and output by virtue of lower propensities on the part of higher income groups to spend as large a portion of their incomes, thereby generating less aggregate demand compared with more equally distributed purchasing power. A growing body of economic research suggests this wage differential is a major driver of growing disparities overall.

Automation drives more reduction of middle-income jobs by replacing, particularly, repetitive tasks often characteristic of such jobs. This is reinforced by globalization and low cost labor availability at other locations. Together these forces further increase income disparities, at least in the outsourcing economies, and likely within the supplying economies, even while the differential between the two groups of countries is reduced.

At the same time, redistribution following initial market results, effected through transfer payments and public services, defines ultimate disposable incomes and living standards. In the period studied, however, reduced tax rates on income and wealth—personal and corporate—have reduced public resources available for redistribution to address those differentials and curtailed the fiscal redistribution that offsets market-generated disparities, even when output-increasing innovation is also occurring.

This discussion is not ideological. Where initial impacts of innovation are inequitably distributed, and in the absence of resources for redistribution, social discontent could be exacerbated, innovation slowed and damage inflicted, over time, on everyone.

It is also important to stress that public policy can and does influence the entirety and each stage of the process from R&D selection and its financing, to technology development and its dissemination, as well as market structure, taxes, and subsidies. A technology policy that not only fosters innovation but also, from the beginning, has poverty reduction and a less sharply disparate income distribution as objectives would lead to much greater balance in the allocation of gains from technology than a policy that does not focus on these objectives, or tries to deal with them only at the late stages of the cycle. This latter adjustment would come after the basic allocations have been made by the dynamics of: market power; technology ownership and rights; skills; available technologies; deployment choices in the use of methods of implementation of technologies and the investment climate—and subject to the interactions of particular technologies newly available with the terms and conditions of access to their benefits. R&D initiates the process. Competition and intellectual property policies clearly affect dissemination and distribution of gains. Education and skills training affects the supply of needed workers, development capacities, incomes, and work force adaptability. Fiscal policy affects resources available for redistribution and investment incentives. Political values and priorities influence them all.

It is the situation of impressive new technology, slow improvement of aggregate productivity, slow GDP growth and significantly increased income disparities and the above diagnostics that brought us together. Our analysis began with the recognition of a systemic interconnection of technology, productivity, output and income distribution; their common determinants and the confluence of technical, economic, social, political and ethical consequences. The collaboration of the Chumir Foundation for Ethics in Leadership and the Brookings Institution attempts to gather a state-of-the-art description of the facts, of the best evidence of the causes (proximate and underlying), and indications of the variables and variations that might suggest appropriate policy action in pursuit of more fair, harmonious, productive, and innovative societies.

What influences arise from technology—today's mix in particular—but also from industrial, trade, financial, educational, and social policies—or their interactions with technology and each other? What methods should be considered for offsetting disparities or addressing those disadvantaged and unable to protect themselves while continuing to incentivize and capture innovation that generates the capacity to benefit all?

The purpose of this project is to stimulate an informed dialogue in our communities and governments about the increasing disparities in society and chronic suboptimal economic performance, and to consider what can be done to change or superimpose a reshaping of those dynamics or redressing of results that undermine economic productivity and fairness, trust in government, and social cohesiveness. The objective is to achieve an economy that stimulates and captures the gains of innovation, productivity, and growth from technology in economic activity and captures the gains of global production rationalization and trade. The aim is to understand and foster a society that distributes income in a manner that serves the purposes of productive incentives, compensates equitably and is a society that enjoys cohesiveness, stability, and well-being.

There are numerous pieces of analysis on parts of these problems, but the research often does not link the productivity problem to the income distribution issues. It is our hope that this report will advance an integrated approach. Certainly distribution is easier to address in a context of stronger growth. We hope this will help to inspire open dialogue—particularly at a time of significant technological advances—on the causes, effects, and optimal response to the concerns of slowed growth and widening disparities for a healthy economy and society. We hope to stimulate an interest in seeking "productive equity."

Joel Bell and Kemal Derviş

Notes

1. This is not inconsistent with the performance of leading firms in pursuing cost saving innovations as well as product and service development that creates obsolescence and repeat demand from their customer base. Moore's Law has continued to apply.

2. Some ostensible transfer activity is more tax driven than market service related, but the multinational firm remains a relevant factor for this analysis.

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Technology, Productivity, and Distribution: A Framework for an Informed Dialogue

JOEL BELL

Anyone who grew up in the postwar period, at least in the developed world, came to expect that technology would indefinitely drive growth and standards of living to increasingly higher levels. It would generate constantly easier, more appealing and demand-stimulating ways to satisfy needs and desires, from the most basic to the most luxurious or frivolous. Demand would not become satiated, as some economists had earlier speculated. This would not be just a passing condition resulting from postwar reconstruction and pent-up consumer demand.

Despite momentary anxieties over employment displacement from automation, Joseph Schumpeter was borne out again and again as automation-led elimination of jobs produced higher-valued new jobs and, therefore, higher incomes and greater overall effective demand and employment. It appeared that unemployment—after making allowances for transitional frictional unemployment, growth of the workforce, and a shorter workweek—need be only cyclical in a well-managed economy. The utility of the hard-to-come-by savings of our parents and, by extension, of our generation was questioned in some quarters as those savings were dwarfed by the much higher earnings of their children, even at an early age.[1]

This secular growth mindset was supported by cost-reducing innovations and by mass market dissemination of new capacities through the life cycle of a technology. New technologies and innovations included lower unit cost and new ways to meet needs. Community-managed technologies contributed significantly. Targeted technological needs or functionalities for defense, space, and health-related programs generated publicly funded basic research, products and services development, and procurement spending. It was relatively easy to develop civilian derivatives once the public purpose was met. Public sector research and research funding maintained a pipeline of technology opportunities, providing successively higher value opportunities. With this came an expectation, if not a promise, that the sequence of R&D, technology, innovation, dissemination, lower cost mass and derivative production and growth would continue and would spread economic activity, gains, and well-being, domestically and globally. If the market mechanism needed complementary measures to achieve distributional goals, growth was rapid enough that some redistribution could be achieved with taxes and transfers without hurting the incentives needed for investment and innovation.

This causally linked sequence of R&D, technology, and innovation—and the feedback loops—is an accurate description. But the subsequent stages—disseminating access to technologies, investment in their deployment, consequent growth, and more equal or converged income distribution—while observed at the time, were not inevitable. Changing influences on performance at any stage in the sequence changes the stages further down the chain. From exogenous changes in R&D selection and funding to shifts in conditions affecting the dissemination of innovations, market structure, or investment embodying such advances can change the dynamics and results.

The fallacies in thinking that inclusive growth automatically follows technological innovation are now palpable in the disparities of income and wealth, as well as in lesser economic performance representing a lost growth/output opportunity. This poses questions of a technical economic and technological scientific nature, as well as of a psychological, sociological, and governance or political character.

At its most basic, a worker can vary output per hour only to the extent of his or her skill and his or her speed at the task. The introduction of technology and innovation can more significantly increase output per hour of work, measured as "productivity." Where and how the value of added output is captured and influences well being, either geographically or by capital or labor, is part of the question of distribution. The elements that explain productivity and distribution are the topics of this work. They include:

- Market power and level of competition
- Selection and investment in (and financing for) technology and innovation development and deployment
- Accessibility, costs, appeal, or uses to a firm of any particular technology

- Supply of required skills and human capital
- Effective demand for components and end products and services
- Taxes and fiscal transfers that influence behavior, available resources, and income distribution

Growth and Productivity: Demographics, Investment, and Potential Growth

An economy's "potential output" is determined by the natural use of its factors of production—labor and capital.[2] Aging populations across advanced economies and some major emerging market economies will reduce the available labor supply for those economies in the years ahead, all else held equal. Declining investment rates, particularly in advanced economies, suggest that the contribution of capital will slow down, as well. In such a setting, technological advance and efficiency provides the principal hope for overall production to keep potential economic growth at a high level.[3]

A look at the data underscores the slowing trends on labor, and capital and their limiting of growth and productivity from which dynamics of income distribution arise.

Actual Output Growth: In advanced economies, overall GDP growth fell, from 2008 to 2017, to 1.2 percent a year, a full percentage point below its longer-term average since 1990 and less than half of the pre-crisis average of 2.7 percent. On a per capita basis, growth fell to under half its longer-term average, down to 0.7 percent a year from 2008 to 2017 compared to 1.5 percent a year during 1990 through 2008. In emerging and developing economies, overall growth since the crisis remained around the longer-term average of 5 percent, although it has been steadily decelerating in recent years, down now to close to 4 percent. On a per capita basis, growth in emerging and developing countries has fallen to 3.5 percent from 2008 to 2017 compared to 3.8 percent since 1990.

Aging Populations: According to the UN's World Population Ageing report, older persons (over age sixty) are the fastest-growing age group in the world, posing a further constraint on growth. Between 1950 and 2000, the share of the world's population that is sixty or older increased slightly, from 8 percent to 10 percent, and is projected to more than double between 2000 and 2050, from 10 percent to 21 percent. The aging process is most advanced in developed countries. Though some developing countries, like India, currently have a large and growing workforce of younger people, the pace of population aging in the developing world is substantially faster than what occurred in developed countries in the past.

Investment: Investment is fundamental for technological innovation and is a fundamental driver of labor productivity through its influence on the capital available to workers. U.S. net business investment as a percentage of net operating surplus fell from 50 percent in the early 1980s to 25 percent in the 2010–15 timeframe. The McKinsey Global Institute estimates that this lower investment explains around half the productivity growth rate decline in the United States and the larger Western European economies. A comparison of 2000–04 with 2010–14, when labor productivity growth in the United States fell from 3.6 percent to −0.2 percent and, in Germany, from 1.7 percent to 0.9 percent, makes clear that the shock of the financial crisis drastically reduced the pace of aggregate capital accumulation. The total capital stock in the United States grew half as fast after the crisis as it had in the decade before, falling from 3 percent a year from 1996 to 2007 to 1.5 percent a year from 2008 to 2014. In the euro area, growth in capital stock fell from 2.3 percent a year to 1.3 percent a year, and in Japan it collapsed from 2 percent a year to 0.2 percent a year. In emerging and developing economies, investment growth had been robust, led by emerging Asia, but has been on a downward trend in recent years, slowing from over 15 percent per year in 2010, which was above its 2003–08 pre-crisis average, to around 4 percent per year in 2016, below its longer term average from 1990 to 2008.

Potential Growth: Estimates from the World Bank project that potential output growth in both advanced economies and emerging and developing economies will slow down in the coming decade, led by slowdowns in the contributions of labor, capital, and productivity. Comparing average annual potential growth from 1998 to 2017 to projections for 2018 to 2030, potential growth is projected to decline from 1.8 percent to 1.2 percent in advanced economies, and from 5 percent to 4 percent in emerging and developing economies.

Market Power

A thread that runs through the analysis of the dynamics of technology, productivity, and distribution is that of market power and competition. Market power can be conferred by policy and technology, and its exercise has a great deal to do with distribution. Exclusivity or monopoly power, the antithesis of competition, generally reduces the drive to innovate and, consequently, constrains productivity. In limited doses, intellectual property policy has long relied on some monopoly-profit-like gains to motivate investment in R&D and innovation.

Power can be acquired, constructively when limited, through unique know-how, first-mover advantage, and intellectual property rights conferred by law. Where acquired for reasons of economies of scale and/or convenience, whereby one or a few suppliers fulfill all or a large proportion of customer demand (natural monopoly), regulation (or public ownership meant to accomplish the same result) has been its companion policy. More recent "winner takes most" platforms and markets have generally had different characteristics. Use of power to cultivate further exclusivity by creating higher entry barriers for others is, in some cases, characterized as abuse of market power. Power is seen—depending on degree, context, and use—as beneficial, detrimental, or neutral; but it is, essentially, judged by its impact on creativity and distribution.

Empirical research reveals creative leading firms deploying innovations, reaping rewards, and compensating personnel—particularly those in possession of skills in short supply—more generously than others in the same sector. But when they erect barriers and effectively keep other firms from catching up, the technology diffusion process slows down, the economy loses the productivity gains of wider deployment, and the dynamic fosters disparities within a sector or employee skill set. Some leading firms become complacent and, on occasion, use monopsony power with employees, using buying power to limit their incomes in favor of owners or suppliers of capital.

With more enterprise being global, firms have increasingly been open to international competition but also in a position to effect international dissemination of technology within their own company network, extending and potentially increasing market power while retarding interfirm transfers that would increase competition, capturing savings from international rationalization of activities. Globalization, however much responsible for displacement of labor compared to technology, has enhanced the power of capital over labor with distributional consequences of downward pressure on wages. Technological displacement is accompanied by an output and income effect; globalization can reduce consumer prices and alter capital/labor split.

With some 80 percent of international trade accounted for by multinational corporations and affiliates, given the importance of foreign direct investment, but with regulatory power lodged in sovereign states, larger international companies also have increased their market power by being able to escape, or at least minimize, some intended impacts of regulation. International collaboration on public interest and policy enforcement has not kept up, and national interests have been promoted by governments in ways that have reinforced corporate power by championing their country's leading firms in both domestic and international dealings, largely through domestic and international intellectual property and investment protections.

There are numerous indications of reduced competitive forces. To begin with, in twenty-four OECD countries, firms in manufacturing and nonfinancial services with twenty or more employees, which represented the top 5 percent of firms by labor productivity, saw their productivity rise by approximately 35 percent, while the rest rose by only some 5 percent from 2001 to 2013. The leading firms are taking off while the rest are left behind.

In the United States, between 1982 and 2012, the market shares of the top four companies by sales rose, on average, from 5 to 10 percentage points in manufacturing, utilities, services, and wholesale trade, starting at 38 percent, 30 percent, 11 percent, and 22 percent market share, respectively. In retail trade and finance, the leading four companies boosted their market shares by 10 to 15 percentage points in the same period, starting at around 15 percent and 24 percent market share, respectively. It is telling that the average markup above marginal costs increased by more than 3.5 times between 1980 and 2014, from 18 percent to 67 percent. And new competitive entry, measured by firms five years old and less, accounted for about half of all U.S. firms and one-fifth of total employment, declining to about one-third and one-tenth at the end of the period. In other words, markets are more concentrated and profits are rising with higher markups, yet there are fewer new entrants despite the profit potential.

A 90th percentile firm saw a 100 percent return on invested capital, actually five times that of the median firm, up from two times twenty-five years earlier. Profits in excess of cost of capital across the U.S. economy rose from 3 percent to 17 percent of total U.S. income. In finance, the top five banks went from 25 percent to 45 percent of the sector's assets from 2000 to 2014 and captured 35 percent to 40 percent of corporate profits in the years before the financial crisis. In Europe financial sector employees representing one in twenty-five workers, were one in five of the top 1 percent of earners.

The top eight multinational technology companies account for about one-third of the market capitalization of the 100 most valuable firms globally, as of 2018. Patent lawsuits have increased by at least eight times between 2003 and 2011 in the United States, suggesting a rise in the anticompetitive use of intellectual property rights at the same time the private sector's share of total R&D spending has grown. It is typically harder for smaller firms than for big firms to endure costly legal battles or to develop the capacity to protect their own intellectual property. This has consequences for the dissemination of technology and the ability of a broader range of firms to catch up in terms of productivity and, consequently, wages.

Nature of the Technology

Different technologies have differing characteristics that influence whether technology proves to be pro-competitive and convergent or disparate in its distribution. These differences, which influence dissemination, individual and aggregate productivity, and, potentially, distribution of the benefits,[4] include:

- The novelty, distinctiveness or constructive disruptiveness, and cost of production impact of the applications of a technology
- Economies of scale or tendencies to concentration or otherwise
- Sector and/or need to which a technical capability is applied, and the scope and selection of ways to use and deploy a technological capacity
- The significance and ease with which related know-how can be replicated by a non-inventing party, especially when assets are intangible and can more easily spill over to other firms

- The skills required for its application, their availability, and employment characteristics
- The terms on which a technology is available to others

In the postwar world, if not before, government procurement for space, defense, and medical services—particularly in the United States—drove a large proportion of research and product development. Support of research in basic science by grants and funding of R&D for applied capabilities—whether directly in government laboratories, by contractual specification of a functionality to be developed by third-party sources, or by subsidized private commercial activity—all contributed in a major way to technology development. Government goods and services procurement served as a further driver and R&D selection mechanism. Later commercial derivatives of the technologies and products developed under these public sector demands have accounted for a great deal of the technologies used in current industrial and consumer applications. Defense and space needs dominated the technology selection mechanisms and spawned industrial consequences for many years in an economy like that of the United States.

By comparison, consider R&D for educational devices made available in public schools; or medical treatments developed in government labs and used in public health services at no specific patient expense; or compulsory licensing or other methods to ease competitive access to technological developments; and, perhaps, attractive pricing or consumer sensitive terms and conditions for end-user acquisition. These conditions and practices would all impact innovation, productivity, investment, growth, distribution and both economic and social results and income distribution consequences. Public social policy technological priorities (health, education, environment), wealth driven demand, defense and space ambitions, and innovation introduction methodologies are fundamental drivers that would be expected to change R&D priorities and produce different results in productivity and distribution. There are advocates for so-called “pro-poor” technology selection and socially conscious deployment methodologies designed to focus more attention on the impact of technologies and innovation on distribution of benefits and gains.

This analysis brings an admittedly economic and public policy perspective to the matter rather than a technical one. But it is hard to think that there is a fundamental "law of nature" that involves a shift in the potential for technology today to lead to significant functionality or productivity change compared with historic levels of increasing productivity and output growth. Methods of technology deployment can have a material impact on the consequences of a new technology. These variables of technology policy merit further consideration, but any reported decline in the productivity of R&D, or in the functionality and productivity of currently emerging technologies, would seem to result from the selection of research targets, research spending, market conditions, and policy choices—or from the somewhat random timing of discoveries or developments—and not from the exhaustion of scientific capacities.

There is some evidence supporting concerns about new technology development. First, there has been a relative reduction in publicly funded and basic research. Additionally, the private sector focus is more on product development rather than technological research that may, over time, produce more widely impactful technology advances. Leading firm dominance and reduced productivity in R&D output are elements for concern.

Moreover, the relative shift from defense and space contracting as a driver of technology and greater funding for consumer market-driven selection of priorities could conceivably improve the market benefits from technology, although consumer wealth-driven demand for technology is not necessarily expected to be more socially responsive or "pro-poor" in nature. The recent hesitation of the consumer-driven digital technology developers and service providers to serve military needs, the liberal democratic governments' worry about privacy, the public/private funding mix and the risk/reward debate over funding, risk absorption, and deployment review are as yet of unclear significance.

Additionally, the impact of the emerging geopolitical technological competition—or, perhaps even rivalry or conflict—of a rising R&D player, China, is not yet fully evident. The rivalry for leadership and control of technology could become the counterpart of the Cold War arms race and impact development and trade in technologies. How significant new technologies emerge, are owned, are located geographically, or interact with geopolitics could involve important output and distributional differences. Consider, for example, the emergence of artificial intelligence under the ownership of one or two jurisdictions, such as the United States and China, versus global participation.

One notable observed characteristic of digital technology is the "winner take all," or at least "most," of the market embodied in the applications of such technology. This has obvious consequences for market power as well as for policy addressing the application of pro-competitive conditions to product or service offerings. Technical standards, compulsory licensing, and third-party network attachments and access to technology are elements that might require more attention in competition policy if competitive forces are to drive conditions and behavior in sectors deploying the technologies. This, obviously, runs counter to the less regulated culture with respect to such services.

There are a few technology-related indicators that signal less technology-driven growth than is otherwise possible—all elements that impact distribution and income disparity. First, as noted earlier, in the United States, government spending on R&D in 2015 was on the order of 0.6 percent of GDP, down from 1.2 percent in the early 1980s. But the productivity of R&D spending has also declined and researchers indicate this reduction is related to the decline in basic research.

Second, the rising importance of intangible or knowledge-based capital—such as the output of R&D, design, training, operating models, or know-how—is reflected in the fact that business investment in intangible capital now exceeds that of investment in traditional tangible capital such as equipment, machinery, and structures. Between 1977 and 2015 in the United States, the share of intangible investment in GDP rose from 8 percent to 15 percent, while that of tangible investment fell from 16 percent to about 10 percent. This signals the importance of such issues as skills and education; the significance of know-how for methods of competition, regulation, and enforcement; and the ease of transfer of critical elements of market power, particularly within a company, even between jurisdictions. It also affects borrowing collateral to the detriment of the competitiveness of smaller firms and further skews the system toward greater concentration.

Larger firms have greater resources and credit histories to finance investments in intangible assets that do not have physical collateral (small firms rely more on bank loans, which often require collateral) and can more readily acquire smaller firms to expand their ownership of knowledge-based assets, making them even larger and more dominant. These variables tend to suggest less, not more, competitive bias with consequent negative growth and income distribution implications.

There are differences in economic and distributional impacts that arise from the case-specific characteristics of technologies, the prioritizing of technological prospects pursued in R&D, the mix of innovations introduced into an economy, the activities to which they are applied, and the methods of their application and deployment. There are risk/reward issues in regard to the development of new technologies that are of considerable distributional significance, particularly as related to public sector support, risk-taking, ownership and control, and allocation of rights and revenues. These raise further policy questions and choices that impact the pace, nature, and distributional consequences of technology that drive so much of productivity, growth, and income disparity.

A science and engineering review might identify other important generalized productivity, output, or distribution characteristics of the current and emerging technology mix. But the evidence on significant characteristics of new digital technology—and on the role and tactics of the private sector, governments, and multinational enterprise in international dealings—suggests, in the market and policy conditions today, the continuation of concentration of power and its impacts on productivity and distribution, producing slower growth and more income disparity relative to the potential.

The pace of technological change may quicken through expenditures on R&D and investment/innovation—and the pace does appear to have quickened—but low levels of competition or the absence of sufficient ingredients (for example, skills) still play a role in the consequences. The "creative destruction" adjustment (i.e., the replacement of eliminated jobs by the jobs created by the new technology, plus the jobs created by the demand that higher aggregate income generates) and the timing of the erosion of the early stage extra profits for the developer of a new technology are slower. Both dynamics generate more extra profits for leading firms; and, suboptimal productivity, slower than possible growth and more uneven income distribution. What is less clear is whether the "nature" of the technology mix is affecting the growth and distribution results, but the policy issues would not appear to turn on the answer.

Labor and Capital Distribution

One direct link of technology and employment with productivity and income distribution consequences is through the increase in output per hour worked. Technological change is likely to shift the type or amount of work required for any given production or to bring a new offering to market. Higher efficiency may reduce the need for some workers, and increasingly capable automation technologies may eliminate some tasks or occupations entirely. On the other hand, demand for new tasks and jobs arise, raising issues of retraining, supply of human capital, skills matching, and overall labor market adjustment. Should the new skills in demand be in short supply or otherwise command higher compensation, income distribution can change. The capital/labor split of proceeds can also change as a result. Ensuring no one is worse off, or correcting for a changed distribution, requires attention.

Education for job/skill matching, adaptability to change, and social policy to facilitate mobility are obviously relevant. But linear thinking may not produce the right conclusions. The numbers and proficiencies of U.S. students in mathematics, sciences and engineering are a target of criticism and concern. But, there may be more than a lag at work in the fact that the United States remains the world's leading industrial and innovative economy.

Like every aspect of this analysis, the outcome for income disparity, productivity and growth—through innovation, employment, compensation, and shift in demand for particular goods, services, and workers—is variable with the circumstances and policies involved. It is, however, evident that the extent and frequency of job change and skill requirements of higher value jobs are increasing and contributing to income disparity.

Some magnitudes can be put on these matters. First, technological advances in automation and its growth in applications in production processes that have contributed to wider disparities and job polarization have caused middle-skill routine jobs—those that consist mostly of repetitive tasks and are more readily susceptible to current automation—to fall by almost 20 percent on average in OECD countries between 1995 and 2010, while the employment share of low-skill jobs, consisting mainly of nonroutine manual tasks, rose by almost 10 percent.

High-skill jobs that generally require more education and command a wage premium rose by more than 20 percent over the same period. In 2016 post-graduate degree workers in the United States earned 215 percent of the wages of a high school graduate (compared with a 155 percent differential in 1980). This, of course, contributes to wider income disparity. In the United States, middle-income households fell from 58 percent in 1970 to 47 percent in 2014.

Second, in the process, the capital/labor split of income has shifted to benefit owners of capital. Labor's share of total U.S. income declined from the mid-60 percent range to mid-50 percent from 2000 to 2015. Across the U.S. economy between 1973 and 2014 labor productivity increased 72 percent but lifted the hourly compensation of the median worker by only 9 percent. Productivity has grown by almost six times more than pay. The McKinsey Global Institute projects that two-thirds of the productivity gains over the next decade are likely to arise from new digital technologies, setting the stage for the skills demand and policy debate. Of course adjustment policies, potential new forms of income security, and the possibility of a reduction in working hours are all part of the discussion.

Also, a study published in the Brookings Papers on Economic Activity in spring 2018 found that the effect of automation over the period from 1970 to 2015, while displacing some employment (particularly, again, jobs focused on routine tasks), has been net employment generating, due to the replacement (likely more productive) jobs and demand seen elsewhere in the economy but generated by increased incomes from automation. However, there has also been a notably slower growth in workers' earnings than in productivity and a resulting decrease in labor's share of the proceeds. There are two dynamics at work separately and together: globalization with offshoring that displaces some jobs and adds to wage competition with a generally downward pressure on wages, and technological change that displaces employment through more automation but most often also provides capital and equipment support for increased labor productivity. The above-noted Brookings study concludes that there is no evidence that automation, even combined with globalization, is destroying jobs in aggregate. There is evidence of a notable impact on worker earnings, pointing to fundamental issues around skills required for new technologies, wage differentials and reduction of middle-income jobs. Without entering the debate over which influence dominates, most studies find that the impact of globalization on jobs and wages accounts for less than technological change, but there are sectors and substitutions reflecting both. However, offshore displacement without innovation, or displacement by technology that alters the supply/demand balance for labor, each has its particular impact on income distribution; each contributes to its disparity, absent offsets; and each generally produces winners and losers. Empirically, there has been a net marked shift in the capital/labor split in favor of capital, as noted above.

Disparities appear especially stark when looking at the top earners and asset owners, particularly in the United States. Between the early 1980s and 2012, the richest 1 percent in the United States more than doubled their share of the national income, from 8 percent to almost 20 percent, a level last seen before the Great Depression. Even more striking is the rise in the amount going to the top 0.1 percent over the same period, quadrupling from 2.5 percent to over 10 percent. Though less pronounced, the rise in the income concentration of the top 1 percent has been widespread across advanced economies. In the last decade alone, overall inequality as measured by the Gini index has increased markedly for most major developed and developing economies around the world.

Beyond income, the wealth share of the top 1 percent is on average double that of income in advanced economies. Globally, forty-two people own as much as almost half, 3.7 billion, of the world's 8 billion population. (In the United States, three people own more than the bottom 160 million inhabitants; the top 1 percent held half the stock and mutual fund assets in 2013; and the top 10 percent held over 90 percent of such assets.) The top 1 percent globally are estimated to have captured 80 percent of the growth in wealth in 2017.

International Dimensions

The analysis of technology, productivity, growth, and income distribution applies equally to the international setting and to economic comparisons between states, particularly in a globalized world. In a global economy versus a domestic economy the differences are essentially institutional and a matter of conditions being more diverse. Policy instruments for affecting market power between states or their residents are different; international agreements govern intellectual property rights and investment protection alongside domestic laws, practices, and competitiveness of market conditions. Although the visibility of international differences is higher in the modern world than in the past—at least in the feelings of well-being or deprivation of those in lower living standard countries—the social affinities between different national populations, particularly those more remote from one another, are less significant than most domestic bonds. That affects attitudes toward international disparities.

In fact, income disparity measured for the world population has declined due to the significant growth in the past few decades of the national average income of several countries, particularly very populous ones: China and other East Asian countries, India, and some countries in West Asia, Latin America, and Africa. Excluding just Asia, however, the gap between developed and developing countries, on aggregate, has barely changed. Domestic disparity, on the other hand, has grown within most countries. So, many countries are still left behind, and it is premature to consider income disparity to be essentially a domestic issue; it remains both a domestic and an international policy issue.

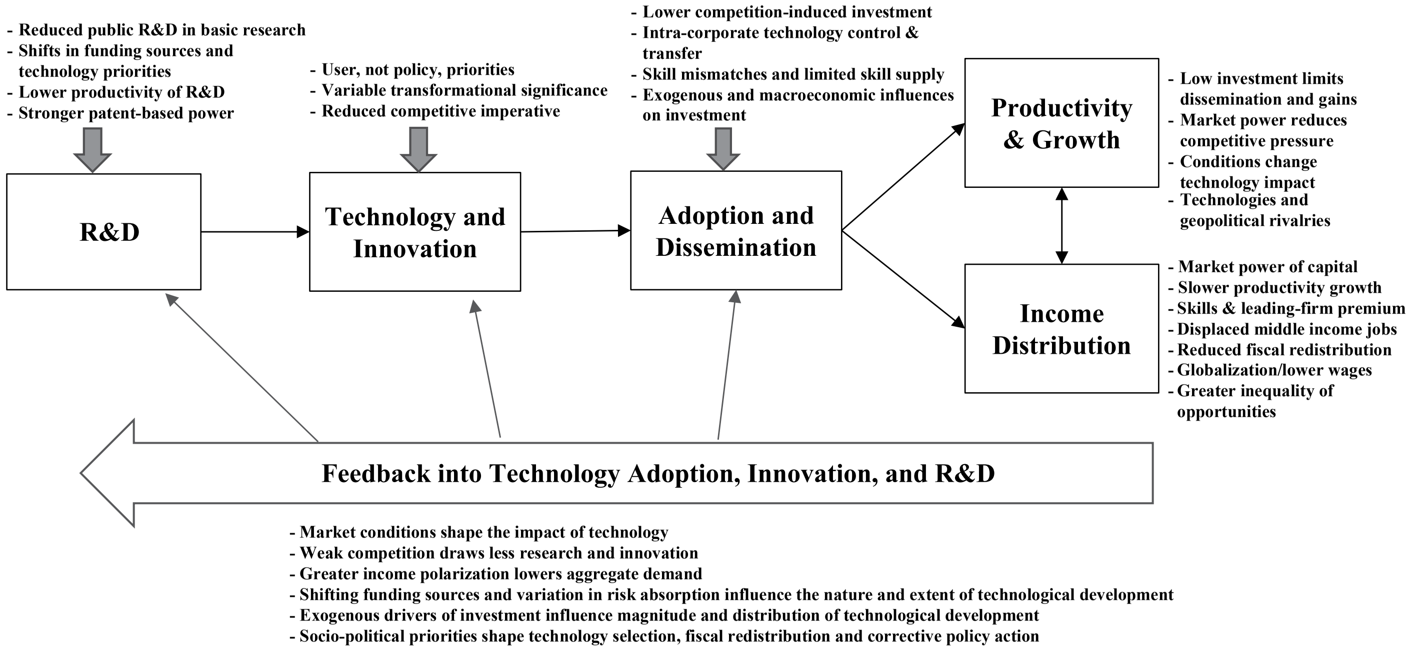
The role of technology—and hence, the national interests in policies for intellectual property ownership rights protection—differs significantly between the many countries in which little R&D or first deployment originates or is controlled and those that carry out considerable R&D and originate technology development. The self-interest for technology importing countries begins with a later step in the research-to-growth/distribution sequence. National interest in those cases begins with the international transfer of technology at lowest costs and widest possible dissemination terms. However, international technology transfer is now increasingly undertaken in intra-company arrangements that extend power through cross-border control and international rules regarding intellectual property, thus delaying competitive dissemination among firms in different jurisdictions.

Nevertheless, international trade in goods and services is a major factor in competitive forces, dissemination of technology and productivity, as well as income distribution domestically and internationally. Recall the often-repeated technology life cycle is that of R&D and innovation occurring in an advanced location; first product or service production being undertaken at the source and at a price reflecting the market power of the supplier; followed by a search for lower-cost production methods and locations and more mass market distribution of the good or service at lower pricing, resulting in easier accessibility for users. This progression is a particularly important dynamic of globalization and of the digital era through fast communication technologies and, sometimes, massive scale over online platforms. In a more open and fair trade environment, globalized value chains raise competition for production, labor, and location. That, in turn, stimulates efficiency, dissemination, productivity, and growth.

Global value chains have integrated more emerging and developing economies into global production processes and have facilitated channels for technology transfer, as well as exposed domestic firms to global frontier firms. But the maturation of these cross-border supply chains suggests that productivity gains from participation in them may not continue to be as large as they have been in the last thirty years. And the competitive dynamic is weakened, as noted, by a considerable amount of the cross-border activity being internal to international companies and affiliates, suggesting, increasingly, that international dissemination enhances corporate market power, increases surplus profits, grows leading companies' influence over which economy receives what gains, and retards the dynamic of copying economies' mass production at lower prices of a good or service in a technology maturation process. If the pace of technology development increases, as it seems to have in some fields, early-stage market conditions become the norm. Governance issues, including taxation of global enterprises and enforcement of competition policies or other regulations, are also less effectively addressed by domestic governments against global firms.[5]

In the two decades prior to the global financial crisis, world trade grew twice as fast as world GDP. Since 2012, international trade has roughly kept pace with GDP growth. The slowdown in international trade expansion could be a contributor to slower productivity growth in both advanced and emerging/developing economies by virtue of weaker competition from abroad and, thereby, lower pressures to invest in or pursue lower-cost sources. That also results in less transfer of productivity-increasing technologies embodied in such investment—all with distributional consequences, as well.[6]

Technology, Productivity, Growth and Disparity: ***Causes and Effects***



Note: This graphic is a depiction of dominant influences of and on technology and innovation – and, ultimately, on both productivity and income inequality. It reflects as well the feedback from low productivity, slow growth and income disparity on technology, and its deployment, in an interactive loop. This is not an exhaustive depiction of the variety of the dynamics and inter-relatedness of these variables which are explored at length in this book.

The evidence shows that transfer of technology and knowledge from the world's technological leaders in terms of patents and R&D—the United States, Japan, Germany, France, and the UK—to developing countries accounted for 0.7 percentage points (or 40 percent) of developing country annual productivity growth from 2004 to 2014, compared to 0.4 percentage points a year from 1995 to 2003, according to estimates from the IMF.[7] In other words, the impact of cross-border technology transfer on aggregate productivity growth in developing countries has grown over time.

Other research points to faster diffusion of technology from country to country but slower diffusion of technologies within countries. Globally active, if not dominant, firms can more readily transfer activities between countries to capture lower costs and better serve remote markets while experiencing limited competition and capturing the lion's share of production cost savings in profits. The widening productivity gap between firms at the technological global frontier versus the laggards reflects this slowdown of competition related diffusion between firms.

Cross-country differences in productivity explain most of the differences in cross-country standards of living. While there are differences in the capital stock between developed and developing economies, capital as a share of output is roughly similar across countries, reflecting lower wages in the latter. In 2010, differences in productivity explained over 90 percent of the difference in GDP per capita between the United States and Malawi, for example, and around 50 percent to 60 percent of the difference between the United States and other advanced economies. In 2017, labor productivity in the United States was around forty-two times larger than that of Malawi's.

Over the last two decades average annual productivity growth for emerging and developing economies as an aggregate has been 2.5 percentage points faster than in advanced economies, at 3.6 percent a year compared to 1.1 percent a year, respectively. The gaps in average incomes between countries has also narrowed over time, as emerging and developing economies became more productive and grew faster than advanced economies, on an overall and per capita basis. From 2000 to 2013, the worldwide Gini coefficient declined from 0.67 to 0.62. Though still at very high levels, overall international income inequality declined. However, as noted above, disparities within most major emerging market economies, with the exception of Latin American countries at least until recently, have risen at the same time. It is important to note that not all emerging and developing economies participated in the income convergence with the advanced economies. Led by China and India, average incomes in emerging Asia rose from 14 percent of the average incomes in developed economies in 1990 to 25 percent in 2014.

Migration is another key channel through which knowledge diffuses internationally, and it can result in stronger trade links and productivity gains. One study finds that a 10 percent increase in the number of immigrants that come from a country that exports a certain good can result in a 2 percent increase in the likelihood that the migrant receiving country will start exporting that same good, competitively and from scratch. Research shows that not only skilled migrants but also unskilled immigrants can improve productivity and income gains for native workers without crowding out employment. Immigrants can promote efficient task specialization, as they take the jobs natives do not want and free up locals to focus on other tasks that involve higher value additions. In individual U.S. states between 1960 and 2006, an increase in employment of 1 percent due to immigrants from Mexico produced an increase in income per worker of 0.5 percent. Refugees that fled to Denmark from former Yugoslavia and Iraq from 1991 to 2008 were found by researchers to not impact Danish unemployment but rather increase wages by 1 percent to 2 percent over the course of four to five years. The key, of course, was Denmark's ability to absorb these incoming migrants and integrate them into the labor force. These dynamics apply to forced migration as well, but the absorption of very large, unplanned, sudden, and unmanaged arrivals in one location that is, itself, facing challenging economic conditions calls for additional methods and mechanisms if the absorption capacities on which this productivity improvement depends is to be maximized or even be possible.

While capital has moved out of the poor countries of the developing world over the last decade seeking greater safety despite lower and negative rates of return (at least in reserve currency measurement), a growth opportunity that could reduce international disparities and benefit both high and low income countries can be seen in the existence of material amounts of excess savings in the developed world, still earning low, or even negative, returns. At the same time, many investment needs and opportunities for better returns are unaddressed in the developing world. Those investment projects would increase returns of investment, call for exports from the developed economies, and bring enhanced output and employment growth to the economies on both sides of the transactions. And acceptable policy solutions to disparities are easier to find amidst robust growth.

The contextual impediments and risks to such investment in the lower-income countries—and, hence, hurdles to increased productivity and growth—and to larger income with which to approach the reduction of disparities are more numerous in the developing world. The debilitating consequences of poverty pose significant constraints for investment: a low level of skills and education; likely greater market power of the leading firms; deficient infrastructure for social, public, and market services; fragile states and often corruption-suspect governments; strained debt levels limiting resilience of the macroeconomic investment climate; and, in some cases, shocks/burdens of uninvited arrivals of displaced populations fleeing nearby conflicts, risks, and, increasingly, other conditions including severe income disparities. Investment in these more challenging conditions requires more deliberate methods and mechanisms.[8]

Macroeconomic Management and Fiscal Policy

Macroeconomic management that stabilizes an economy and attempts to allow business decisions to be made without the concern of sudden surges or collapses in variables such as interest rates, exchange rates, or inflation, is of great importance for the investment climate and, hence, productivity. To commit their resources, investors have to expect a broadly stable overall environment over a time horizon that will pay a reasonable return. Monetary and fiscal measures can affect both propensities to invest and choices in investment and consumption.

Fiscal policy does not have only macroeconomic objectives, however. Almost all fiscal measures have impacts on distribution. Tax rates as well as tax breaks for certain activities are structural tools of public policy, just as are transfers and incentives from the government to the private sector. Together, taxes and transfers (which transform the “primary” income distribution as well as the provision and capacities of different segments of the population to utilize some public services), cumulatively impact distribution of disposable income.

Comparing the pre-taxes and transfers to the post-taxes and transfers distribution is very informative about social and governmental values and about political prospects for policy change regarding the subjects of this discussion. The same institutions that produce the policies and results evidenced in a market would be responsible for policy changes to address any concerns to which the data give rise.

In this context, it is noteworthy that redistribution through public services and transfer payments has produced a reduced offset of market inequalities in recent periods. Around 2013, OECD countries on average reduced the index of market inequality by one-third through fiscal redistribution. Lesser fiscal capacity in the emerging countries is reflected in a smaller offset in those jurisdictions. From 1985 to 1995, fiscal redistribution in advanced economies offset 60 percent of the increase of market inequality, while between 1995 and 2010 hardly any of the increase was offset. This is a result of two circumstances.

First, personal income tax progressivity was reduced. In OECD countries the top rate declined from 62 percent in 1981 to 35 percent in 2015. Corporate rates fell from an average of 45 percent in 1990 to 26 percent in 2015. The United States just reduced this levy from a top rate of 35 percent to a flat rate of 21 percent. The effective tax rate on various elements of wealth in the major countries that have such data declined from 0.9 percent in 1970 to 0.5 percent in the early 2010s. Second, net public wealth fell from 36 percent to –17 percent of national income between 1970 and 2015, while net private wealth increased from 326 percent to 500 percent of national income.

Tying It All Together

The following figure displays the dynamics of technology and contextualizes the factors, conditions, and policy levers that influence productivity and distribution.

Summary and Conclusions

Context of Technology, Productivity, Growth and Income Distribution

Technology is the principal source of increases in output for any time or effort, a cornerstone of productivity, a central contributor to growth, and, in turn, a major determinant of improving living standards. The market summation constitutes the economy's output; and the relative power of the parties influences distribution of gains between workers, suppliers, producers, and ultimately, between capital and labor. The results impact the sentiments and political choices of members of society. Despite imperfections in measurements, these dynamics have evolved to produce markedly different results over the last two to three decades from those of the immediate postwar periods, both reducing output relative to the potential and concentrating starkly greater proportions of income in fewer hands, beyond parameters that might be argued to support and reward innovation. Wealth disparity is some twice that of income disparity.

Given that the results are the consequence of numerous and systemically interrelated factors and market settings, it is no surprise that changing pre-redistribution market performance requires the adjustment of the many policies that influence the determinants; nor that changing some particular policies does, as the reported research reveals, contribute simultaneously to remedying underperformance of productivity and growth, and ameliorating inequalities in income distribution. The political prospects, however, of significantly changing what was created over a long period will require a public airing and discovery of the shared self-interests in reform that the evidence presented in this report suggests.

Our purpose is to set out the best evidence of conditions, their causes and effects, and to provoke an informed and constructive dialogue as to what policies and practices would produce a fair, harmonious, and productive society. The objectives of policy ought to be to stimulate productivity and growth from technological innovation, realize the efficiencies of global rationalization of production and trade, and achieve an income distribution that produces an equitable result in society. For this, we must look to the aggregate, average, and array of results, particularly as there are some who lose from the dynamics of the process, despite being faultless for their displacement from their work or loss of share. Those adversely affected are members of a community within which we share a socio-political affinity and decision making process—that could, therefore, impede innovation and growth, as well as undermine social stability and cohesiveness, if not effectively addressed.

Technology and globalization are not, alone, the causes of the performance. Both are factors in the dynamics and tools in pursuit of our goals. There is room and need for debate over the specific policy provisions that would be appropriate to motivate innovation, produce optimal growth, and achieve an equitable distribution of output. But it does not take much foregone productivity or output—lost resources—that, if achieved, captured and compounded constantly, could cover considerable costs of corrective measures.

Policy Choices

Very broadly speaking, the discussion should consider the effectiveness and political prospects of correcting currently unsatisfactory results along four, not mutually exclusive, lines:

1. Attempt to fix the myriad and interacting policies that play a role in shaping the results, including what is needed to enhance pro-competitive investment.
2. Assess opportunities to generate a higher level of investment by addressing factors that impede the reallocation of savings and resources from low to high yield opportunities.
3. Override distribution consequences of the market through fiscal redistribution and/or employment sharing or other social adjustment support for the purpose of less economic disparity.
4. Address directly the R&D and selection of technologies to mitigate poverty and manage technology deployment in ways that benefit a wider community, including those who otherwise capture a very low share of economic output.

1. The Interacting Policies

Competition Policy

Increased market concentration, weak competition policy and enforcement, company use of market power, as well as diminished national government ability to enforce policies on global businesses and their practices have reduced competitiveness markedly over the last two to three decades. Market power, including that conveyed by intellectual property rights and practices, under domestic law and international convention, in both technology-originating and technology-importing countries, reduces or delays competitive dynamics that, in the past, produced better economic performance and more distributed benefits.

A fast pace of new technological development by leading firms regularly renews the extra profits and market power of those early adopter firms. Reduced competitive forces for the dissemination of innovations extend early stage profits for innovators and delay increased productivity in the lagging firms and aggregate economy. Increased disposable incomes for workers from higher value employment and enhancement of overall demand take longer; and are reflected in lower productivity, lower growth and less added worker income. The transition may be too long delayed to affect market performance measurement or count much for policy purposes.

While dominant firms seek to maintain market power, through fueling innovation for both cost saving and product obsolescence, they can also become complacent or endeavor to do so by methods that retard dissemination and do not serve innovation, productivity, and growth. Similar observations might be made of the methods of deployment of new technologies where they affect productivity, adoption, and dissemination.

Further, powerful global companies capture more of the savings from rationalization of production (compared with benefits to consumers and workers) and the leading firms highly compensate their top earners. Intracompany domination of international trade and technology transfers preempts control of remote markets and impedes effective competition from that source, further enhancing company power.

Clearly, competition policy and enforcement are prominent policy issues raised by the data and analysis presented.

Technology Policy

There seems to be no a priori reason to believe that the potential for technological advance and its productivity contribution is exhausted or diminished, and there is anecdotal evidence that suggests the potential for continuing significant productivity enhancement.

Material changes are visible in the technology cycle. An increased role is being played by the private sector in R&D, although sight should not be lost of tax incentives, government subsidies, public sector contracted research, and procurement policies and practices. Relevant changes that raise technology policy questions are seen in a greater product focus of private R&D compared with more basic science research from public R&D; some evidence of reduced productivity of R&D; a propensity of private sector owners of intellectual property to litigate to reduce dissemination; tighter international control over technology dissemination by prompt intra-company transfers; and slower inter-firm access to developments. The quasi-natural monopoly characteristics of digital services raise questions regarding competition-stimulating policy techniques like compulsory licensing, mandatory open standards, and attachment/access for competing service/application providers. Perhaps linking certain legally provided intellectual property rights to pro-competitive provisions—and international cooperation in anti-trust enforcement—should become a more important part of the discussion. Also, geopolitical rivalry between world powers is increasingly focused on comparative technological strength, the significance of which is not yet fully understood or felt in the market.

There does seem to be a good case for renewed attention to the genesis of technology advance, risk bearing and reasonable rewards, balancing of competitive dynamics and technology development motivation and the globalized world.

Universal periods of protection and uniform provisions of intellectual property rights are overly blunt tools for balancing, in diverse conditions, the protections needed for motivation and the dissemination that is essential for best overall economic performance. Variable periods of patented exclusivity might be considered. Pro-competitive techniques that might differ by sector or by case-by-case assessment of conditions—for example, licensing or access to the opportunity to compete at individual levels of a vertically integrated business—would be more cumbersome, but perhaps needed. The current situation calls for recalibrating.

Education Policy

Education and training also impacts market performance and income distribution. For productivity, growth, and income distribution, policy should address the shortage of skills for higher value-adding jobs, the adaptability of a workforce to change with technological advances, and insufficient skilled worker availability, all contributing to limitations on growth and to skewing the distribution of gains to the more skilled workers. Potential easing of immobility of labor and other factors of production is relevant in some markets.

Demographic Policy

Aging populations impose constraints on demand and growth. The potential for migration to be highly productive in maintaining demand and productive capacities, subject to the effective absorption of the migrants, should form part of the policy mix.

2. Investment Climate

Disincentives for investment by leading and/or lagging firms for reasons other than uncompetitive settings exacerbates the less than optimal investment performance created by reduced competition. For example, lower returns from investment for macroeconomic reasons impede investment and, hence, limit new technology deployment. Whether the low return condition is transient or fueled by macroeconomic excess savings/low investment yields and low interest rates that cannot be reduced to stimulate investment and reduce savings—a chronic liquidity trap or secular stagnation—may merit more investigation. But the conclusion would not change much in this discussion, as these all direct attention to searching out prospects for higher return investment.

The needs in underdeveloped locations and their underserved history suggest such higher return opportunities. But public resources are grossly insufficient to mobilize much of those opportunities; and investment conditions and these markets are very challenging for private sector capital. Reallocation of a relatively small but meaningful scale of funds from low to higher yields in such uses would make a significant impact, but requires new methods and mechanisms to address the impediments to such investments. Policies to advance this would be justified by the public interest in: increased global growth by higher returns for currently poorly yielding capital; export opportunities and greater output for the developed world; incomes and fiscal revenues for the developing economies; positive social externalities in the form of engagement of the many unemployed/underemployed otherwise requiring assistance, while success would enhance stability, improve security, and permit budgetary savings on those matters.

There are other significant, somewhat separate, impediments to investment that are a challenge to overcome. Distrust is a drag on investment and considerations range from: financial market disruptions like the 2008 recession; to the very high percentage of institutional shareholdings with their short-term performance motivations that restrains some longer-horizon investment; underinvestment in infrastructure; the rise of less productive financial superstructure (itself facilitated by technology of data and transaction management and, perhaps, an example of the fact that different ways of using a given technology can involve very different impacts); policy and political uncertainty in the locations of many prospective projects; governance instability and locations of conflict or corruption; the deficiencies of developing markets (in education and skills; poor business, social services, and infrastructure); to the mismatch of maturity between savings and investment opportunities, particularly in riskier locations where investors seek shorter payback periods.

3. Redistribution Override

Taxes, transfer payments, and social services can transform the "primary" income disparity. The same institutions that produce the policies and results in respect to output and income distribution are, of course, responsible for the policy adjustments noted. It should, however, be no surprise that redistribution through public services and transfer payments has produced a reduced offset of market inequalities in recent periods. Government fiscal policies have materially reduced their revenues and capacities to offset disparities in this way.

This is happening while adjustment is potentially most needed as a result of automation, which increases the number of workers adversely impacted (displacing particularly middle-level jobs), and for globalization that causes offshoring of some low-skill and middle-level jobs. Both phenomena increase the need for adjustment support as the economy works to benefit by moving up the industrial value chain through its innovativeness.

Discussion of a revised social contract that finds other ways to share economic gains that are accompanied by socially disruptive changes for some—guaranteed minimum income, job sharing, personalized control over earned rights to look to social services—need to be part of the policy dialogue.

4. Pro-Poor Technology Policy

Governments can—and, in varying degrees, do—select the technologies on which an economy focuses. Defense and space (which can extend to communications, data management, materials, computers, transportation, energy, and even health), health, education, and environment are among the examples of sectors chosen by different governments for technology spending within their borders. Direct R&D activity, subsidies, procurement contracting, and tax incentives have all been used. There is scope for considering disparities or rebalancing that result from the sectoral focus of technology initiatives on socially selected R&D to better serve the needs of the lower-income population.

Closing Thoughts

Economics is sometimes defined as an examination of the principles for efficiency in the use of factors of production, the process of allocation of scarce means to numerous competing ends. Political economy is more the process for decision making on such matters under conditions of uncertainty. Cause and effect linkages are imperfectly understood from empirical observation. This is further complicated by a single factor influencing multiple consequences and also by differing results depending upon the context or conditions. Nonetheless, it is our mission to try to sort out the evidence and linkages to the best of our analytical abilities and to stimulate reasoned discussion for the definition of specific policy and behavioral proposals. The first step is to recognize the existence of the issue. This policy challenge involves us all—producers and consumers; investors and workers; skilled and unskilled—and affects the resources available for living standards and the cohesiveness of the societies in which we live.

Kenneth Boulding once wrote, whimsically:

Our policy, to be effective
Must chase a suitable objective.
So our economy should be
Both Growing, Stable, Just and Free.

The Dog would surely be a dunce
Who tried to chase four things at once.
Yet that is just the way we plan
The task of our Economic Man.

Notes

1. Approximately 90 percent of children born in the 1940s earned more at age thirty than their parents did. By the time those born in the 1980s were that age, the number was about 50 percent.

2. An economy would be "overheating" when actual output exceeds potential and underperforming when output falls below potential.

3. Actual output growth is the output per worker (or, labor productivity) multiplied by the number of employed workers. Output per worker depends on how much capital is at the disposal of the worker and how well labor and capital interact. The same answer would be represented by the output per working hour multiplied by the number of hours worked.

4. It is, of course, critical to distinguish between the availability of a technology to those using it to produce a good or service for end users and the market penetration of the end-user offerings. Few manufacturers of a mobile device or infrastructure, with extensive market diffusion of service to end users who are paying a high price, is different than widespread dissemination among the manufacturers of that equipment, competition among which lowers the cost of equipment. In

the latter case, competition among service providers would be expected to lower the price of services to the end user more than in the former case.

5. This trend can be seen in the intergovernmental management of intellectual property. International agreements have strengthened intellectual property and investment rights, reinforcing and extending market power of dominant companies, thereby affecting competition and its results.

6. This has implications for international development in pursuit of the Sustainable Development Goals or management of migrant populations.

7. IMF, World Economic Outlook, April 2018.

8. For an examination of this topic and such methods and mechanisms, and their consideration in the context of development in lower-income countries where forcibly displaced migrants are located, see the report of the Chumir Foundation organized World Commission on Forced Displacement at www.ChumirEthicsFoundation.org

ONE

Overview: Booming Technology, Slowing Productivity, and Rising Inequality

Paradoxes, Problems, and Policies

ZIA QURESHI *and* **KEMAL DERVIŞ**

The economic story of recent times is marked by important paradoxes. Technology has been booming, led by digital innovations. Evidence of advances in digital technologies is all around us—increasingly sophisticated computer systems and cell phones; digital platforms that are transforming information, communication, and commerce; and growing applications of robotics and artificial intelligence in industry and services. Technology is a major driver of productivity growth. Therefore, with technology booming, so should productivity. This has not been the case, however. Paradoxically, as new technologies flourished over the past couple of decades, productivity growth slowed in advanced economies and in many major emerging economies as well. Economic growth picked up in 2017 and early 2018, but the underlying productivity trajectory continues to be weak. The outlook for potential growth in the medium to long term, which depends crucially on prospects for productivity, remains subdued.

Related to this "productivity paradox"[1] is the investment paradox. Investment, especially fixed capital formation, has shown a persistent weakness in most major economies despite low borrowing costs and high corporate profits. Interest rates have been at historic lows since the 2007 global financial crisis. The rate of corporate profitability dipped for a while after the financial crisis, but the average trend rate has been high. Since technological innovations are typically embodied in new capital, weak investment has been part of the story of slumping productivity growth amid rapid technological advances.

The world today is more prosperous than ever, yet many societies are marked by increased discontent. So we face another paradox, one of mounting social discontent amid rising prosperity. Underlying this paradox is an increasingly unequal distribution of national incomes. The benefits of economic growth and the rise in economic prosperity have been unequally shared. While income inequality between countries has been decreasing in recent decades—thanks to the rise of faster-growing emerging economies that are narrowing the income gap with advanced economies—income inequality within countries has been increasing. In advanced economies and most major emerging economies, income inequality has been on the rise. In these economies, the distribution of both labor and capital income has become more unequal, and income has shifted from labor to capital.

Technological transformation and globalization have been two major long-term forces propelling the rise in economic prosperity. Yet, they are also the forces that drive much of today's societal anxiety—and, indeed, have been the subject of a rising backlash. Herein lies still another paradox.

This is the backdrop that motivates this report and its focus on the two dominant economic concerns of our times: slowing productivity growth and rising income inequality. Together, these trends have produced weaker and less inclusive economic growth, caused a slower and unequally shared rise in living standards, and contributed to social tensions and political divisiveness. These outcomes have fueled the recent surge in populism and nationalism in many countries. History warns about the political consequences of sharp and unchecked increases in income inequality and related disparities.[2]

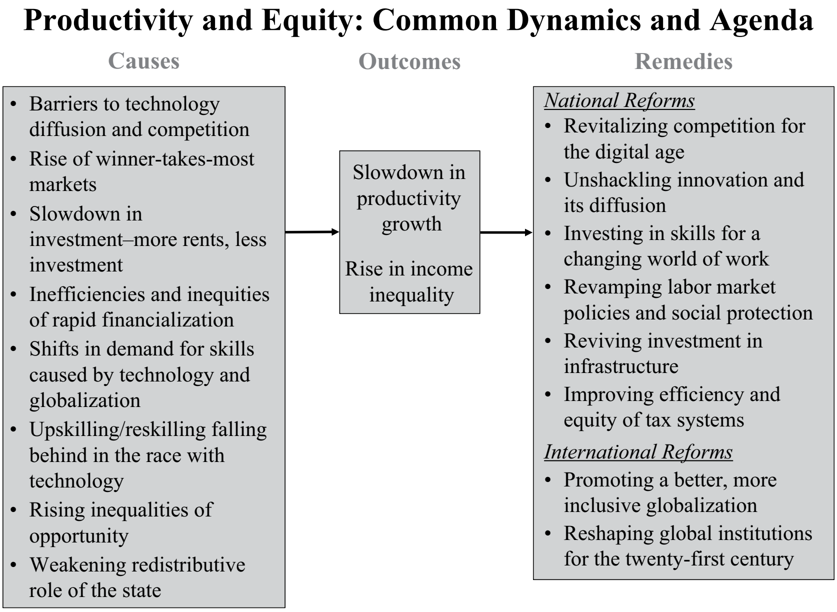
Are the slowdown in productivity and the concurrent rise in inequality just coincident, are they parallel trends, or are they connected by some common factors? Given their significance and topicality, both these trends have been the subject of intense scrutiny by economists. Much of the analysis, however, has looked at them in isolation. This report presents an overview of the findings of recent research and seeks to add value by exploring possible linkages between these trends and by providing an integrated narrative. It finds that the slowdown in productivity growth, the related weakness in investment in productive capital, and the rise in income inequality are interlinked and have important common drivers. A key cross-cutting factor has been the nature of new technologies and how they have interacted with policy and market failures. There is a strong nexus connecting technology, policies, and productivity and distributional dynamics.

Technological change recently has not delivered its full potential in boosting productivity and has pushed income inequality higher. Globalization also has contributed to the rise in inequality. Both these forces have caused business and job dislocations as comparative advantage and demand for skills have shifted. These outcomes present tough challenges, but the correct response to these challenges is not a Luddite retreat from technology or a slip back into protectionism. Rather, policies have a crucial role to play in helping firms and workers adjust to the new environment and ensure that technological change and globalization produce better outcomes for productivity and economic growth as well as equity.

Productivity and equity are often viewed as competing objectives in economic policy debates, echoing Arthur Okun's "big trade-off" (Okun 1975). But the analysis of recent trends shows important complementarities between the two. Research over the past decade has found increasing evidence that higher inequality hurts long-term growth (see, for example, Cingano 2014, Ostry and others 2014). The analysis in this report adds to research on the consequences of inequality for growth. It looks at the causes of the rise in inequality together with the causes of the slowdown in productivity—the main driver of long-term growth. It finds that the two trends share important common causes. Developments in productivity growth and equity have been linked by shared dynamics.

As the slowdown in productivity and the rise in inequality have important common causes, the agenda to boost productivity and improve equity is positively interconnected, with scope for win-win policies. We call it an agenda for productive equity, a theme captured in the title of this report. Such an agenda is best pursued through integrated policy frameworks that exploit the synergies between productivity and inclusiveness—and allow trade-offs to be mitigated. Figure 1-1 provides a schematic representation of the report's theme of productive equity, identifying the main common drivers of the slower productivity growth and higher inequality, and the key elements of the common forward policy agenda.

FIGURE 1-1 Productive Equity



To achieve better outcomes on productivity and equity, policies will need to rise to the challenges of the digital age. New technologies are transforming the economic landscape. Their impacts on the "economic possibilities for our children" may be even greater (Summers 2013). The digital revolution is reshaping markets and the world of work in ways that carry profound implications for policy. The agenda ahead will require new, out-of-the-box thinking and innovation in policies to harness the potential of technological advancement to foster more robust and inclusive economic growth. The era of smart machines will demand smarter policies.

Near-term economic prospects have improved recently in many major economies as recovery from the global financial crisis and the ensuing Great Recession has matured and aggregate demand and market confidence have picked up. However, the underlying challenges of slowing productivity growth and rising income inequality, which predate the crisis and are more secular in nature, remain—as do the policy and structural factors that drive these trends (Spence and Karniol-Tambour 2018, Derviş and Qureshi 2018). Recent improvement in the economic environment carries the risk of policy complacency and neglect of the underlying trends. Rather, policymakers should use it as an opportunity to step up reforms to address the deeper agenda on which longer-term prospects for growth and shared prosperity will depend.

The report is organized into seven chapters. This first chapter provides an integrative and summary overview of the analysis, findings, and main policy messages. Chapter 2 documents recent trends in technology, productivity, and income distribution. Chapter 3 delves deeper into productivity trends with firm-level evidence. Chapter 4 synthesizes research on the causes of the slowdown in productivity growth. Chapter 5 analyzes the rise in income inequality and examines factors and common drivers that link increased inequality and slower productivity growth. Chapters 6 and 7 develop the policy implications and set out an integrated agenda for reviving productivity growth and reducing inequality, with chapter 6 focusing on national-level reforms and chapter 7 on areas of international cooperation.

The report focuses primarily on advanced economies and major emerging economies. The examined trends in technological change, productivity, and income distribution have been more pronounced in these economies. Many of the report's analytical findings and policy conclusions, however, apply more widely across economies. Also, where necessary, a more global context is provided by broadening the coverage to include other emerging and developing economies.

High-Tech Era with Slower and Unequal Growth

"Productivity isn't everything, but in the long run it is almost everything" (Krugman 1994). The role of productivity as the engine of economic growth will likely become even more important in the years ahead if the impulse to growth from factor accumulation slows. Notably, in many major economies, population aging will constrain the growth in labor input. In advanced economies, the leveling off in labor force participation and education attainments will reinforce this effect. Since technological progress is the key driver of productivity in the medium to long term, how technologies evolve and affect productivity will matter more and more to economic growth.

The last two to three decades are often referred to as a high-tech era, marked by a boom in digital technologies ranging from computer systems and mobile telephony to large digital platforms and industrial robotics. How significant are these technologies in their potential to boost productivity and economic growth? There is considerable debate on this issue. At one end are "techno-pessimists," who see a long-term weakening of the innovation engine (Cowen 2011, Gordon 2016). They believe the new technologies are inherently less consequential than their predecessors and simply do not bring the kind of economy-wide productivity and growth benefits that were brought by past technological breakthroughs, such as the internal combustion engine and electrification. They also believe that much of the fruit from digital technologies was plucked when they were first introduced and that subsequent innovations have been largely of an incremental nature. Some wonder if many of the latest innovations were "more fun than fundamental" (Krugman 2015a).

At the other end of the debate are "techno-optimists," who believe digital technologies are transformative and do have the potential to drive rapid productivity growth; their benefits are merely subject to lags and come in waves (Brynjolfsson and McAfee 2011, Mokyr 2014). They argue that even if the benefits of the first wave of digital innovations are considered to have been largely realized already, productivity could benefit from the next waves of innovation—such as radical increases in mobility from smartphones, cloud computing, 3D printing, artificial intelligence, and the Internet of Things. These next-generation innovations could unleash a "fourth industrial revolution" (Schwab 2016).

The middle ground in this debate is occupied by "techno-adaptationists," who see the continuing promise of the new technologies to deliver productivity gains but note that the realization of these gains is not automatic and can be delayed or thwarted by a variety of barriers. The gains depend on complementary improvements and adaptations in workforce skills, organizational structures, and policies affecting the functioning of markets (Syverson 2013, OECD 2015a).

What do the numbers say? As reviewed in chapter 2, productivity growth has slowed significantly in advanced economies since the 1980s, and more recently in many major emerging economies as well. Some economies experienced a rebound in productivity growth in the 1990s and early 2000s.

The rebound was most notable in the United States and appears to reflect, in large part, the adoption of digital innovations where the country has been the clear leader among its peers. But the rebound proved to be short-lived, and productivity growth slumped again thereafter. Over the past decade, productivity growth in OECD economies has dropped by half or more of its level prior to the slowdown. The slowdown in productivity growth is broad-based, affecting more than two-thirds of the sectors (McKinsey 2018). It also extends well beyond the OECD economies. Over the past five years, productivity growth was lower than the long-term average in about 65 percent of countries (World Bank 2018).

The global financial crisis accentuated the slowdown in productivity as aggregate demand fell, international trade slowed, and investment financing tightened. There is a cyclical element, therefore, in the post-crisis deceleration of productivity growth. However, the productivity slowdown in major economies started well before the crisis, and the longer-term slowing trend suggests there are deeper, structural factors at play, which have slowed the underlying rate of productivity growth.

Analysis of the productivity dynamics at the firm level in chapter 3 provides important further insights. Productivity growth has slowed but remained relatively robust in leading firms at the frontier of the new technologies. However, it has slowed considerably in the vast majority of other, typically smaller firms, pulling aggregate productivity growth much lower. Productivity growth appears to have slowed particularly in firms in the middle of the productivity distribution. Between 2001 and 2013, in OECD economies, labor productivity among frontier firms rose by around 35 percent; among non-frontier firms, the increase was only around 5 percent (Andrews and others 2016).[3] While technology adoption lags across countries have been declining over time, technology penetration across firms within countries has slowed (Comin and Mestieri 2013).

The implication of this pattern of widening productivity gaps between leading and lagging firms is that the problem may not be the technology itself but, rather, its lack of penetration. It is not so much that innovation has weakened greatly, as feared by techno-pessimists, as it is that barriers are preventing a broader diffusion of innovations across firms and limiting productivity gains, a finding more akin to the views of techno-adaptationists. The widening gaps in productivity performance between firms go some way in explaining the paradox of advancing technology but slowing aggregate productivity growth.

One view on the productivity paradox that has gained some traction is that it may be illusory. Productivity is underestimated, the argument goes, because statistics fail to capture fully the gains from the new technologies in terms of improvements in product quality and variety and provision of goods and services that provide substantial utility to consumers but carry a low or zero market price (such as Google searches). Research finds that gains from new technologies are, indeed, underestimated but that this underestimation can explain only a relatively small part of the measured slowdown in productivity growth (Byrne and others 2016, Syverson 2016). For the most part, the productivity slowdown, and the related paradox, are real.[4]

Concurrent with the slowdown of productivity growth, income inequality within countries has been rising. As reviewed in chapter 2, income inequality has risen in all major advanced economies since the 1980s, and quite appreciably in several of them, particularly in the United States. Inequality has risen particularly sharply at the top end of the income distribution. Wealth inequalities are more acute—roughly twice as high on average as disposable income inequality in advanced economies—and have in many cases increased even more sharply. Trends in income distribution are more mixed across emerging economies, but most major emerging economies also witnessed a rise in inequality over the same period.[5]

The concurrence of the slowdown in productivity growth and the rise in inequality is vividly illustrated by the trends in the United States. Labor productivity growth in the decade to 2015 averaged less than half the growth rate of the preceding decade. Over the same period, income inequality, as measured by the broadest measure of inequality (the Gini coefficient), increased by more than 10 percent. The income share of the richest 1 percent has more than doubled since the early 1980s, to around 22 percent, with more than half of that increase occurring after the mid-1990s. The share of the top 1 percent in wealth rose to almost 40 percent. A still more dramatic indicator of wealth inequality is that the three richest people in the United States now own more wealth than the entire bottom half of the population, a total of more than 160 million people (IPS 2017).[6] Broader measures of economic and social well-being that go beyond the distribution of monetary income paint a similar picture of a highly uneven evolution of human welfare (Case and Deaton 2017, Graham 2017).

The Technology-Productivity-Distribution Nexus

What explains the slowdown in productivity growth amid booming new technologies and the concurrent rise in income inequality? Chapters 4 and 5 address this question. A synthesis of recent research reveals that the productivity slowdown and the rise in inequality are interconnected, driven by important common factors and mutually reinforcing mechanisms. Technological change has been at the center of these productivity and distributional dynamics. The interaction of the new technologies with product and factor market conditions as influenced by policies has been the major driver of the evolution of both productivity and income inequality. Technology, productivity, and distribution have been linked by a common nexus, with outcomes significantly shaped by the prevailing policy environment.

Technology Diffusion, Competition, and Rents

The slowdown in productivity, at its root, reflects a growing inequality in productivity performance between leading firms and the rest of the firms. Across major economies, the benefits of new technologies have been captured, for the most part, by a relatively small number of larger firms. Aggregate productivity growth is typically slower in industries with wider gaps in productivity between firms. Barriers to a broader diffusion of new technologies are producing outcomes that are both inefficient and unequal.

A weakening of competition is one important reason for the adverse productivity and distributional outcomes. Lower competitive intensity in markets weakened incentives to boost productivity. Barriers to competition kept the forces of competition from working to prevent a persistent rise in productivity and profitability gaps between firms.

The erosion of competition is reflected in a variety of indicators: rise in market concentration in industries, higher markups showing increased market power, and corporate ossification with declining business dynamism as measured by new firm formations. These trends are observable broadly across advanced economies but have been particularly marked in the United States. The share of the top four U.S. companies in total sales has risen in each of the major sectors covered by the U.S. Economic Census; between 1982 and 2012, the rise averaged 5 to 10 percentage points in manufacturing, utilities, services, and wholesale trade and 10 to 15 percentage points in finance and retail trade (Autor and others 2017). Over roughly the same period, average markup above marginal costs in U.S. publicly traded firms increased by more than 350 percent (De Loecker and Eeckhout 2017). In 1982, young firms (five years old or less) accounted for about half of all U.S. firms and one-fifth of total employment; these figures had dropped to about one-third and one-tenth, respectively, by 2013 (Decker and others 2017).

Evidence for OECD economies links weaker competition to slower productivity growth and wider productivity dispersion. In industries less exposed to competitive pressures, technological innovation and diffusion are weaker, inter-firm productivity divergence is wider, and aggregate productivity growth is slower (Andrews and others 2016, Cette and others 2016, Égert 2016).

With increased concentration of market power, the distribution of returns on capital has become more unequal. The return on invested capital has diverged sharply across firms, with the typical firm seeing only a modest increase in return but a relatively small number of firms reaping supernormal profits. In the United States, for example, the 90th percentile firm earned a return on invested capital reaching around 100 percent in 2014, which was more than five times the return earned by the median firm; this ratio was around two about twenty-five years ago (Furman and Orszag 2015). Markets shifted toward oligopolistic structures, giving rise to higher economic rents (Krugman 2016, Summers 2016).[7] Reflecting higher markups supported by increased market power, the share of "pure profits" or rents (profits in excess of competitive market conditions) in total income in the U.S. economy rose from an estimated 3 percent in 1985 to 17 percent in 2015 (Eggertsson and others 2018). The rise in the concentration of market power, and the associated increase in the concentration of income and wealth, has prompted some to refer to our era as a "New Guilded Age."[8]

Competition Policies and "Winner-Takes-Most" Dynamics

What explains the weakening of competition? Several factors appear to have been at play to varying degrees in major economies. These include flaws in the patent system that act as barriers to a wider diffusion of innovations; regulatory acts of omission and commission (deregulation unsupported by competition safeguards, and regulations that restrict competition); increase in mergers and acquisitions (M&As) coupled with lax anti-trust enforcement; increase in overlapping corporate ownership of companies that compete by large institutional investors; rise in rent-seeking; firm behavior showing greater adeptness in erecting barriers to entry through product differentiation and other means; and rising protectionism.

Besides competition policy failures, new technologies are contributing to increased market concentration by altering the structure of competition in ways that produce "winner-takes-most" outcomes. Digital technologies offer first-mover advantages, scale economies, network effects, and leverage of "big data," all of which encourage the rise of dominant firms; and globalization reinforces the scale economies by facilitating access to markets worldwide. The rise of "the intangible economy," where assets such as software and intellectual property matter more and more for economic success, has been associated with a stronger tendency toward the emergence of dominant firms (Haskel and Westlake 2017). Digitization may also allow firms controlling big data to extract more of the consumer surplus through increasingly sophisticated algorithmic pricing and customization of offerings.

The winner-takes-most dynamics have been most marked in the high-tech sectors, as reflected, for example, in the rise of superstar firms such as Facebook and Google. Increasingly, however, they are affecting broader segments of the economy as digital technology applications penetrate business processes more widely in other sectors, such as transportation, communications, finance, and commerce. In retail trade, for example, the big box stores, which previously had replaced mom-and-pop outlets, are now losing market share to online megastores such as Amazon.

Investment Slowdown

The weakening of competition helps explain the productivity paradox, but it also helps explain the investment paradox. Private investment rates have been on a downward trend since the 1980s in most advanced economies. Buoyant investment in information technology bucked this trend in the 1990s, but it, too, peaked around 2000 and has waned since. Weakness in investment has persisted in recent years despite historically low interest rates. In the post-global-financial-crisis period, macroeconomic factors such as deficient aggregate demand, credit disruptions, and elevated policy uncertainty depressed investment. But the trend decline in investment spanning the past three decades points to the role of some longer-term factors as well, and the erosion of competition is one such factor.

Studies of the United States and European economies find that decreased competition reduced incentives to innovate and make new investments (Gutiérrez and Philippon 2016, Égert 2017).[9] Firms wielding stronger monopoly power invested less and made a lot more on existing capital through higher markups and rents.[10] An increasing portion of the high corporate profits reflected monopoly power rather than productivity of investment. Financial wealth increased sharply, but this was not primarily embodied in new productive capital; much of it resulted from capital gains as monopoly profits boosted the market value of existing assets. One study estimates that the share of total U.S. stock market value reflecting monopoly power—which the study calls "monopoly wealth"—rose from negligible levels in 1985 to around 80 percent in 2015 (Kurz 2017).

The investment and productivity paradoxes fed each other through a negative feedback loop between investment and productivity. Low investment depressed productivity growth by limiting capital deepening and slowing the adoption of capital-embodied new technologies. Lower expected productivity growth depressed investment.[11]

In addition to lower private investment in plant and equipment, investment in infrastructure declined, adding to the forces pulling down productivity growth (Ollivaud and others 2016, Adler and others 2017). Widening infrastructure gaps dampened the productivity of private investment, especially of smaller enterprises, and weakened prospects for broad-based growth in economic opportunities that a strong infrastructure foundation supports.

Rise of Finance

Inefficient and unequal outcomes resulting from decreased competition have been compounded by resource misallocations and skewed rewards arising from rapid financialization (OECD 2015b, Philippon 2016). In the credit boom that preceded the global financial crisis, the lion's share of the credit went to households rather than firms, boosting stock and real estate markets rather than productive investment—an allocation of credit with negative implications for growth, stability, and income distribution. Credit disruptions that followed the crisis hurt investment and spending on development and adoption of new technologies, particularly by smaller firms (Anzoategui and others 2016). There has been much innovation in financial services based on the new technologies. A large part of it, however, has been focused so far on areas such as trading and asset management (especially tailored to the well-off) that do not have first-order effects on productivity.

Rewards in the financial sector rose sharply relative to the real economy. In the United States, for example, the financial sector captured an outsize share of profits—35 percent to 40 percent of all corporate profit in the years leading to the financial crisis. A sizable part of these high profits reflected rents in an increasingly concentrated sector; the top five banks' share of banking assets increased from 25 percent in 2000 to 45 percent in 2014. In European countries, financial sector workers on average accounted for one in five of the top 1 percent of earners even though they accounted for only one in twenty-five of the total workforce (Denk 2015). High rewards lured talent away from potentially more productive activities.[12] Financial wealth boomed but benefited mainly those at the top; in the United States, the top 1 percent of the wealth distribution held half of stock and mutual fund assets in 2013, and the top 10 percent held more than 90 percent (Wolff 2014).

Labor Income Dynamics

In labor markets, a similar interplay between technology, productivity, and distribution to that seen in product and financial markets has been at work. Across OECD economies, increased inequality in firm productivity is mirrored by increased inequality in labor incomes. As productivity gaps widened between firms, so did wage gaps. Rent sharing also contributed to wider wage differences between firms. Better-performing firms reaped a higher share of total profits and shared part of their supernormal profits with their workers. Increased fissuring of the workplace through outsourcing played a role as well, with non-core activities typically employing low-skill workers farmed out to other firms, cutting such workers from the rent sharing. Between-firm wage inequality rose more in industries that invest more intensively in the new digital technologies. Overall, wage inequality has risen sharply in the past couple of decades, and much of that rise is attributable to increased wage differences between firms (Song and others 2015).

Much of the public debate on rising income inequality has focused on the top 1 (or 0.1) percent versus the rest—CEOs, top managers, and professionals versus other workers—and steep increases in earnings at the very top have, indeed, been an important factor. But a large part of the rise in earnings inequality is related to increased wage gaps more broadly across the workforce, and particularly between more and less successful firms.

While workers in firms at the technological frontier earned more than those in other firms, gains from higher productivity at these firms were shared unevenly, with wage growth lagging productivity growth. Wages rose in the better-performing firms but by less than the rise in productivity. For most other firms, limited wage growth reflected limited productivity growth, although even at these firms wage growth tended to fall short of the meager gains in productivity (Schwellnus and others forthcoming). In the United States, net labor productivity increased by 72 percent between 1973 and 2014, while real hourly compensation of the median worker increased by only 9 percent (Bivens and Mishel 2015).

The decoupling of wages from productivity contributed to a shift in income distribution from labor to capital. Over the past couple of decades, most advanced economies have experienced both increasing inequality of labor earnings and declining labor income shares.[13] In the United States, for example, the percentage share of labor in total income dropped from the mid-60s around 2000 to the mid-50s around 2015. Labor income shares also fell over this period in most major emerging economies.

Increased market concentration has played a role in the shifting of income from labor to capital as it reallocated labor within industries to dominant firms with supernormal profits and lower labor income shares (Autor and others 2017). Dominant firms not only acquired more monopoly power in product markets to increase markups and extract higher rents but also monopsony power to dictate wages in the labor market (CEA 2016; Azar and others 2017). A new phenomenon has been the fast-expanding digital labor markets—online jobs platforms such as Task Rabbit and Amazon Mechanical Turk. Here, too, employer concentration has been high (Dube and others 2018). While employer market power strengthened, worker bargaining power weakened with a decline in unionization and erosion of minimum wage laws.

These developments reinforced the effect of labor-substituting technological change on the distribution of income between labor and capital.

Production shifted toward firms and processes using more capital (tangible and intangible) and less labor. The largest U.S. firm in 2017 (Apple) had a market capitalization that was forty times as high as that of the largest U.S. firm in 1962 (AT&T) but its total employment was only one-fifth that of the latter (West 2018). The shift of income from labor to capital increased overall income inequality, as capital ownership is highly uneven.[14]

International trade and offshoring also contributed to the shift in income toward capital by putting downward pressure on wages, especially of lower-skilled workers in tradables sectors. Overall, research suggests that globalization has played a significant role in the decline of the labor income share. However, it also shows that globalization's role has been much smaller than that of technological change and related outcomes (IMF 2017a).[15]

Race between Technology and Skills

Technology has been the key force in changing the structure of the demand for labor. Digital technologies and automation have shifted demand toward higher-level technical and managerial skills. In advanced economies, globalization has exerted pressure in the same direction. Demand has shifted, in particular, away from routine, middle-level skills that are more vulnerable to automation, as in jobs like bookkeeping, clerical work, and repetitive production. Job markets have seen an increasing polarization, with the employment share of middle-skill jobs falling and that of higher-skill jobs, such as technical professionals and managers, rising. The employment share of low-skill jobs has also increased but mainly in nonroutine manual jobs in services such as personal care that are hard to automate. Over the period 1995–2015, the share of middle-skill jobs in total employment fell by about 9.5 percentage points in OECD economies on average, while the shares of high-skill and low-skill jobs rose by about 7.5 and 2 percentage points, respectively.[16] A concurrent development has been the rise of the "gig economy," with more workers engaged in nonstandard work arrangements such as temporary or part-time contracts and own-account employment.

As the demand for skills has shifted, supply has been slow to respond. Education and training have been losing the race with technology (Goldin and Katz 2008, Autor 2014). Shortages of technical and higher-level skills demanded by the new technologies are partly responsible for the paradox of slowing productivity growth in the midst of booming technology; skill shortages have prevented a broader diffusion of the innovations across economies. Workers with skills complementary with the new technologies have been clustered increasingly in leading firms at the technological frontier. Across industries, skill mismatches have increased; in OECD countries, on average around one-quarter of workers report a mismatch between their skills and those required by the job (Adalet McGowan and Andrews 2015).

Imbalances between skills supply and demand have fueled income inequality by increasing the wage premia on higher-level skills (Hanushek and others 2013, Autor 2014). The skill premium rose in all major economies, especially over the 1980–2000 period. The rise has been particularly sharp in the United States. Those with a post-graduate degree could expect to earn around 215 percent of the wages received by those with only a high school education in 2016, compared to around 155 percent in 1980.[17] The rise in nonstandard work arrangements imparted more flexibility to the labor market. However, it probably also contributed to increased earnings inequality as nonstandard jobs (especially at lower skill levels) typically carried lower earnings than standard jobs.

Inequalities of Opportunity

Reducing inequalities in educational attainment takes on added significance with skill-biased technological change, both for the individual and the economy at large. Even as pre-collegiate achievement gaps have narrowed in many economies, gaps in higher education have widened. In the United States, for example, college enrollment and completion gaps by income level increased over the past few decades (Turner 2017). Almost two-thirds of workers in the U.S. labor force do not have a college degree. Access to continuing education and retraining is typically more difficult for lower-skilled workers—those who need it more as skill needs shift. Education and training are key to broadening economic opportunity. Persistent and rising disparities in these areas suggest that it is not only the inequalities of outcomes that have increased; inequalities of opportunity have risen as well, with adverse implications for both future growth and equity.

Studies for OECD economies find that higher income inequality and associated higher inequalities in educational attainment reduce intergenerational income mobility (Krueger 2012, Corak 2013).[18] A recent study of the

United States finds that the proportion of children who earn more at age thirty than their parents did fell to about 50 percent for the cohort born in 1980 compared with about 90 percent for the cohort born forty years earlier (Chetty and others 2016). The largest decline in mobility has occurred for families in the middle of the income distribution. This finding aligns with the concurrent trend of loss of middle-skill jobs in advanced economies—and the middle-class squeeze in these economies as traced by what has come to be known as "the elephant chart" (Lakner and Milanovic 2016).[19]

State's Redistributive Role

As technological change and developments in product and labor market drove income inequality higher, the state's role in alleviating the inequality of market incomes arising from the interplay of these forces weakened. In advanced economies, taxes and transfers (such as public pensions and social assistance benefits) reduce market income inequality on average by about one-third; in 2015, the average Gini coefficient for disposable income in these economies was 0.31 compared with 0.48 for market income.[20] Between 1985 and 1995, fiscal redistribution offset about 60 percent of the increase in market income inequality in advanced economies. Between 1995 and 2010, it hardly offset any (OECD 2016).

Fiscal redistribution declined because of reduced progressivity of personal income taxes and lower taxes on capital as well as tighter spending on social programs as countries took steps to rein in fiscal deficits and rising public debt. In OECD economies, the average top personal income tax rate fell from 62 percent in 1981 to 35 percent in 2015. Lower tax progressivity accentuated top income inequality. International tax competition resulting from capital mobility led to a large fall in corporate income tax rates as well. The average corporate tax rate in advanced economies fell from around 45 percent in 1990 to 26 percent in 2015 (IMF 2017b). A core part of the U.S. tax system changes enacted in late 2017 was the lowering of the corporate tax from a top rate of 35 percent to a flat rate of 21 percent. It is not only the lowering of the personal and corporate income tax rates that reduced tax system progressivity. Most tax systems today are characterized by a motley of tax breaks, many of which are regressive—and also distort market incentives and hurt productivity.

Productive Equity: An Agenda for Our Times

The proverbial economic pie has been growing more slowly and unequally, fueling social discontent and populist politics. To achieve stronger and more inclusive economic growth, the twin trends of slowing productivity and rising inequality seen over the past couple of decades must be reversed. These trends are closely linked. Policies to overcome these trends are linked as well. The politics of reform is inevitably complex and difficult, but policy action must not be paralyzed by continued trite debates about conflicts between growth and equity. Policy options are not limited to a binary choice of one or the other.[21] There is a broad range of policies that can help achieve better outcomes for both productivity and economic growth as well as equity. Linkages between productivity and equity call for an integrated agenda to promote these goals—an agenda for productive equity.

Policies to promote equity are often seen narrowly in terms of redistribution—tax and transfer policies, which can be politically controversial and divisive. But as the foregoing analysis of the interlinked dynamics of productivity and equity suggests, there is a much broader policy agenda of "predistribution" that can make the growth process itself more inclusive—and more robust at the same time. Politicians may find it easier to build winning coalitions around this agenda.

Inevitably, there are trade-offs. Advances in digital technologies hold much promise to boost productivity and human welfare. However technological change is inherently disruptive and, indeed, achieves much of its positive impact through what Joseph Schumpeter termed "creative destruction." Positive economic outcomes from globalization inevitably entail winners and losers. Right policies help balance these effects and facilitate adjustment. Policy failures can exacerbate them. Both technological change and globalization have contributed to the significant rise in income inequality that has taken place, but these distributional consequences are not pre-ordained. Much depends on how these forces are managed. Policies matter and must do better (Tyson and Spence 2017).

Technology is changing how firms compete and grow in markets, and it is changing the nature of work and demand for skills. The new dynamics pose fresh challenges for policymakers, calling for new thinking, experimentation, and learning. Policies will need to be more proactive in responding to change. Close to two-thirds of potential productivity growth in advanced economies over the next decade could be related to the new digital technologies (McKinsey Global Institute 2018), underscoring the importance of responsive policies to capture the full potential of these technologies to deliver higher productivity and broad-based improvements in economic well-being.

The backlash against globalization threatens a retreat into economic nationalism and inward-looking policies. Much of the ire has been directed at international trade for causing job and earnings losses for less skilled workers—even though technological change has been the bigger force. Rules for international engagement must be fair. But national policies—notably those affecting competition, skill development, and social protection—have a key role in ensuring that globalization works for all. In an increasingly interdependent world economy, national and international policies must work better together.

Chapters 6 and 7 develop the agenda for national and international reforms, respectively, in some detail. The major responsibility for boosting productivity and reducing inequality—and thereby fostering more robust and inclusive economic growth—rests with national policies. The reform agenda is broad. Countries will need to define and sequence policy actions depending on their specific circumstances. Given the agenda's scope and interconnectedness, it would pay to underpin policy formulation with a strategic overview of the objectives, priorities, linkages, and a whole-of-government approach.

National Reforms

Financial crises cast a long shadow. Much of the attention of policymakers in major economies in recent years has been focused on the more immediate agenda of responding to the global financial crisis and the ensuing recession. Boosting aggregate demand and restoring financial sector stability and normalizing credit conditions have been priority areas for policy action. Economic recovery has been slow but has shown greater vigor more recently, with the near-term growth outlook improving noticeably in most economies in 2017. Among advanced economies, the recovery is further advanced in the United States than in most European economies. Investment has picked up with stronger aggregate demand, but modestly so far. Corporate and bank balance sheets have improved, and bank capital buffers have been strengthened—again more in the United States than in Europe, though Europe seems to be catching up. Lessons learned from the pre-crisis excesses of the financial system are being translated into improved regulatory frameworks.

With progress in addressing the macrofinancial legacies of the financial crisis, attention must shift more to reforms that will drive longer-term economic prospects. While short-term growth prospects have improved, estimates of long-term potential output growth that depend crucially on productivity do not show the basis for a sustained acceleration of growth. The slowdown in productivity is not a transitional phenomenon that the cyclical economic recovery alone will resolve. The new technologies have the potential to produce a turnaround in productivity over the coming decade, but the realization of that potential will depend on efforts to address the underlying causes of the slowdown (McKinsey Global Institute 2018). Without such efforts, the slowdown could even worsen (World Bank 2018). Meanwhile, income and wealth inequalities within countries have continued to mount. According to one estimate, four of five dollars in growth in global wealth in 2017 accrued to the richest 1 percent (Credit Suisse 2017). Policymakers need to confront these challenges through deeper reforms of markets, policies, and institutions as they steer economies toward more robust and inclusive growth.

As economies recover from the crisis, there has been debate about the relative roles of demand- and supply-side policies in boosting productivity. Looking ahead, the demand and supply sides will be closely linked. Beyond the cyclical recovery in demand, sustained growth in demand will depend greatly on improvements on the supply side. For example, improvements in market competition, diffusion of new technologies, and access to complementary skills and infrastructure will matter for investment demand. Policies that counter rising income inequality and promote broad-based growth in incomes, such as training and transition support programs that help displaced workers move to well-paying new jobs, will matter for consumption demand.

Revitalizing Competition for the Digital Age

One key crosscutting area of reform is to reinvigorate competition and revamp competition policies for the digital age. The weakening of competition in markets has been a key link in the nexus connecting the slowdown in productivity and investment and the rise in income and wealth inequalities. Competition is a strong spur to innovation-embodying investment, the adoption and diffusion of innovation, and productivity growth. It also promotes more inclusive growth by providing a level playing field to businesses and greater opportunities for workers. Regulatory reform is important, but it should not be just about deregulation. It should aim to remove regulations that impede competition. It should also ensure that adequate rules and regulations are in place where needed to prevent excessive concentration of market power and its abuse. There is considerable scope for regulatory reform in a number of OECD economies, especially in network and service industries (OECD 2017a). The M&A activity in these economies has more than doubled since the 1990s, helped by more accommodative anti-trust policies. Given the rise in industrial concentration, the robustness and enforcement of anti-trust regimes merit special attention.

There is a need to rethink anti-trust laws and other competition policies for the digital age where the new technologies tend to produce winner-takes-most dynamics and quasi-natural monopolies. Once in dominant positions, firms often work to entrench themselves by erecting a variety of barriers to entry, discouraging business dynamism and further innovation. The beneficiaries of an open, competitive system often work to close the system and stifle competition, necessitating reform to "save capitalism from the capitalists" (Rajan and Zingales 2003, Krugman 2015b). Regulators need to understand the nature of the new market dynamics, such as the differences between today's digital platforms and networks and how they differ from the network industries of the past, and devise new tools to identify and address noncompetitive behavior. With the rise of "big data," regulations pertaining to how user data are handled, access to those data, and privacy protections matter increasingly for competition and the availability of this information in wider research and further innovation (West and Allen 2018). Competition policy also needs to become more global to address cross-border business practices that restrict competition; today's superstar firms typically are multinationals that affect competition in markets in many countries.

In addition to product markets, enhancing competition is also key to deeper reform of financial markets, to complement progress made in strengthening prudential regulation. It would help address problems associated with size, increased concentration, interconnectedness, and rent-seeking. It would spur better use of advances in digital technology to expand the range of financial services and reduce their cost, open new gateways to entrepreneurship, and democratize access to finance. Innovations such as mobile financial services, digital platforms, equity crowdfunding, and blockchains have much potential. Young FinTech firms are in the vanguard in the application of such innovations. A challenge for policymakers is to foster the growth of these new entrants into the financial industry while managing associated risks.

Unshackling Innovation and Its Diffusion

A second area to reform is technology policies, both to boost innovation at the technological frontier and promote its broader diffusion across economies. Intellectual property regimes need to be better balanced so they reward innovation but also foster wider economic impacts. There is evidence suggesting that stronger patent protection may be associated with greater market concentration, less follow-on innovation and diffusion, and wider productivity gaps within industries (Andrews and others 2016, Autor and others 2017). "The copyright and patent laws we have today look more like intellectual monopoly than intellectual property" (Lindsey and Teles 2017). Patent abuses—rent seeking, defensive patent thickets, trolling, and frivolous litigation—are pervasive. Arguing that patents are locking in incumbents' advantages rather than spurring the hoped-for bursts of innovation, some have even called for a complete abolition of the patent system (Boldrin and Levine 2013). That would seem too radical a step. However, a fundamental review of the patent system seems warranted to reform overly broad and stringent protections and give freer rein to competition that, ultimately, is the primary driver of innovations and their economy-wide penetration.

Also, public investment in research and development (R&D), which has declined in many major economies, needs to be bolstered. In the United

States, for example, government spending on R&D fell from 1.2 percent of GDP in the early 1980s to half that level in 2015 (Shambaugh and others 2017). Public R&D, with its focus on basic research, complements private applied R&D. A recent study finds that productivity of overall R&D spending has declined and suggests that the fall in public investment in basic research could be a contributory factor (Bloom and others 2017). Many breakthrough innovations developed commercially by the private sector had their origin in research at government research institutes, defense-related research programs, and publicly supported research programs at universities.[22] Public research programs should ensure broad access to the fruits of direct public R&D investment as well as access on a level footing by firms to any private R&D incentives provided through tax relief and grants. Governments could also explore ways of better recouping some of their investment in research to help replenish their R&D budgets through a better balance in sharing risks and rewards of public research investment compared with the current paradigm where risks are socialized but rewards are privatized.

Investing in Skills for a Changing World of Work

A third area is boosting and reorienting investment in skills. Advances in digitization, robotics, and artificial intelligence have led some to draw up dire scenarios of massive job losses from automation (a "robocalypse"), such as half or more of the jobs in OECD economies being at risk (see, for example, Frey and Osborne 2013, Ford 2015, and World Bank 2016). However, how many jobs will be killed by automation may be the wrong question to focus on, as it considers only the destruction of existing jobs and ignores the creation of new jobs by the new technologies and economic growth. Experience with past major episodes of automation shows that as technological change made some old jobs redundant, it created new ones complementary with the new technologies. How technological change impacts employment must be seen as a dynamic adjustment process of old jobs and tasks giving way to new ones (Acemoglu and Restrepo 2018b, Autor and Salomons 2018). Looking ahead, not only will the skill needs of jobs continue to evolve, but the composition of employment will evolve as well, with more people working independently—including as microentrepreneurs in an expanding "crowd-based capitalism" enabled by digital platforms, as exemplified by Uber and Airbnb (Sundarajan 2016, Brynjolfsson and McAfee 2017).

The main issue is that the nature of work is changing, and the main policy challenge is to equip workers with nonroutine, creative, and higher-level skills that the new technologies demand and support workers during the adjustment process. The key to winning the race with technology is not to compete against machines but to compete with machines.

Education and training programs must be strengthened and revamped to respond to the new skill dynamics. Traditional formal education must be complemented with new models and options for reskilling and lifelong learning, given the fast-changing skill needs but also the aging of many economies' workforces. As the old career path of "learn-work-retire" gives way to one of continuous learning, the availability and quality of continuing education must be dramatically scaled up. This will demand innovations in the content, delivery, and financing of training, including new models for public-private partnerships. It will involve experimentation, and learning from what works, such as the apprenticeship system in Germany. The potential of technology-enabled solutions, such as online learning platforms, must be harnessed through investing in broader digital access and improved digital literacy. Reducing the digital divide is a big new challenge for equity.

Education is a powerful equalizer of economic opportunity. Inequalities in education start at a young age and are magnified in adulthood. From early childhood education to higher education and training programs, a strong commitment to promoting inclusion of the economically disadvantaged is vital. In a knowledge-based economy, broad-based access to affordable and quality education, including skills upgrading and retraining, will be increasingly important for both boosting productivity and improving equity.

Revamping Labor Market Policies and Social Protection

A fourth area of reform is the overhaul of labor market policies and social protection arrangements to adapt them to the changing world of work characterized by more frequent shifts between jobs and more people working independently. The focus should shift from backward-looking labor market policies such as restrictive job protection laws that seek to keep workers in existing jobs to forward-looking policies that improve workers' ability to change jobs. The latter include innovations in unemployment/wage insurance mechanisms that encourage re-employment and active labor market policies such as retraining and placement services. Reform of backward-looking policies has particular relevance for European economies. Advanced economies, in general, need to do more and better on forward-looking policies.

Reform should also address other barriers to worker mobility and competition in labor markets, such as the ever-increasing professional licensing requirements and non-compete covenants in worker contracts.[23] Well-functioning labor market institutions—collective bargaining, minimum wage laws, labor standards—are important to ensure that workers get a fair share of economic returns, especially at a time of rising market power of dominant firms.

Social contracts, traditionally based on formal long-term employer-employee relationships, will need to be overhauled, with benefits such as retirement and health care made more portable and adapted to evolving work arrangements, including increasing independent work. There is currently an active debate on the options to reform social security systems. Proposals range from mechanisms such as a universal basic income[24] or a negative income tax to various types of social security accounts that pool workers' social benefits and are portable across all jobs. Learning from this debate and experimentation should help inform and guide policy. Reform options will need to be considered in a context where social security systems already face challenges to ensure their long-term fiscal sustainability.

Approaching reforms of job protection laws, active labor market policies, and social protection as a package will have the advantage of capturing reform synergies and would ease the adjustment for workers. Current reforms in France provide an example, combining reforms to stringent job protection laws with innovations such as a portable "personal activity account" that enables workers to accrue rights to training across multiple jobs and types of work.

Reviving Investment in Infrastructure

A fifth area of reform is underpinning economies with a stronger infrastructure foundation. Driven by fiscal constraints as well as suboptimal policy choices, public infrastructure investment has been declining, contributing to mounting infrastructure gaps. At the same time, technology is transforming infrastructure needs, from new digital infrastructure to energy and transport. In the United States, net federal infrastructure investment recently has been close to zero. In advanced economies as a group, real public capital stock declined from around 70 percent of GDP in the early 1980s to below 60 percent in 2013 (Adler and others 2017). Infrastructure gaps are even larger in emerging economies. Well-designed infrastructure projects that fill critical gaps—and are responsive to and complement new technologies—can offer high returns in boosting productivity and broadening economic opportunity. Fiscal policy needs to be more innovative in creating space for such high-return investments, especially when borrowing costs are low. Innovations in developing infrastructure as an asset class, risk mitigation, and public-private partnerships, together with improved regulatory ecosystems, can help mobilize more private investment in infrastructure. Stable, long-term returns provided by infrastructure assets should be attractive to institutional investors. Yet only about 5 percent of the $120 trillion in assets under management by institutional investors globally is currently invested in infrastructure (Bielenberg and others 2016).

Sound infrastructure investments are central to combating climate change and ensuring the longer-term sustainability of gains in economic productivity as well as social equity. Infrastructure currently contributes around 60 percent of global greenhouse gas emissions. New infrastructure investments must be designed to support environmental sustainability. The key action here is to institute carbon pricing, which would shift incentives toward sustainable forms of infrastructure and could also raise substantial revenues. Revenue raised from carbon taxation can support investment in sustainable infrastructure; it can also be put to other desirable uses depending on country circumstances, such as paying down national debt and improving longer-term fiscal sustainability. Shifting to sustainable infrastructure can open a new world of opportunities for innovation and investment, notably in energy-related sectors, that can boost productivity and growth (Bhattacharya and others 2016).

Improving the Efficiency and Equity of Tax Systems

A sixth area is reforming tax systems. Tax policy is often seen as presenting trade-offs between efficiency and growth on one hand and equity on the other—and trade-offs do exist—but there are win-win opportunities for reform. Reducing the tax wedge for low-wage workers through greater use of options such as earned-income tax credit can boost incentives to work and labor force participation as well as improve distributional outcomes. The changing nature of work driven by digital technologies will require more attention to efficiently and equitably taxing workers in different types of work arrangements. Labor income is often taxed at much higher rates than capital income, which can entail both efficiency costs, by distorting investment and employment decisions, and equity costs. For example, biases in the tax code in favor of capital may be creating incentives toward "excessive automation" (Acemoglu and Restrepo 2018a). Policy should seek to tax different types of capital income more neutrally. Tax systems in many OECD economies include differential taxation of types of capital income, assets, and financing (favoring debt over equity), which distorts investor incentives. Given the mobility of capital, international cooperation is important for taxing capital more effectively, even more so in today's digital economy.

Partly driven by international competition for mobile capital, the recent trend in corporate income taxation has been to lower tax rates, most recently in the United States as part of the Tax Cuts and Jobs Act of 2017. This is happening in a period when corporate profits have soared. The sharp rise in pure corporate profits or rents, approaching an estimated one-fifth of income in the U.S. economy, as already noted, suggests that it may be optimal to tax corporate profits at relatively high rather than low rates.

Making better use of wealth taxes can improve both the efficiency and equity of the tax structure. Wealth taxes are underutilized and have not kept pace with the surge in wealth; in major economies with available data, the effective tax rate on different types of wealth fell from an average of around 0.9 percent in 1970 to 0.5 percent in the early 2010s (Clements and others 2015). High wealth inequality is a key driver of intergenerational persistence of income inequality. Thomas Piketty's work on inequality (Piketty 2014) has attracted much controversy, but one key proposal—to find a better way to tax wealth—certainly has merit. The wealth dynamics of the past few decades paint a picture of private riches and public poverty. While private wealth has soared, public wealth has declined, arguably hobbling the capacity of public policy to play its due role in promoting a more sustainable and inclusive pattern of growth.[25] Better taxation of private wealth must be part of the agenda of tax and expenditure reforms to restore government capacities to pursue desirable public policy goals.

Income tax progressivity has declined steeply in major economies. There is scope to recover some of the lost progressivity without hampering economic growth (IMF 2017b). This does not necessarily mean sharply raising marginal tax rates. A more efficient way is to reform the assortment of regressive and distortive tax expenditures that characterize most tax systems—and curb tax avoidance and evasion.[26] Also, the redistributive impact of taxes depends crucially on how the programs they finance promote equity objectives—such as education and social programs already mentioned. Reform should be guided by the overall progressivity of the tax and expenditure system. It is not just that well-designed fiscal redistribution may not be inimical to growth; it can even be pro-growth (Ostry and others 2014).

The International Context

Despite globalization and increased economic spillover effects across national borders, the nation-state remains the primary locus for formulating policies that affect productivity, growth, and income distribution. The international context increasingly matters, however. National economic policies and international rules governing trade, investment, and flows of skills and technology must work well in concert to ensure that globalization delivers for all.

The interface between national and international policies can produce tensions, as is evident in the currently charged debate on globalization and major recent political developments where popular reactions against globalization played a prominent role, such as Brexit and the outcome of the 2016 U.S. presidential election. Protectionist pressures, and actions, have been on the rise. Such tensions are captured well in Dani Rodrik's "political trilemma of the world economy" that points to the difficulty of reconciling national sovereignty, democratic policymaking, and global economic integration (Rodrik 2011). The trilemma leads to "the globalization paradox":

globalization boosts economic prosperity but works best when it is not pushed too far for its own sake but managed through international disciplines that ensure fair play and is complemented by the preservation of adequate policy space for the nation-state. Well-managed globalization within these parameters can stand up better against assault by ascendant national populism.

A Better, More Inclusive Globalization

International trade and investment are important drivers of productivity growth. A retreat into protectionism would be counterproductive. "Mercantilism redux" is not the way forward. Already, growing protectionism, neglect of fresh liberalization, and barriers to investment have contributed to the slowing of international trade and investment, weighing down global productivity and growth. At the same time, it is crucial for both productivity and equity that the rules that govern trade and investment are fair, in that they provide a level playing field for competition and promote the free flow of ideas and innovation rather than allow the reinforcement of new monopolistic tendencies in the world economy. As traditional tariffs have been lowered across the world in past trade deals, particularly in manufacturing, trade negotiations are increasingly focused on "behind-the-border" regulatory issues going well beyond tariffs and traditional nontariff barriers. On one hand, domestic regulations should not be allowed to replace traditional protectionism as countries attempt to protect their firms against competition. On the other hand, country circumstances and citizen preferences differ, and this needs to be respected. Striking the right balance between regulatory harmonization and diversity will be a challenge for policymakers.

Enhancing competition that is open and fair is a key issue. Simply imposing regulatory systems from one part of the world onto others may be seen as a ploy to provide competitive advantage to the former. The huge profits being made by today's multinational giants in part reflects the monopoly power arising from scale, first-mover advantages, and winner-takes-most markets associated with the new technologies.[27] Economies of scale in themselves are a productivity-enhancing factor. If they lead to monopolistic global market structures, however, these structures will, in the longer run, reduce productivity growth by restricting competition. The implications for income distribution are probably even more serious. Overly stringent and broad intellectual property protections add to the forces driving increased market concentration. Appropriate regulation of intellectual property rights acquires increased importance in the knowledge economy to foster broader opportunities for innovation and its diffusion. The biggest challenge for future international policies will be how to strike the most desirable balance on regulatory issues so that competition and innovation are enhanced and how different national preferences are reconciled with the need for a global framework that responds to the challenges of the digital age.

Trade has always created winners and losers (Rodrik 2017). The winners could, hypothetically, compensate the losers as long as net gains are positive. In practice, the losers often are not compensated, which explains their negative reaction to trade liberalization without compensation. Policymakers should address this issue much more seriously than they have in the past. Of course one can argue that most dynamic economic change creates winners and losers and, indeed, the issue is much wider than just the distributional consequences of trade. Much depends on how losses are concentrated rather than diffused sectorally and geographically and over large numbers. When they strongly affect particular sectors or regions, as they often do, the consequences of trade liberalization deserve particular attention. In the future, this may also become the case with the speed and spread of digitization. Trade liberalization needs to be complemented with domestic policies to help those affected adjust to change and to support them through the transition. This reinforces the importance of policies related to skill retraining and social protection discussed in the previous section.

Demographic and technological change and their implications for labor supply and demand have brought migration issues more to the fore, but policy responses and coordination mechanisms have lagged. Gains in aggregate welfare from labor mobility can dwarf the benefits from trade given the large income differences between countries. There is growing evidence of the role of migrants in boosting productivity, through mitigating the impact of population aging, alleviating skill supply and demand imbalances, transferring technology, spurring innovation and entrepreneurship, and fostering cross-border trade, investment, and knowledge networks (IMF 2016, McKinsey Global Institute 2016). There are, however, clear cultural factors that constitute a barrier to large-scale migration, in addition to issues related to income distribution.

National preferences on immigration differ and need to be respected. On the other hand, given the potential gains from migration, an international system that incentivizes it, while respecting national priorities, is desirable. One way forward, for example, could be a system of national quotas to accept migrants based on agreed parameters that are tradable among countries and, thereby, accommodate national preferences (Fernández-Huertas Moraga and Rapoport 2014). This is being explored in Europe as an option to address the refugee issue. It could, however, be considered on a more global scale among interested countries for certain types of migrants, such as those seeking temporary work visas. With deeper global integration, skilled migration is likely to increasingly involve shorter durations and circular paths as opposed to one-way and long-duration moves. To facilitate temporary cross-border movements of skilled workers, one proposal is to work through the General Agreement on Trade in Services (GATS) and establish a plurilateral but open "innovation zone" within which technical personnel could move freely over periods spanning a certain number of years (Doherty and others 2016).[28]

With globalization increasing the mobility of capital and making it easier to shift income and assets to offshore lower-tax jurisdictions, international cooperation on tax matters takes on added significance. Tax avoidance and evasion from such tax arbitrage and often-outright concealment of income and wealth in offshore havens distorts investment decisions, erodes fiscal capacities, and exacerbates inequality.[29] International tax competition threatens a race to the bottom in the taxation of capital. Differences in national preferences on tax policy should be respected, but a system that undermines each nation's ability to tax, leading to a situation akin to a prisoner's dilemma, with lack of cooperation resulting in lower tax revenues than desired by any nation, should be avoided. The G20, supported by the OECD, has recently launched initiatives to facilitate exchange of information on financial assets and to curb tax-base erosion and profit shifting (OECD 2017b). Given implementation challenges, and new challenges arising from fast-expanding digital commerce, this is easier said than done.[30] But at least a start has been made.

Another area for stronger international cooperation is carbon taxation and other policies to tackle climate change—the "mother of all global public goods." The Paris Agreement on climate change was an important step. While it may not at the outset provide a sufficient degree of ambition, it was the first truly global agreement on climate action, until the United States pulled out a year later. Tackling climate change is crucial to longer-term sustainable growth in economic productivity as well as to inclusive growth, as lower-income groups typically are more vulnerable to its impacts. As with trade, however, and particularly in the short run, climate policies can produce winners and losers. That is why measures to ease adjustment and address distributional effects—as well as support poor countries on climate actions—must be an integral part of climate policies (Commission on Carbon Prices 2017).

Global Institutions for the Twenty-First Century

A crosscutting challenge at the global level is to ensure that global markets are "embedded"—following John Ruggie's well-known terminology—in rules and institutions that help them work efficiently, fairly, and equitably (Ruggie 2008). While much has been built in the past few decades, global institutional frameworks have not kept pace with the increasing integration of global markets (OECD 2017c).

Looking ahead, technological change will pose new challenges as policies attempt to catch up with expanding digital trade; the rise of "the intangible economy" with more knowledge-intensive investment and commerce; multinational technology giants that affect competition across national markets; and issues of data privacy and cybersecurity.[31] In this world of digital globalization and global value chains, where multinational corporations account for about 80 percent of world trade, issues relating to international trade, investment, competition, and intellectual property rights are increasingly intertwined. Yet the world lacks a multilateral institutional framework to address these issues in a holistic, coordinated way (Baldwin 2016). The WTO's current mandate is focused primarily on trade. It needs to be broadened. While today's backlash against globalization threatens to weaken the WTO, the institution, in fact, needs to be strengthened to anchor an updated, open, and fair rules-based system to make globalization work better.

Absent a multilateral framework, groups of countries have attempted to address this evolving and interlinked agenda of trade, investment, competition, and intellectual property in regionally negotiated arrangements. Some regional agreements have also included provisions on labor standards.

Innovations through these regional initiatives can help in developing rules and practices that incrementally lead to wider adoption and application. Major economies working through the G20 can also play a facilitating role on this forward agenda. In today's political climate, strengthening global institutional frameworks appears especially daunting. Eventually, however, there will be a need to adapt multilateral frameworks to the demands of the twenty-first century.

The governance and modus operandi of international institutions would benefit from improvements to enhance their political legitimacy and efficiency of decisionmaking. This includes how nation-states are represented and engage in these institutions—their voice and accountability—and how decisions are taken among a large number of members of different size. In the case of the WTO, for example, where decisions by consensus may be difficult, plurilateral approaches could be considered that are open to others to opt in later (IMF and others 2017). In the case of some other institutions, notably the IMF and multilateral development banks, the system of weighted voting seems to work well.

If we want to achieve productive equity, we will need to harness the forces of globalization and technological change so that they promote a better world for all. Nation-states will be the primary actors in this effort, but some degree of "global civics" (Altinay 2011) will be necessary, as reflected in fit-for-purpose global institutions.

Notes

1. This is sometimes termed "the Solow Paradox" in reference to Robert Solow's quip, "You can see the computer age everywhere but in the productivity statistics" (Solow 1987).

2. Past episodes of high and persistent inequality have typically been followed by political upheavals or other shocks to the system that Walter Scheidel (2017) calls the "Four Horsemen of Leveling," namely: wars, political revolution, state collapse, and pandemics.

3. Frontier firms in this estimate are defined as the top 5 percent of firms with the highest labor productivity within each two-digit industry. Non-frontier firms cover all other firms. The estimate covers firms in twenty-four OECD countries, operating in manufacturing and business services (excluding financial services) and employing twenty or more workers.

4. Productivity statistics based on GDP by definition do not include the consumer surplus. However, research finds that even when a reasonable allowance is

made for the higher consumer surplus associated with digital products, such as Internet-linked services, the data still show a slowdown in productivity. For an overview of the measurement debate, see Derviş and Qureshi (2016).

5. Actual levels of inequality may be even greater than the measured ones given the potential for underestimation of income and wealth at the top end of the distribution.

6. At the global level, forty-two people own as much wealth as the bottom 3.7 billion people, almost one-half of the global population (Credit Suisse 2017).

7. Krugman (2016) terms this period a "robber baron era," and the stagnation of economic activity resulting from increased monopoly power and its effects of dampening investment and productivity "robber baron recessions."

8. See, for example, "Digitalization and the New Guilded Age," http://www.imf.org/external/POS_Meetings/SeminarDetails.aspx?SeminarId=295.

9. Research also finds some evidence that changing composition of stock ownership with increasing shares held by financial institutions, in particular large institutional investors, played a role by shifting corporate decisionmaking toward short-termism, favoring more immediate financial gains (such as through stock buybacks) at the expense of longer-term investments in innovation and new capacity (Gutiérrez and Philippon 2016). Institutional investors now hold more than two-thirds of the stock of U.S. publicly traded companies—up from about one-third in 1980.

10. In the United States, net business investment declined from above 50 percent of net operating surplus in the early 1980s to below 25 percent in the first half of 2010s (Egerttsson and others 2018).

11. McKinsey (2018) estimates that slowing growth of capital per hour worked because of lower investment accounts for about half of the decline in labor productivity growth in the United States and major Western European economies between 2000–04 and 2010–14.

12. "Too many potential physicists and engineers spend their careers shifting money around in the financial sector, instead of applying their talents to innovating in the real economy" (Barack Obama, "The Way Ahead," *The Economist,* October 8, 2016).

13. Consistent with Kaldor's stylized facts (Kaldor 1957), the labor income share had been relatively stable over several preceding decades.

14. The role of uneven wealth ownership and returns on wealth as sources of inequality has been particularly emphasized by Thomas Piketty in his 2014 bestseller (Piketty 2014).

15. IMF (2017a) finds that, in advanced economies, technology accounts for about half of the decline in the labor income share. Global integration is estimated to have contributed about half as much as technology.

16. OECD Employment Database.

17. U.S. Bureau of Labor Statistics data.

18. The negative relationship between income inequality and intergenerational mobility is often referred to as the "Great Gatsby Curve," a name coined by Alan Krueger.

19. In the United States, for example, middle-income households declined from 58 percent to 47 percent of total household population between 1970 and 2014 (Alici and others 2016). A recent work (Temin 2017) provides a particularly detailed and illuminating account of the middle-class squeeze in the country.

20. The redistributive impact of fiscal policy is typically much smaller in emerging economies because of lower levels of taxes and transfers. In 2015, for twenty-nine emerging economies with available data, the average Gini coefficient was 0.49 for market income and 0.45 for disposable income (IMF 2017b).

21. See Stiglitz (2015) for a similar conclusion: "The new research and thinking that has emerged suggests that equality and economic performance are in fact complementary rather than opposing forces. No more false choices."

22. Recent examples include the Internet, Google's basic search algorithm, and key features of Apple smartphones (Mazzucato 2015).

23. In the United States, almost one in three workers requires a government occupational license (CEA 2016). Non-compete restrictions cover between 20 percent to 25 percent of all workers, with the ratio rising for higher-level occupations—about 40 percent for engineers and 70 percent for business executives (Shambaugh and Nunn 2018).

24. Pilots of universal basic income are currently under way or in the works in Finland and some subnational jurisdictions such as Ontario, Canada, and Oakland and Stockton, California. The Finland pilot will end in 2018, and its results will become available in late 2019.

25. The *World Inequality Report 2018,* led by Piketty and others, estimates that most major economies experienced this pattern of rising private wealth and declining public wealth. In the United States, for example, while net private wealth (or private capital) increased from 326 percent of national income in 1970 to about 500 percent in 2015, net public wealth fell from 36 percent to -17 percent. Net wealth is measured as assets minus debt (Alvaredo and others 2017).

26. A recent study of rich economies estimates that the super-rich evade about 30 percent of their taxes compared with an average evasion rate of 3 percent for the whole population (Alstadsæter and others 2017).

27. Eight multinational technology companies account for about one-third of the market capitalization of the world's 100 most valuable firms (Wolf 2017).

28. Mode 4 of WTO's GATS covers cross-border movement of persons.

29. Wealth held in offshore tax havens is estimated to have risen to the equivalent of more than 10 percent of global GDP (Alstadsæter and others 2017). This may be a conservative estimate.

30. While most big companies can use financial engineering to offshore profits, companies based on intangibles, such as Internet protocol, rather than traditional tangible goods can do it more easily. Among these are U.S.-based technology platform companies such as Apple, Google, and Facebook. Their growing heft and offshoring ability means that half of all U.S. corporate profits from overseas are now located in tax havens such as Ireland, Luxembourg, the Netherlands, Switzerland, and Jersey (*Financial Times*, February 17, 2018).

31. Just fifteen years ago, cross-border digital flows were almost nonexistent; today, they have a larger impact on global economic growth than traditional flows of traded goods. The volume of cross-border data flows has soared forty-five-fold since 2005, and is expected to grow another nine-fold over the next five years (Tyson and Lund 2017).

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TWO

The Evolution of Growth, Productivity, and Income Inequality

KARIM FODA

In the fall of 2016, eight years after the global financial crisis, the managing director of the International Monetary Fund (IMF) warned the G20 that the world economy risked slipping into a trap of low growth and high income inequality. It had taken the advanced economies longer to recover from the loss of output from the crisis than the recoveries of any recession since the Great Depression. Yet even after GDP recovered, the growth engine remained stuck in low gear. Wishful outlooks for faster growth were consistently scaled back with each data update until late 2016. Higher income inequality, which in some countries had grown to levels not seen since before the Great Depression, were stubbornly difficult to reverse, as the chances for people to move up the income ladder were eroding. Emerging and developing economies had at first quickly recovered from the setback of the crisis, contributing nearly 90 percent of global growth from 2008 to 2011, but eventually began to lose steam. As the leaders of the G20 countries gathered in Hangzhou, China, in the fall of 2016, the global economy seemed to be, by most accounts, sliding into a trap of low growth and high income inequality—enough reason for the IMF to sound the alarm bells. One year later, the global economy appeared to be on a cyclical upswing, but the main driver of longer-term growth—productivity—remained asleep at the wheel.

Without a revival in productivity growth, there is little expectation of sustained growth in the future and, therefore, less incentive for firms to invest in the future. This further slows down productivity growth in a somewhat vicious cycle. The result could very well be a low growth trap, reinforced by wide disparities that have emerged within many countries around the world.

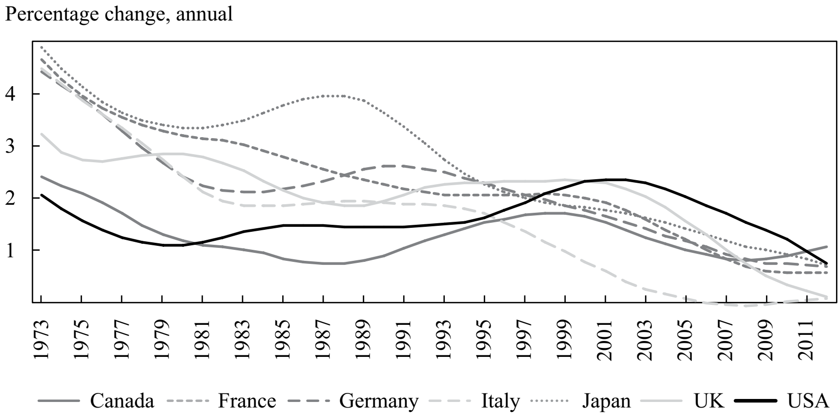
This chapter outlines the underlying trends for growth and inequality across both developed and developing economies over the last thirty years. Next is a review of the recent growth challenge in a longer-run context to provide perspective, then an illustration of the changes and patterns in the ultimate driver of longer-term economic growth: productivity. Last, the chapter turns to the evolution of income inequality, both within countries and between them.

The Era of Economic Growth

For hundreds and, perhaps, thousands of years, economic growth was essentially nil. Human progress had resulted in discoveries and inventions that gave rise to civilization, science, architecture, and engineering before the Industrial Revolution, yet the size of an economy could grow only as fast as its population.[1] This changed with the technological breakthroughs of the first industrial revolution in the late eighteenth and early nineteenth centuries. The invention of the steam engine replaced human and animal power with machine power, enabling workers to produce far more than they ever had in traditional agricultural societies. These new technologies and methods of production enabled workers to be significantly more productive. For the first time in recorded history, productivity began to grow, and the era of economic growth was born. The second industrial revolution, around the turn of the twentieth century, had an even greater impact on productivity and growth. Electric power, internal combustion engines, chemical production, and other technologies launched a wave of productivity growth that originated in the United States and eventually spread to Europe and Japan after World War II (Bergaud, Cette, and Lecat 2014).

Between 1920 and 1970, average incomes in the United States quadrupled, and prosperity was widespread. Growing manufacturing industries

FIGURE 2-1 Trend Labor Productivity Growth in Major Advanced Economies, 1973–2012



Source: OECD (2016b). Labor productivity in terms of output per hour worked.

created stable and well-paying jobs; rising numbers of high school and college graduates had the right skills; and government policies strengthened the bargaining power of labor and widened the social safety net. In Europe and Japan, pent-up demand after years of war and austerity combined with a wave of productivity-enhancing innovations, many of which arrived from the United States, and drove rapid, sustained, and widespread growth. In the post-war decades from 1951 to 1973, the world economy grew at an impressive annual rate of nearly 5 percent (Levinson 2017).

In the early 1970s, however, the prosperous years of rapid growth in the West appeared to be over. Rapid productivity growth in the United States did not recover after the shock of the oil crisis in 1973 and, with the exception of the information technology boom years of 1996 to 2004, has remained relatively slow. In European countries and Japan, still in the process of catching up to the United States, productivity growth decelerated and has continued on a general downward trend through today (figure 2-1).

Beyond the West, economic reforms in East Asia and the opening of China to the world economy in the 1970s laid the foundations for faster growth in the developing world. Increased trade and the diffusion of technological progress from the frontier, improvements in macroeconomic policy frameworks, higher investments in education and infrastructure, and technologies that enabled global value chains to spread helped lift productivity and economic growth in many emerging economies. In 1980, developing countries accounted for about one-quarter of world output and 85 percent of the world's population. By 2015, their share of world output increased to 40 percent (58 percent under purchasing power parity), though their ability to sustain such rapid progress is in question as they, too, are losing steam.

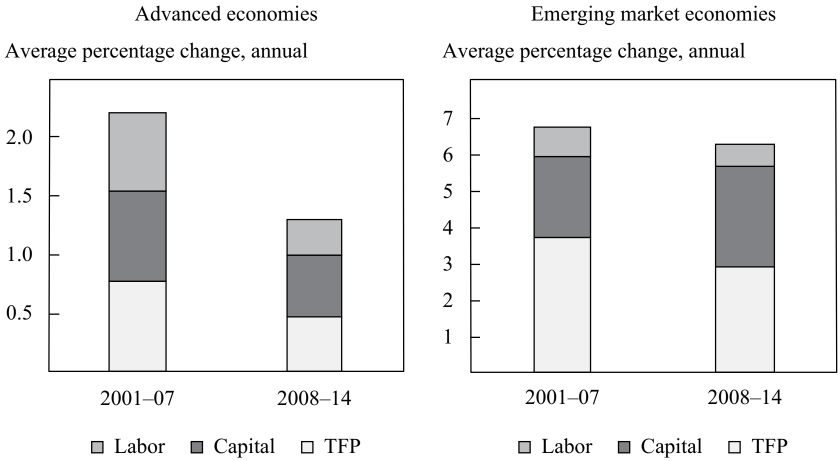
The Recent Low Growth Challenge

Since the global financial crisis, the pace of economic growth and its longer-term drivers drove the IMF managing director to warn the G20 of a low growth trap. In advanced economies, overall GDP growth from 2008 to 2017 fell to 1.2 percent a year, a full percentage point below its longer-term average since 1990 and less than half of the pre-crisis average of 2.7 percent. On a per capita basis, growth fell below its longer-term average by half, down to 0.7 percent a year in 2008–17 compared to 1.5 percent since 1990. In emerging and developing economies, overall growth has remained around the longer-term average of 5 percent since the crisis, though it has been steadily decelerating in recent years down to nearly 4 percent. On a per capita basis, growth in emerging and developing countries has fallen to 3.5 percent in 2008–17 compared to 3.8 percent since 1990.

At the core of today's low growth challenge is the widespread slowdown in labor productivity growth. "Labor productivity" (a term used interchangeably with "productivity") can be measured in terms of either output per person employed or output per hour worked. It depends on two key ingredients. One is how much capital is available per worker, like machinery for welding, computers for programming, or office space to work in. The other is how efficiently all the inputs are used together, which is what economists call total factor productivity (TFP). TFP is where the less observable but often most important characteristics of economic growth come in. It captures the knowledge, innovation, and technological progress embodied in the production of goods and services. Labor and capital are the inputs, but the ingenuity and know-how in combining labor and capital to create a final product is often what matters most, especially when new information, knowledge, and technologies are used to make workers more efficient.

These three components of productivity—labor, capital, and TFP—can be taken together to come up with an estimate of how much an economy is

FIGURE 2-2 The Evolution of Potential Output Growth and Its Components



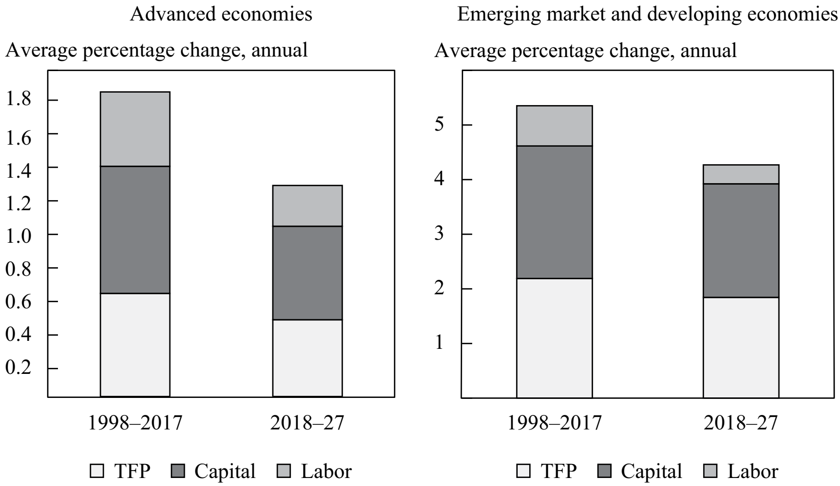
Source: IMF World Economic Outlook (2015) April.

capable of producing at a sustained rate, what economists call potential output. In other words, potential output can be estimated by knowing the amount of production inputs in an economy and how efficiently they work together. Over the last few decades, potential output growth in both advanced and emerging economies has been slowing down (figure 2-2). In other words, not only has actual GDP growth slowed down, but its potential has, too, as shown by the ingredients of productivity.

The contributions of labor and TFP growth have declined across both advanced and emerging economies. On labor, shifting demographics are posing a significant challenge for growth. According to the UN's World Population Ageing report, older persons (over age sixty) are the fastest-growing age group in the world (United Nations 2015). The aging process is most advanced in developed countries. Though some developing countries, like India, currently have a large and growing workforce of younger people, the pace of population aging in the developing world is substantially faster than has occurred in developed countries in the past.[2]

On the contribution of capital, the notable decline in advanced economies is partly explained by the shock to investment from the global financial crisis. The slower accumulation of capital also hinders total factor productivity

FIGURE 2-3 Projections for Potential Output Growth and Its Components



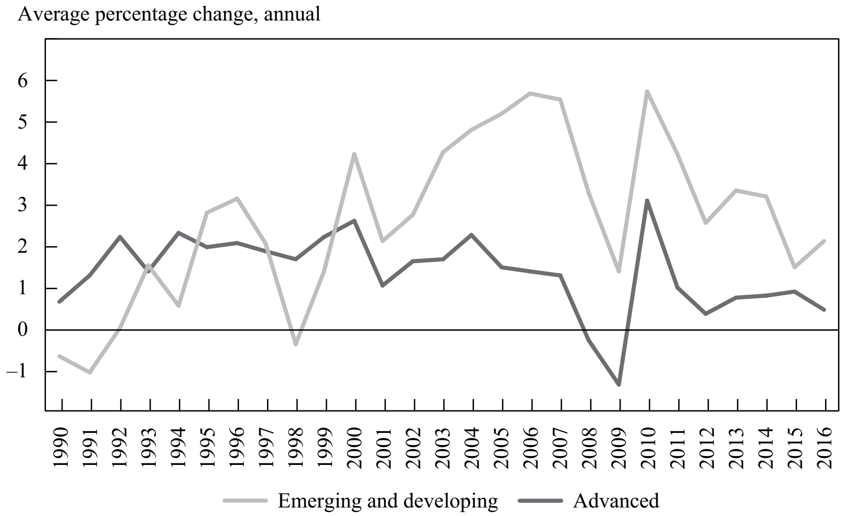
Source: World Bank (2018).

growth because efficiency gains and technological progress are often embodied in capital itself (more on that later). Emerging market economies had at first increased investment in response to the global financial crisis, but they, too, slowed down in later years.

Holding all else constant, the impact of slowing total factor productivity growth, lackluster investment growth, and aging populations will continue to place a drag on potential output growth and exacerbate the low growth challenge. Projections by the World Bank suggest a continued decline in potential growth in the decade ahead, led by a continued slowdown in labor, capital, and TFP (figure 2-3) (World Bank Global Economic Prospects, January 2018).

In an era of aging populations in most advanced economies and some large emerging economies, increasing investment in capital and raising TFP are necessary to boost potential output and labor productivity. One cannot escape the need to spark productivity growth if one is to have any chance of tackling the longer-term low growth challenge facing the global economy. The task is a tall one, however, because the slowdown in productivity growth has been under way for some time.

FIGURE 2-4 A Global Overview of Labor Productivity Growth, 1990–2016



Source: The Conference Board. Labor productivity in terms of output per person employed.

The Productivity Slump

Today, popular debate around the productivity slowdown often begins with the shock of the financial crisis in 2008. Part of the puzzle definitely includes the lackluster recovery since the crisis, which was, indeed, the turning point for emerging and developing economies. In advanced economies, however, the productivity slowdown began before the crisis (figure 2-4). Let us first observe what has been happening to productivity growth in the developed world—whose proximity to the technological frontier raises a different set of questions—before turning to emerging and developing economies.

Advanced Economies

Grouping the advanced economies into one group suggests that the most recent slowdown in productivity growth began in 2004. A closer look, however, reveals a more nuanced picture.

As described, though productivity growth in European countries and Japan began to slow down in the 1970s, it was still growing faster than in the United States until the mid-1990s. At that time, the spread of the Internet and the rise of information and communication technologies (ICT) in the United States launched a wave of productivity growth (Bergaud, Cette, and Lecat 2014; McKinsey Global Institute 2018). As the United States began to pull away in the mid-1990s, productivity growth in other advanced economies continued to slow. Only later did other advanced economies begin to adopt these technologies, but with less impact on productivity than in the United States (see chapter 4). In 2004, less than one decade later, the ICT-led wave of productivity growth in the United States had waned. The result is a "rise and fall" wave of productivity growth in the United States over the last three decades. Since then, the productivity slowdown has been widespread across most major advanced economies (figure 2-5).

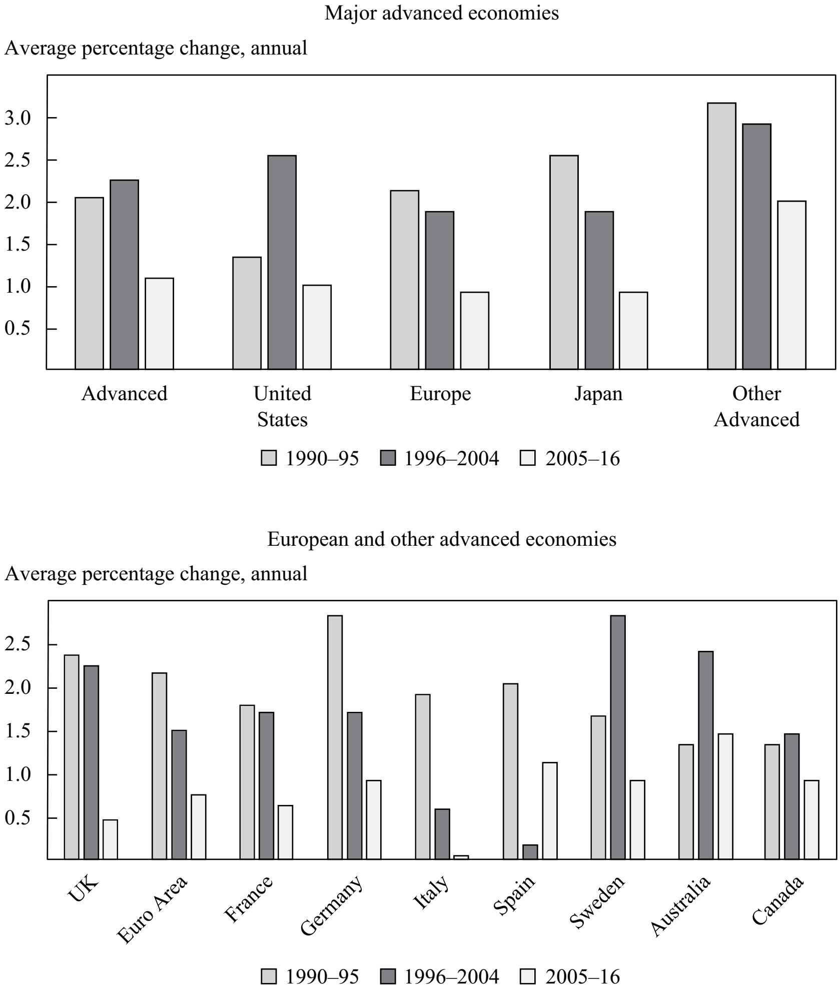
What is behind the widespread slowdown in productivity growth? Is it driven by declining efficiency or by less new capital for workers to work with? Breaking down labor productivity growth into its two key ingredients—growth in capital per worker and total factor productivity growth—reveals that a widespread slowdown of TFP growth has been behind much of the productivity slowdown (figure 2-6).

In the midst of rapid technological change, this has left many economists scratching their heads in confusion. TFP captures the technological progress, knowledge, and innovation in the production of goods and services. Though rapid TFP growth led the ICT-led wave of productivity growth in the United States, it also led the subsequent slowdown. In most other advanced economies, TFP has also played the dominant role in driving slower labor productivity growth.

A passionate debate has emerged around the paradox of rapid technological progress but slow productivity growth. Some argue that today's innovations are just not as impactful as those of the past, while others argue that we are on the cusp of a far-reaching technological revolution led by digital technologies and artificial intelligence. Dany Bahar and Karim Foda unpack this debate in chapter 4 with possible explanations for why this paradox exists.

The contribution of capital also has played a role in the widespread productivity slowdown. The shock to investment from the financial crisis drastically reduced the pace of the capital accumulation in the post-crisis years. The total capital stock in the United States grew half as fast after the crisis as it had in the decade before, falling from 3 percent a year in

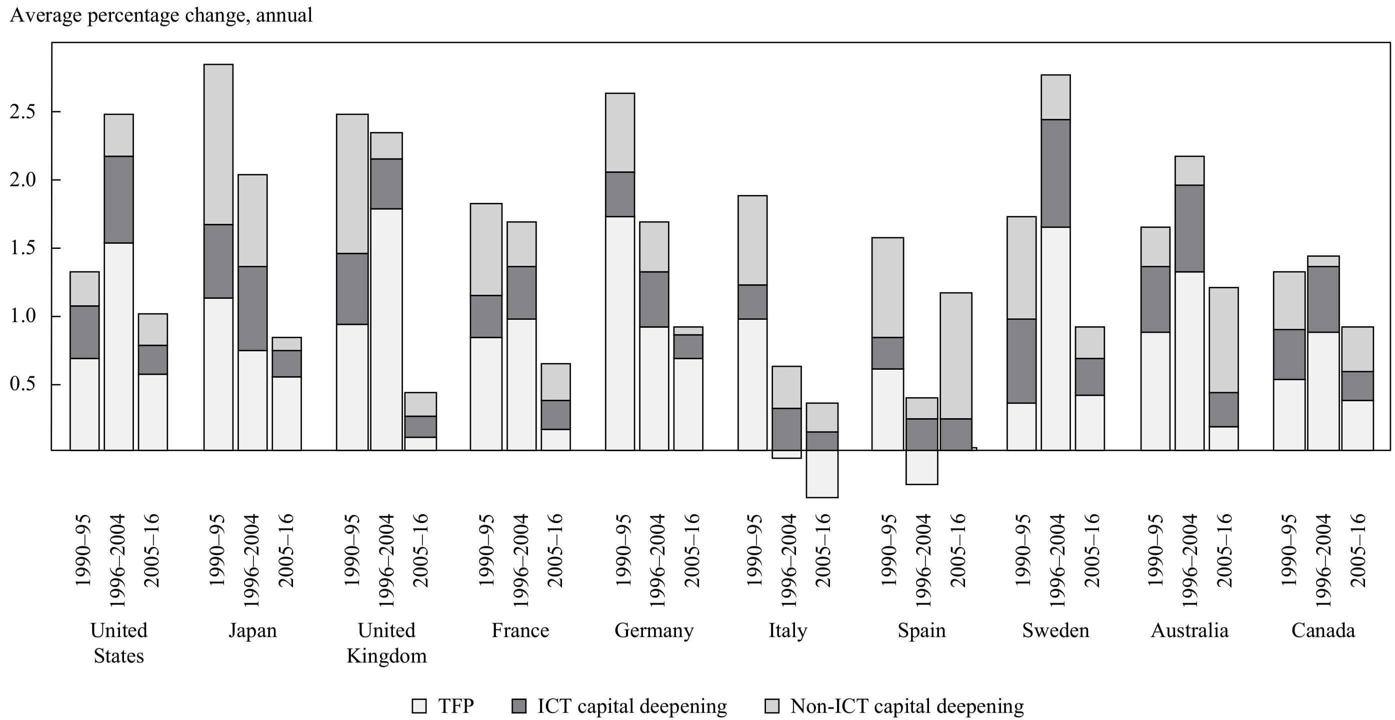
FIGURE 2-5 **Labor Productivity Growth in Advanced Economies**



Source: The Conference Board and author's calculations. Labor productivity is in terms of output per hour worked.

Note: Smaller advanced economies, such as Australia, Canada, and Sweden, also experienced a similar rise-and-fall pattern as the United States over this period, primarily due to successful structural reforms implemented in the early 1990s.

FIGURE 2-6 Contributions to Labor Productivity Growth in Advanced Economies, 1990–2016



Source: OECD.

Note: Capital deepening refers to growth in capital per worker. ICT refers to information and communication technologies.

1996–2007 to 1.5 percent a year in 2008–14. In the euro area, growth in capital stock fell from 2.3 percent a year to 1.3 percent a year, and in Japan it collapsed from 2 percent a year to 0.2 percent a year (OECD 2015). The direct impact on labor productivity growth is clear through a lower contribution from capital deepening. Less clear is the indirect impact of slower capital accumulation on TFP growth, since technological advances can be embodied in capital itself.[3]

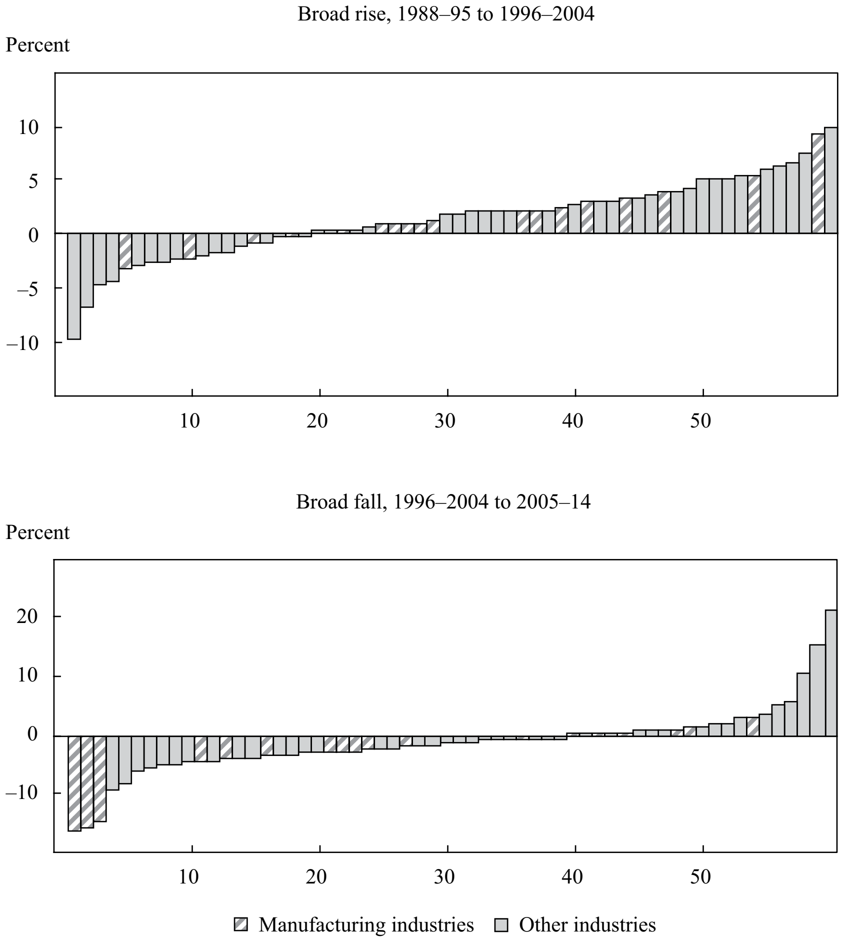
A Broad-Based Slowdown

The productivity slowdown is not only widespread across countries; it is also broad-based across industries. In the United States, although the slowdown was strongest among ICT-related sectors (Fernald 2014), TFP growth slowed down in nearly two-thirds of all industries, ranging from apparel and chemical products to transport and waste management. On the flip side, when productivity growth sped up in the mid-1990s, the same share of industries sped up too (figure 2-7). The ICT-led wave of productivity growth carried most boats with it; most of the industries that sped up in 1996–2004 were the same ones that slowed down afterward (Baily and Montalbano 2016). Only the information and finance, insurance, and real estate sectors defied the slowdown by speeding up in both periods. In other advanced economies, the productivity slowdown has also been broad-based across a variety of service and manufacturing industries (figure 2-8).

But not all industries are equal in terms of their impact on national productivity growth. Changes in larger industries have a larger impact than smaller ones. Manufacturing is of particular interest, since it has a large influence over growth for the whole economy and is a core source of technological progress, accounting for the majority of recorded research and development performed by private business (70 percent in the United States). In the United States, the manufacturing sector contributed 40 percent of the rise in TFP growth in 1996–2004 and over half of the slowdown after 2004. The services sector contributed slightly more than manufacturing to the acceleration in TFP but was a relatively minor part of the slowdown (figure 2-9).[4]

This challenges a common view that the productivity slowdown is a result of growth in the size of the less efficient services sector while the more

FIGURE 2-7 Broad-Based Rise and Fall in the United States: Change in Average Industry TFP Growth

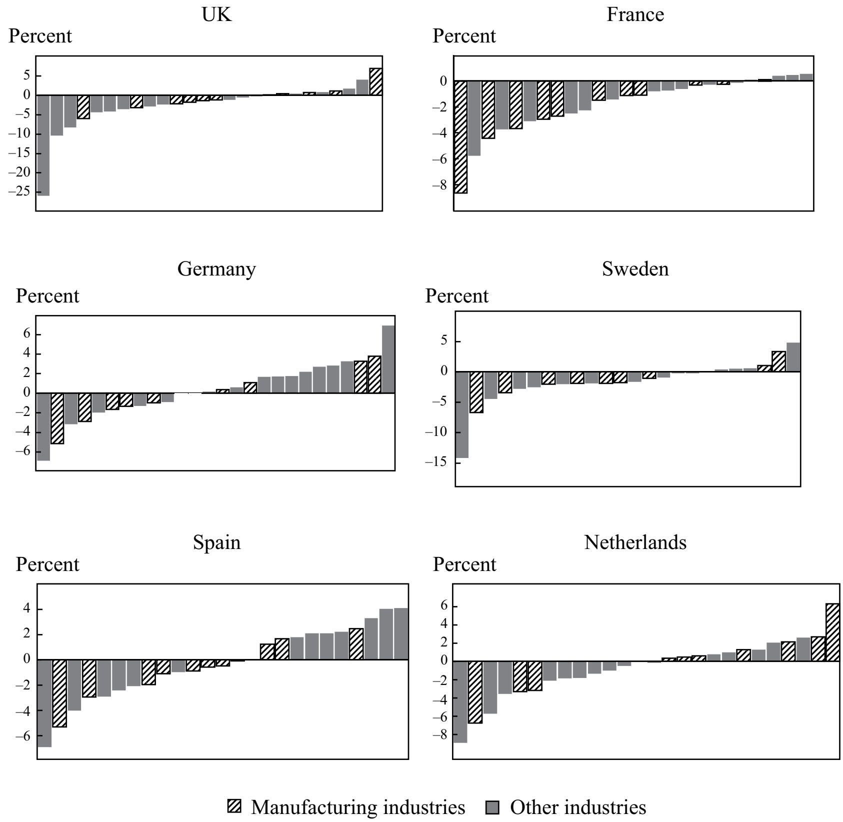


Source: BLS and author's calculations. Based on David Byrne, John Fernald, and Marshall Reinsdorf (2016).

Note: Value-added TFP growth. Horizontal axis ranks industries using 3 digit NAICS.

productive manufacturing sector is shrinking as a share of total output. Byrne, Fernald, and Reinsdorf (2016) did an experiment where they held the size of each industry in the United States constant at 1987 levels to see what aggregate productivity growth would look like if no industry changed in size. The result looked nearly the same as actual productivity growth,

FIGURE 2-8 Broad-Based Fall in Other Advanced Economies: Change in Average Industry TFP Growth, 1996–2004 to 2005–14



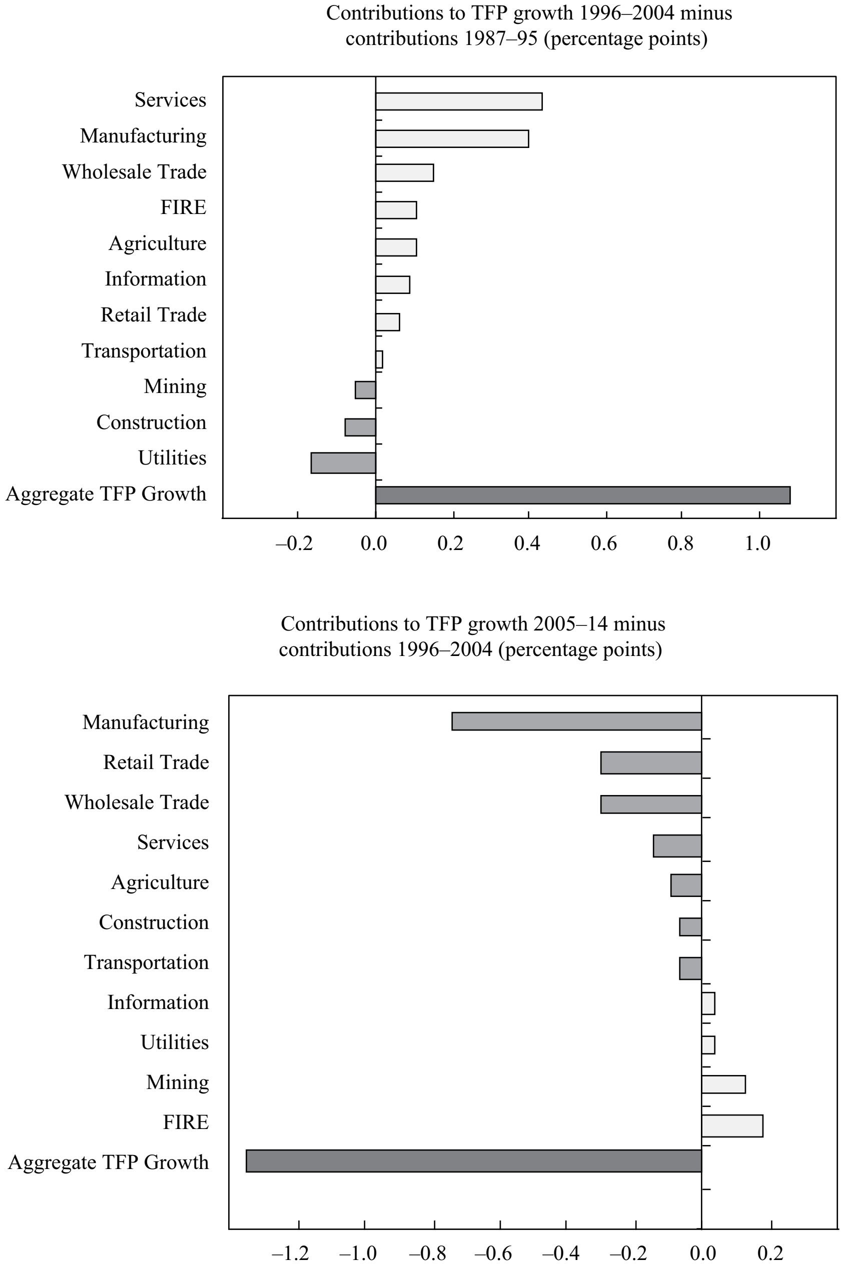
Source: EU KLEMS and author's calculations.

Note: Industry groupings differ from U.S. industry groups in figure 2-7. Horiztonal axis ranks industries. U.K. data begins in 1999; Germany and Netherlands data begin in 2001; Sweden data ends in 2013.

suggesting that shifts in the industry composition of the economy are not a central part of the slowdown story.

By now it is clear that there has been a widespread slowdown in productivity growth under way in advanced economies that predates the global financial crisis in 2008. By historical standards, a brief wave of productivity growth led by rising information and communication technologies occurred in the United States between the mid-1990s and the mid-2000s, but

FIGURE 2-9 **Contributions to the Rise and Fall in U.S. TFP Growth**



Source: BLS and author's calculations. Based on Baily and Montalbano (2016).

its impact on productivity has since waned. Other major advanced economies also benefited from these technologies, but the impact on productivity growth was not as strong as in the United States. Beyond ICT-related sectors, the widespread slowdown of productivity growth across countries has also been observed across industries, revealing the broad-based nature of the slowdown. These facts all come together to show that the productivity slowdown is widespread and broad-based, but a critical questions remains: Is it real?

Estimating the Gains

A crucial question has emerged around the productivity slowdown: Is it real or are the statistics misleading us? The idea that official statistics are not properly measuring recent productivity gains, especially those from new and higher-quality ICT goods and services, is one that has merited a considerable amount of attention.[5] There are two leading sources of mismeasurement that are different from other measurement challenges related to non-market services (see Box 2-1). One is that price indices used by national statistics agencies often fail to capture improvements in quality and, therefore, end up underestimating real output. The other is that an increasing amount of consumer activity is taking place outside the market economy, where free digital services like Wikipedia and Facebook may generate significant consumer surplus and welfare but are outside the scope of production and output measures like GDP. A growing body of research confirms that productivity growth is underestimated, yet not by enough to explain the slowdown in productivity growth. In other words, the slowdown is real despite challenges in measurement.

One of the most difficult yet also most important issues is how to measure quality change to more accurately distinguish between changes in nominal and real measures of output. When new or better products are recorded in the national accounts, the price indices used by national statistics agencies to deflate the nominal value of these products tend to be the same price indices used for older or lower-quality products. The result is an underestimated measure of real output, thereby underestimating productivity as well. Economists Byrne, Fernald, and Reinsdorf, in a 2016 Brookings paper, took on this issue and came up with a surprising result. They estimated that the failure of prices to reflect quality changes in ICT

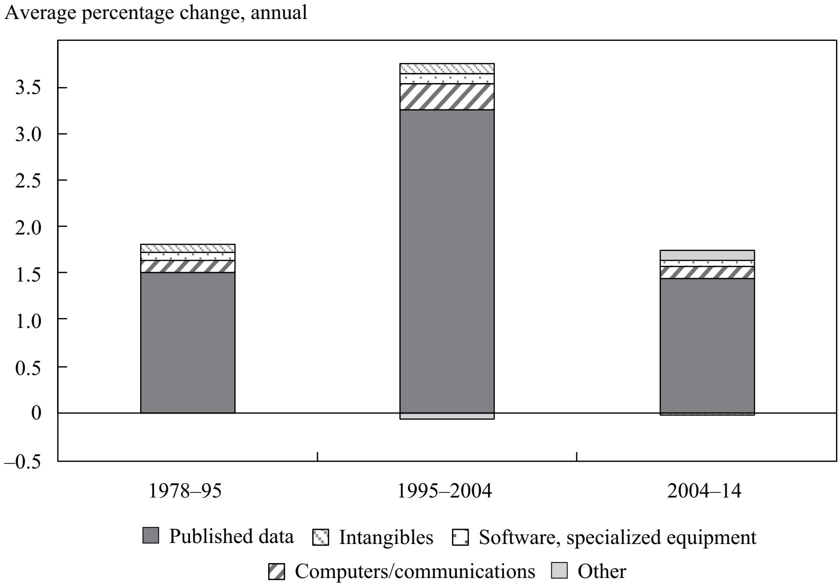
BOX 2-1 Measuring Non-Market Services

Most recent research has focused on measurement issues in the ICT industries themselves, but it is possible that unmeasured productivity gains from digital technologies and related innovations are also happening outside these industries, including in non-market service sectors such as public education and health, where it is already difficult to measure productivity. For example, how does one define the productivity of a public school? With inputs from teachers, staff, and supplies, a school tries to produce graduates with a certain level of knowledge and core skills. But these outputs are not products that are sold in a marketplace, so how is their value measured?

For public services like education and health care, which in some countries accounts for over a fifth of the economy, output is officially measured by total expenditures. Right now, the more you spend on a school, the more "output" is recorded. If a school invests in a wide array of new technologies to help boost learning, the bump in productivity comes from the new spending without really knowing if students learned any better. A similar problem is true in health care, where health services try to produce healthier patients, but the yardstick used for productivity is on spending rather than patient outcomes.[6]

The potential for vast improvements in education and health-care delivery are large as new digital technologies improve the quality and efficiency of care and learning. On one hand, efficiencies in these sectors can free up significant resources that can be invested elsewhere. On the other hand, a healthy population and an education system that develops the right skills, aided and facilitated by new technologies and innovations, are essential for both faster productivity growth and shared prosperity.

FIGURE 2-10 **Adjustments to U.S. Labor Productivity Growth**



Source: Byrne, Fernald, and Reinsdorf (2016).

Note: Average annual business sector growth in output per hour. "Other" comprises Internet, free digital services, globalization, and fracking.

equipment in the United States during the surge period 1996–2004 is actually larger than in 2005–14, when productivity slowed (figure 2-10). The result is an even larger slowdown. Part of this is because domestic production was higher in 1996–2004 than afterward, when imports grew.[7] In the end, mismeasurement was, indeed, a problem, yet not one that can explain the slowdown in productivity growth since 2004.

More recently, a 2017 paper by Philippe Aghion, Peter Klenow, and others set out to account for mismeasurement from creative destruction—the exit of old firms as new ones displace them with better products. They corrected for statistical agencies' use of prices from older surviving products to impute inflation from disappearing products, finding that underestimated output growth accounts for about one-third of true productivity growth. This is a notable amount, but still not large enough to dismiss the slowdown as an illusion.

On the other hand, the proliferation of free digital services, like Snapchat and sites like YouTube that host user-generated content, create tremendous value for consumers, but their use does not involve any monetary cost, so they are left out of official statistics.[8] To get a sense of how this would hypothetically affect GDP, economists have tried to measure increases in consumer surplus to capture how much people would be willing to pay if they had to buy these services. But even the largest estimate of consumer surplus in the United States accounts for less than one-third of the missing output resulting from the post-2004 productivity slowdown.[9] Certainly not enough to suggest the slowdown is due to a shift in activity beyond the scope of GDP.

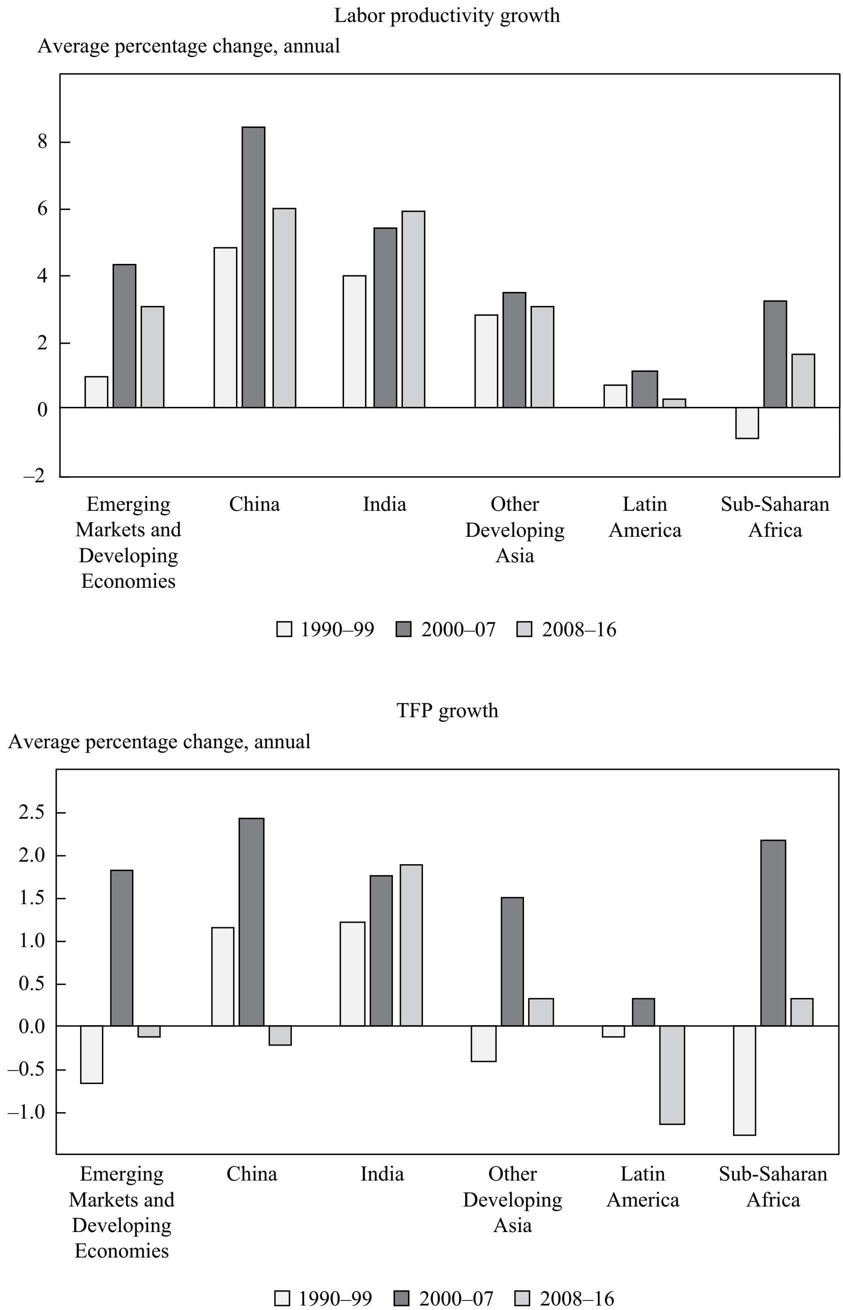
Emerging and Developing Economies

Like advanced economies, slowing productivity growth has also been under way in many emerging and developing economies, making the widespread productivity slowdown a global phenomenon. Unlike in the advanced economies, however, the widespread slowdown of productivity growth in the developing world was triggered by the global financial crisis in 2008. In the post-crisis years, labor productivity growth did not return to the same high pre-crisis growth rates but remained higher than it had been in the 1990s. With the exception of India, this pattern was common across the major emerging and developing economies (figure 2-11).

This common experience is an uncommon one by historical standards in this large and diverse group of economies. University of California, Berkeley economist Barry Eichengreen and others at the Asian Development Bank and Korea University found that periods of relatively slow productivity growth vary based on a country's level of income and other national characteristics, which are more diverse in developing countries than in developed ones. Global factors, like shocks to commodity prices, correlated more strongly with productivity slowdowns in advanced economies than in emerging and developing economies (Eichengreen, Park, and Shin 2015).

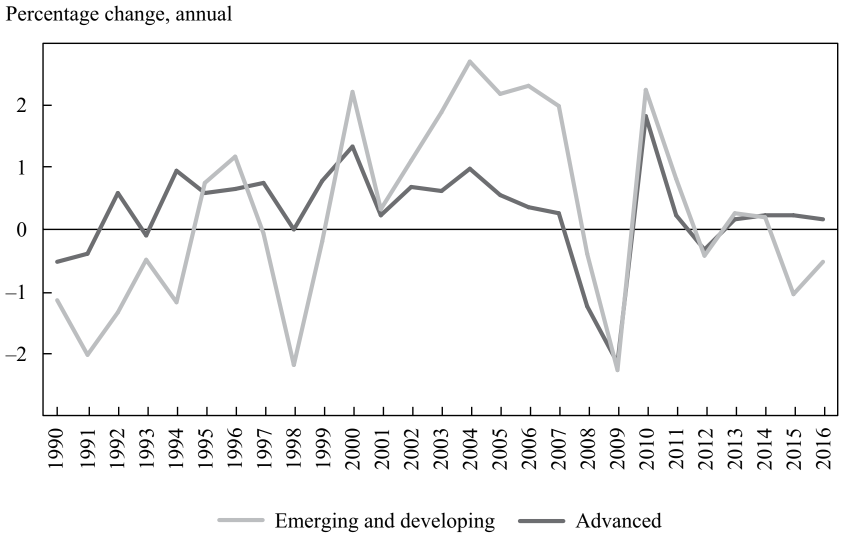
Less intuitively, TFP growth also decelerated across much of the developing world (figure 2-12). For the most part, developing countries are behind the technological frontier and are less reliant on innovation to drive growth. Diffusion of technological progress from the frontier, the strength and quality of institutions, ease of doing business, education and skill levels, and property rights, for example, can go a long way in boosting productivity

FIGURE 2-11 Productivity Growth in Emerging and Developing Economies, 1990–2016



Source: The Conference Board. Labor productivity is in terms of output per person employed.

FIGURE 2-12 **A Global Overview of Total Factor Productivity Growth, 1990–2016**

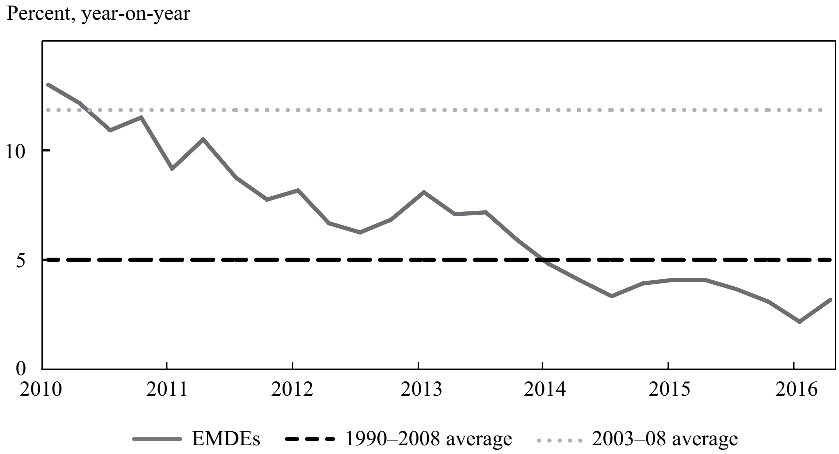


Source: The Conference Board.

and economic growth. The pronounced slowdown in TFP growth is, therefore, a different kind of puzzle than in the advanced economies where innovation is more necessary for growth. Among emerging and developing economies, high investment rates and growth in capital per worker propped up labor productivity growth after the crisis, but the pace of investment has been gradually declining since 2010 (figure 2-13). Slower investment growth reduces the rate of capital accumulation and could also limit the potential for capital-embodied technological change. Technology that is embodied in capital is a key channel of technology transfer from developed to developing countries through trade or foreign direct investment.

Emerging and developing economies have made impressive gains in narrowing the gap with advanced economies, raising standards of living for millions of people around the world. Through catch-up growth and the adoption of existing technologies and best practices across public and private sectors, there is ample room for developing countries to improve productivity and more efficiently allocate existing resources to where they can be most productive. On the other hand, developed countries also can make

FIGURE 2-13 Investment Growth in Emerging and Developing Economies, 2010–16



Source: World Bank Global Economic Prospects (2017) January.

Note: Weighted average of twenty-eight emerging and developing economies with available quarterly data. The last observation is 2016Q2.

similar efficiency gains within their own economies and support innovation and investment.

Over the last thirty years, productivity growth around the world has seen some improvements, particularly in the United States and in major emerging and developing economies, like China, that have not been able to be sustained. The waning of the ICT-led wave of productivity growth in the United States and the shock of the financial crisis in developing economies ushered in a period of slowing productivity growth around the world. This challenge of slowing productivity growth is not unique to a particular country or a particular type of country that is at or behind the technological frontier; it is widespread around the world. Evidence in advanced economies shows the slowdown is not unique to any particular industry, either, but is broad-based. Though mismeasurement challenges are real and can explain part of the observed slowdown in some countries, they are not large enough to explain the overall trend of a widespread, broad-based, and real productivity slowdown. This is a trend that is related to, as we will now observe, high levels of income inequality in many countries around the world.

Income Inequality

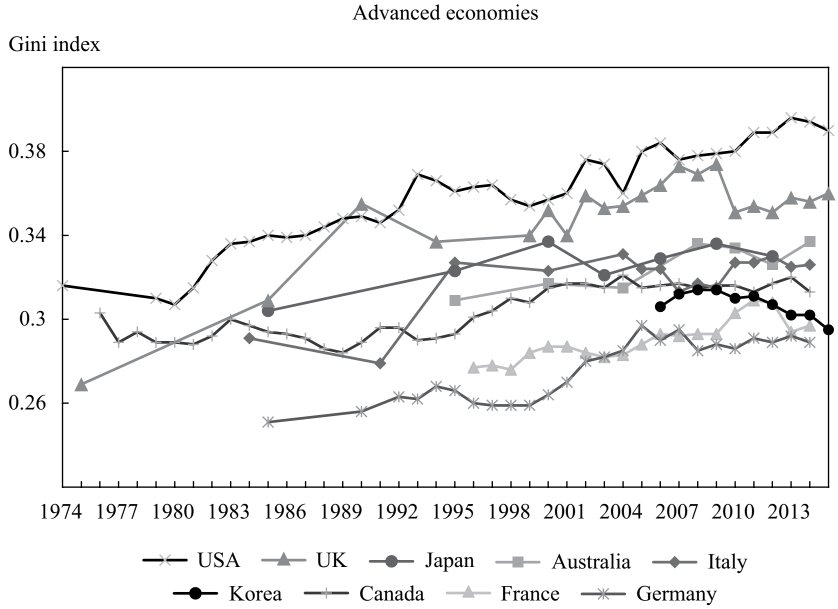
The low growth trap that the IMF managing director warned the G20 about in Hangzhou, China, in 2016 was also related to another defining trend that has shaped the world economy over the last three decades: high and rising income inequality within countries. In some advanced economies, inequality has risen to levels last seen nearly a century ago. High income inequality in a low growth environment can be particularly problematic because it can entrench wide disparities and limit the ability for people to move up, or down, the income ladder—what economists call economic mobility—which has, indeed, been the case in many countries. This begs the question as to whether high income inequality is a cause or a symptom of low growth. While this question is the subject of a growing body of economic literature too large to cover here, it is important to recognize that the trap of low growth and high inequality reinforce each other. The IMF itself, which has historically stayed away from income distribution issues, due in some extent to its social and political nature, has found in its more recent research that high inequality can be an impediment to growth (Ostry, Berg, and Tsangarides 2014). Chapter 5 explores the links between slowing productivity growth, high income inequality, and rapid technological change.

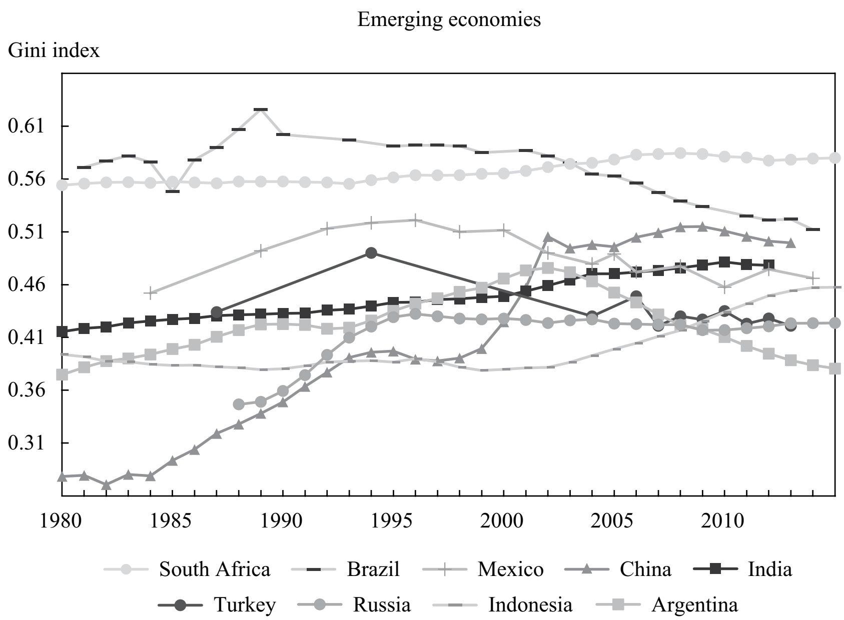
Here, we explore what has been happening to income inequality in both advanced and emerging and developing economies over the same period used to observe the slowdown in productivity growth. We also take a step back to look at inequality at the global level, as if the whole world were one country. Over the last three decades, the increased weight of developing countries in the global economy has helped narrow the gap with developed countries despite the fact that the gap between the rich and poor within many developing countries has risen.

Higher National Inequality

Though the overall trend is that many countries around the world have become more unequal in the last thirty years, not all countries have had the same experience. Two observations stand out when looking at the Gini coefficients for major advanced and emerging and developing economies over the last three decades (figure 2-14).[10] The first is that income inequality

FIGURE 2-14 Income Inequality in Advanced and Emerging Economies: Gini Coefficients





Source: OECD Income Distribution Database for all advanced economies; UNU-WIDER World Income Inequality Database for Latin American countries and Turkey; Standardized World Income Inequality Database (Solt 2016) for all other emerging economies.

Note: All Gini data are for disposable incomes.

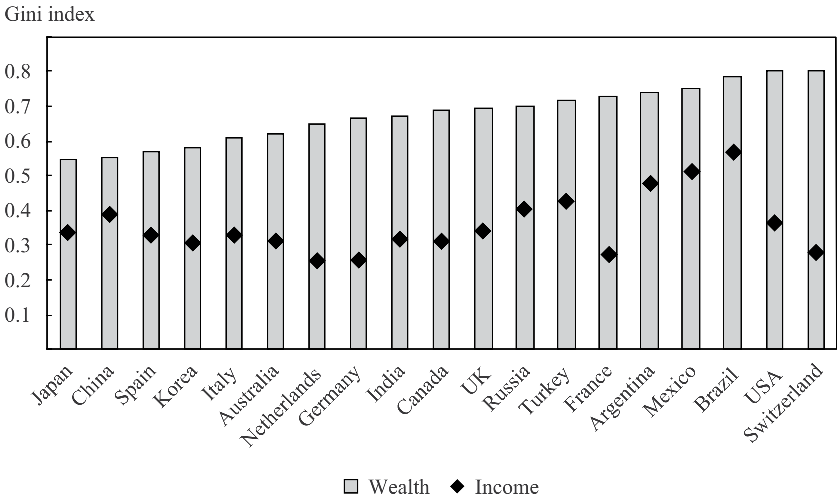
varies across countries and is generally higher in emerging and developing economies. Among advanced economies, the United States stands out with the highest level of overall income inequality, followed by the United Kingdom and the English-speaking world. All the major emerging economies shown in figure 2-14 have higher income inequalities than all the major advanced economies, including the United States. This remains the case even as many emerging economies have seen declines in income inequality in recent years.

This leads to the second observation. Income inequality has grown in varying degrees for different countries over the last three decades. In the United States, inequality grew rapidly during the early 1980s and has continued to grow. Inequality in the United Kingdom widened dramatically in the 1980s but has changed little since 1990. In France and Germany, inequality rose briefly and modestly. Among emerging and developing economies, inequality also grew but has declined in recent years. Between 1993 and 2008, inequality rose in more than half of the countries in East Asia and the Pacific, in three-quarters of countries in South Asia, and in half of sub-Saharan Africa. After 2008, inequality in major emerging economies held roughly steady. Latin America is the only region where the majority of countries reduced inequality since the 1990s (World Bank 2016).

Though our focus is on income inequality, it is worthwhile to note that inequality in wealth is significantly higher (figure 2-15). Wealth includes the value of a household's assets, like real estate, stocks and bonds, land, and even precious jewelry or art. Though all households can accumulate wealth, the wealthiest in most societies tend to be those with higher incomes who have more to invest in assets, or those who inherit wealth passed down from earlier generations. Chapter 5 explores the implications this has for inequality of opportunity and economic mobility, which measures the ease with which anyone can move up or down the income ladder.

Where are the disparities coming from? To answer this question, we need to look at the different parts of the income distribution. What we find is that in advanced economies, the rich are pulling away, the middle is hollowing out, and the bottom is stagnating. Incomes for the top 10 percent increased by about 40 percent on aggregate in the last twenty years while barely growing at all at the bottom (Lagarde 2016). In emerging and

FIGURE 2-15 Wealth Inequality in Advanced and Emerging Economies, Early 2000s



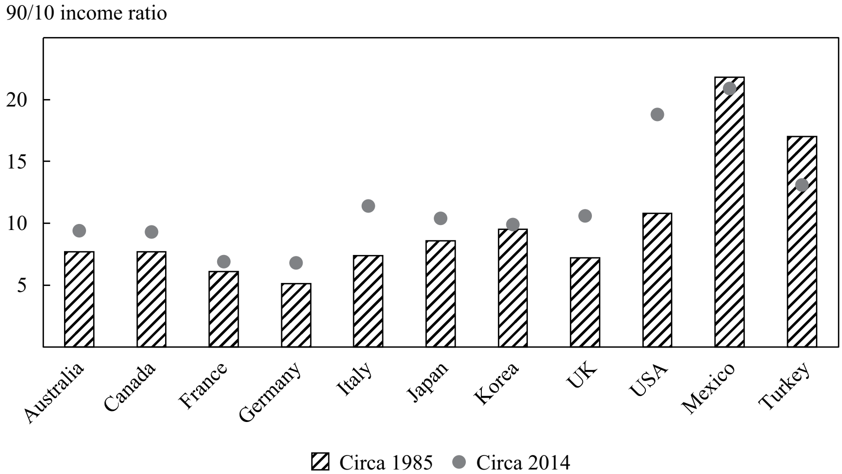
Source: IMF (2014). Income Gini is based on disposable household income.

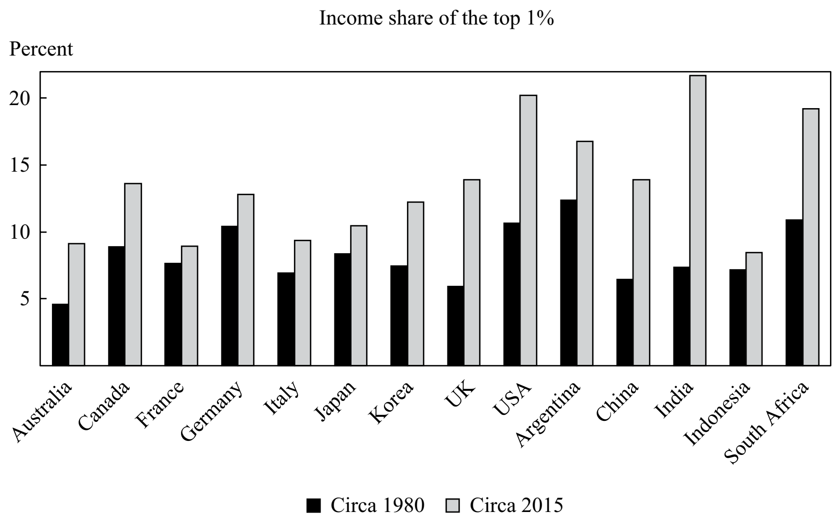
developing economies, income has also concentrated at the top, but rising average incomes have quite strongly offset the impact on the poor.

Figure 2-16 shows two measures of income concentration. The first is the 90/10 ratio, which compares incomes of the richest 10 percent (the 90th percentile) to the bottom 10 percent (the 10th percentile). Since the mid-1980s, this ratio has risen for most advanced economies, especially in the United States, but has slightly declined in some major emerging markets. Looking at the top end alone, however, the concentration of income by the richest 1 percent over the last three or more decades has been widespread. The most striking rise occurred in the United States, where the share of the top 1 percent more than doubled from 8 percent in the early 1980s to almost 20 percent in 2012, a level last seen before the Great Depression. Even more striking is the rise in the amount going to the top 0.1 percent, quadrupling from 2.5 percent to 10.4 percent in the same period in the United States (all before taxes).

Those at the other end of the income distribution had a very different experience. Thomas Piketty, Emmannuel Saez, and Gabriel Zucman compare

FIGURE 2-16 **Income Concentration at the Top**

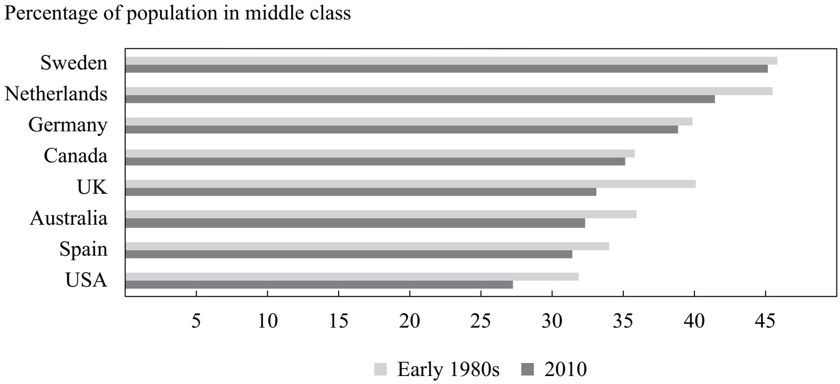




Source: OECD Income Distribution Database and World Inequality Database.

the income gains of the bottom 50 percent of adults in the United States to those at the top. What they found was "a tale of two countries" (Piketty, Saez, Zucman 2016a and 2016b). From 1980 to 2014, the average income per adult in the bottom 50 percent did not grow at all, even as income surged at the top. A study by the McKinsey Global Institute finds that between

FIGURE 2-17 Shrinking Middle Class in Advanced Economies



Source: Milanovic (2016).

2005 and 2014, 65 to 70 percent of all households in France, Italy, Netherlands, Sweden, the United Kingdom, and the United States, or 400 million people, experienced flat or falling market incomes (McKinsey Global Institute 2016).

Meanwhile, the strength and size of the middle class eroded. According to Branko Milanovic, a leading expert on income inequality, the middle class has shrunk in nearly all advanced economies, though in varying degrees. See figure 2-17 for a sample of the major Western economies. The middle-class squeeze has been the most dramatic in the United States, shrinking from about one-third of the population in 1979 down to 27 percent in 2010. As it became smaller, the economic strength of the middle class also eroded. The share of total national income going to the middle class declined by 5 percentage points in the United States, 4 percentage points in Sweden, Australia, and Netherlands, 3 in Spain, and 1 in Germany (Milanovic 2016).

The move away from the middle class has left many countries' income distribution polarized between top and bottom, threatening to divide society between haves and have-nots. Income polarization is the move away from the middle of the income distribution out into either the higher or lower income groups. According to a recent IMF study, about half of the households that exited the middle class in the United States between 1970 and 2014 moved down into lower income groups, while the other half moved up. Before 2000, most of the movement was upward. After 2000, however, nearly all the movement has been downward. Despite more people in the bottom ranks, the share of total national income going to lower income groups did not budge, while the share at the top skyrocketed (Alichi and others 2016).[11]

Beyond the growing income gap between rich and poor, broader disparities that give rise to hopelessness and social unrest are also growing. Research by Carol Graham uses traditional measures of income inequality as a point of departure to estimate inequality of well-being, which includes life satisfaction, mortality, and other dimensions of human welfare. In the United States, where the gap between rich and poor has grown the most among advanced economies, Graham finds that the costs of being poor or downwardly mobile are more evident in stress, insecurity, and hopelessness than in material deprivation (Graham 2017a and 2017b). With disappearing employment opportunities and stagnant wages for many low-skilled workers, optimism in their futures is fading, as they lack the capacity to plan for or invest in their futures.

There is a racial dimension as well that has contributed to further unrest. Princeton professors Anne Case and Angus Deaton find rising mortality rates since the 1990s among less educated white non-Hispanic Americans despite falling mortality rates among all education classes in most of the rich world. Case and Deaton document a rise in the number of "deaths of despair"—deaths by drugs, alcohol, and suicide—that is accompanied by a deterioration in economic and social well-being. As the blue-collar economic heyday of the early 1970s ended, social dysfunction among working-class whites grew and has become more pronounced with each successive age cohort (Case and Deaton 2015 and 2017).[12]

Lower Global Inequality

In stark contrast to the hollowing out of the middle in advanced economies, middle classes in emerging and developing economies have thrived. Predominantly in China and emerging Asia, millions of people have joined the ranks of the middle class as emerging and developing economies grow faster than advanced economies. The result has been the emergence of a global middle class as average incomes grew and over a billion people escaped extreme poverty.

In 2013, Branko Milanovic and Christoph Lakner of the World Bank first published the "elephant chart"[13] that shows how fast (or slowly) incomes grew for each part of the world, showing an income distribution between 1988 and 2008. The clever "elephant" label comes from the S-shape of the chart, a result of high growth rates in the middle part of the distribution (the global middle class), the dip to very low growth in the upper part of the distribution (where the lower middle classes in the advanced economies are), and the spike at the very top among the world's richest. Paul Krugman referred to the elephant chart as "recent history in one chart" for how clearly it reveals the dramatic changes to the structure of the global economy (Krugman 2015). More recently, researchers at the World Income Database extended the elephant chart back to 1980 and forward to 2016 (figure 2-18).

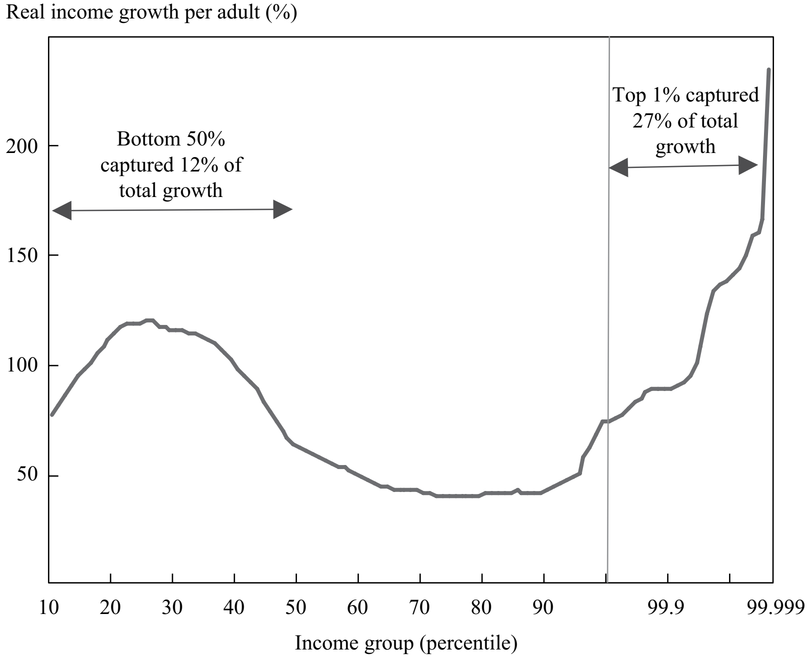
In nine of ten cases, the global middle class comprises the middle classes in the fastest-growing emerging Asian economies; predominantly China but also India, Thailand, Vietnam, and Indonesia. According to Milanovic, in just the twenty years from 1988 to 2008, average middle-class incomes tripled in China's cities and more than doubled in its rural areas (Milanovic 2016). Between 2008 and 2011, when China alone drove nearly half of global GDP growth, average urban incomes in China doubled and rural incomes increased by 80 percent. Such rapid gains in average incomes for a large number of people in the world's most populous country has reinforced the "global middle," which also includes many in India and other countries. Development expert Homi Kharas, at the Brookings Institution, finds that the rate of increase of the global middle class is still growing. By the end of 2016, there were about 3.2 billion people in the middle class, with around 140 million joining every year, potentially rising to 170 million a year by 2022.

Alongside rising middle classes in the developing world, a historic reduction in extreme poverty has also contributed to rising average incomes. Between 1990 and 2013, an astonishing 1.1 billion people escaped extreme poverty (under $1.90 a day), of which 850 million were from China, East Asia, and the Pacific. In just a little over three decades, the share of the world's population living in extreme poverty fell from 37 percent (1.8 billion people) to 10.7 percent (797 million people).[14]

For the first time since the industrial revolution, global inequality began to decline. Global inequality is the sum of inequality within and between

FIGURE 2-18 Global Income Growth and Inequality, 1980–2016

The Elephant Curve: Cumulative real income growth per adult by global income level, 1980–2016

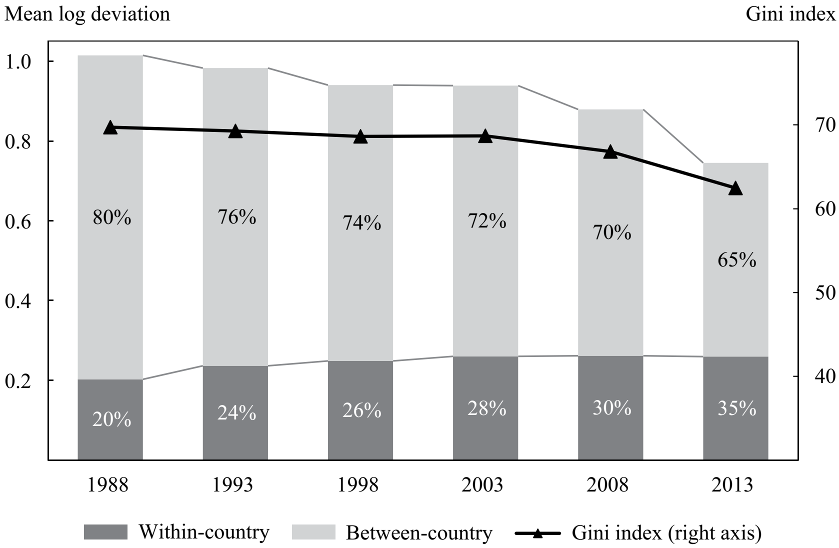


Total cumulative real income growth per adult (%), 1980–2016

Income Group	**China**	**India**	**Europe**	**US-Canada**	**World**
Full population	831	223	40	63	60
Bottom 50%	417	107	26	5	94
Middle 40%	785	112	34	44	43
Top 10%	1316	469	58	123	70
Top 1%	1920	857	72	206	101

Source: World Inequality Report (2018).

FIGURE 2-19 **Global Inequality: Between and Within Countries, 1988–2013**



Source: World Bank (2016). Based on Lakner and Milanovic (2016) and Milanovic (2016).

countries. Though inequality has risen within many countries, it has fallen between countries. Since the industrial revolution, between-country inequality assumed the dominant role in increasing global inequality as the industrializing world left the rest behind. According to estimates by Francois Bourguignon and Christian Morrison, between-country inequality accounted for less than 20 percent of global inequality in 1870. By 1980, the same number had grown to 80 percent. Around that time, global inequality itself also approached its peak (Bourguignon and Morrison 2002). Figure 2-19 shows the decline in global inequality since the late 1980s, driven entirely by a decline in between-country inequality, thanks to the rapid growth in emerging and developing economies and, in the aftermath of the 2008 financial crisis, the low growth that engulfed the advanced economies.

Not all emerging and developing countries participated in narrowing the gap, however. Led by China and India, who together account for 37 percent of the world's population and 43 percent of the population in developing countries, the rapid growth of income per capita in Asia has been the main source of income convergence between developed and developing economies. Average incomes in Asia rose from 14 percent of the average incomes in developed economies in 1990 to 25 percent in 2014. Exclude Asia, however, and the gap between developed and developing countries barely budged. According to John Page of the Brookings Institution, average per capita income in Africa was about 12 percent of per capita income in developed countries in both 1990 and 2014, despite the "African Growth Miracle" of some individual African economies. Per capita incomes in Latin America and the Caribbean have remained around 36 percent of the developed countries. Brazil, the region's largest economy, improved its per capita income from 25 percent of the United States to just 28 percent fifteen years later (Page 2016).

However, slowing productivity growth is slowing down the overall convergence between developed and developing countries. Absent a revival of rapid productivity growth in emerging and developing economies, the outlook for sustained convergence is in doubt. Regardless, the declines in income inequality after 2008 within many emerging and developing economies and the continued decline in between-country inequality, however fast, will continue to put pressure on global inequality. One scenario that could change this would be a revival of productivity growth in the advanced economies. Such a scenario could further scale back the convergence of emerging and developing countries unless they also pick up pace. On the other hand, it could also lead to even wider inequality within the advanced economies. Gains from new technologies and innovations could further concentrate income at the top, squeeze the middle class, and leave the poor farther behind.

Slow Productivity Growth and High Income Inequality

The widespread slowdown in productivity growth and high income inequalities are two defining trends of our time. Together they can reinforce a low-growth trajectory for the world economy. With aging populations and slow investment growth across advanced and many emerging economies, productivity is increasingly important to sustain economic progress. Rapid technological progress suggests that productivity should be on a more rapid rise, but the data does not show that this is actually happening. On the contrary, growth has slowed. Bahar and Foda explore the paradox of rapid technological progress and slow productivity growth in chapter 4. Though innovation and technology has been the key to the forward march of economic progress, the experience of the industrial revolutions in the previous two to three centuries says that this process can take time. The process itself, however, is not always smooth and can result in entrenched disparities between rich and poor. Chapter 5 explores the links between inequality, productivity, and technological progress, while chapters 6 and 7 discuss policies that can address these challenges. The promise for progress is clear, but the reality on the ground suggests that this promise will not materialize by itself, unaided by policies to help translate technological change into stronger and broadly shared economic gains.

Notes

1. Early nineteenth-century British economist Thomas Malthus argued that technological advances can increase the supply of resources and food but would encourage population growth, bringing per capita standards of living back to original levels. This is known as the Malthusian Trap, which was broken by the productivity gains from the Industrial Revolution.

2. Of course, what counts for actual growth is the number of workers employed, which can also increase with longer work lives.

3. Consider a new computer with a faster processor that can generate more reports and memos than an older model in the same amount of time. Holding all else constant, this computer processor is more productive than its earlier version, thanks to the technological superiority embodied in the newer processor. This kind of technological advancement interacts with the other inputs of production to improve overall efficiency in, say, the professional services firm that presents such reports to its clients.

4. The outsized role services played in the high-growth years is because the sector went from negative to slightly positive productivity growth. Before 1995, the less efficient service sector subtracted 0.30 percentage points from overall TFP growth in the United States. It then contributed a modest 0.14 percentage points in 1996–2004, implying that its contribution to the increase was 0.44 percentage points (Baily and Montalbano 2016).

5. A number of research programs, conferences, and initiatives have emerged just to deal with productivity measurement issues, including an initiative by the Hutchins Center on Fiscal and Monetary Policy at the Brookings Institution that brings together measurement experts from academia and statistical agencies with representatives of the relevant sectors of the business communities.

6. In the case of education, researchers try to measure the output of the education sector as the value of its investment in human capital, or the level of

knowledge, skills, and competencies of students, which depend on lifetime earnings and wages of different students in different fields of studies. There is still a long way to go in ensuring the comparability of these estimates and the ability for national statistics agencies to adopt them (Jorgenson and Fraumeni 1992).

7. This seems true despite mismeasurement worsening for some types of ICT products, especially as the sector continues to shift from hardware to software (Byrne, Fernald, and Reinsdorf 2016).

8. In some cases, they can push official measures of output, like GDP, down. A switch to using a free online encyclopedia like Wikipedia instead of paying to use Britannica, or free calls from Skype instead of a traditional telephone service, or free classifieds like Craigslist instead of newspaper ads, can make billions of dollars disappear from companies' revenues and the GDP statistics (Erik Brynjolffson and Andrew McAfee 2014).

9. The method for the largest estimate is by Austan Goolsbee and Peter Klenow (2006), from Chad Syverson (2016).

10. This observation is based on household income after taxes and transfers (disposable income). Ginis based on market income are notably higher.

11. Alichi and others (2016) use a broader definition of middle class than Milanovic: within 50 percent of median income as opposed to 25 percent used by Milanovic. Both measures show a hollowing out of the middle, though the IMF study (Alichi and others 2016) recorded an 11 percentage point decline in the share of the population in the middle class in 1970–2014, compared to Milanovic's 5 percentage point estimate in 1980–2010.

12. Further work by Carol Graham (2017a) shows that although poor racial minorities may have similar or smaller incomes, they report higher levels of optimism for a better future.

13. Lakner and Milanovic (2016), first published in a 2013 World Bank working paper.

14. Around half of the world's poorest are now in sub-Saharan Africa (World Bank 2016).

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THREE

The Economy Is about Firms

Productivity Slowdown and Divergence

DANY BAHAR

It would be impossible to fully understand the global macroeconomic trends on productivity—in particular the marked slowdown across all sectors—without looking in detail at what has been happening at the firm level. After all, economic growth in a country is a reflection of the growth and, in turn, the productivity dynamics among its firms. In what follows, the analysis examines firm-level empirical evidence on productivity and links it to the overall productivity slowdown.

The productivity of a firm reflects how efficiently it can convert input into output. For example, imagine an experiment in which two football manufacturing plants are exactly the same in terms of their inputs: same workers, same equipment, and same amount of leather to be used for making the balls. They should be able to make the same number of balls, shouldn't they? In practice, their output might be quite different due to differences in productivity. If one of these plants is able to produce more footballs than the other one, then the former is more productive than the latter. This is what economists call Total Factor Productivity: what firms produce after taking into account the factors of production used as inputs

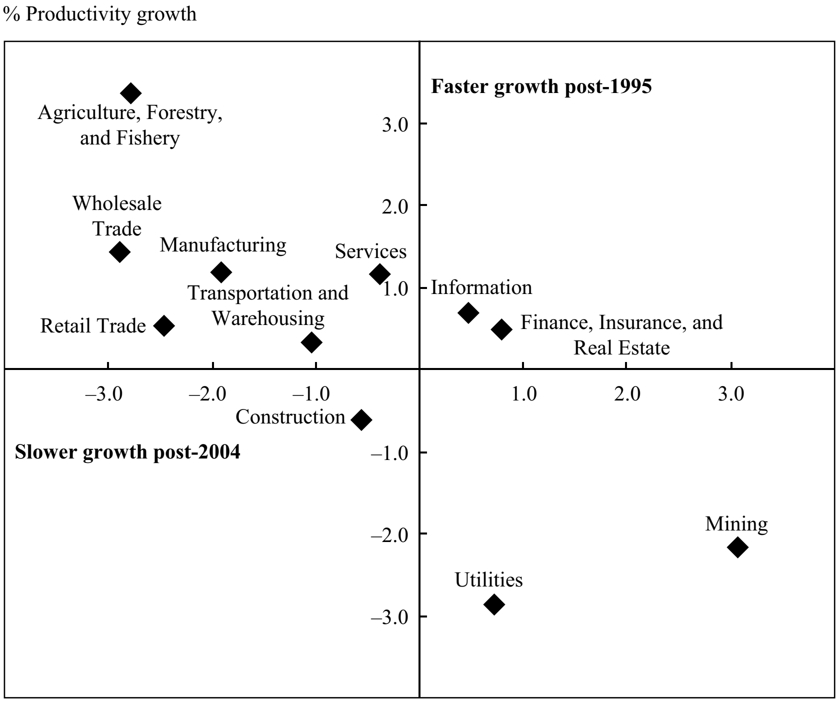
This analysis is based on research by Bahar (2018).

in the process, such as labor, machinery, and raw materials. Economists calculate the productivity of a firm by employing the "residual" method: TFP is the difference between the actual output of a firm and its expected output given its inputs. In other words, it is the portion of a firm's output that cannot be explained by its inputs. Moses Abramovitz wrote in 1956 that productivity is a "measure of our own ignorance."[1] In a more intuitive way, a firm is more productive when it adopts new technologies, often embedded in new machines or in experienced workers and managers, that allow the firm to do more with the same resources. As firms become more productive they can produce at lower cost, sell at lower prices, export to foreign markets, gain more market share, and grow in size and in sales.

The slowdown in productivity growth has been recognized by many researchers. In the United States the manufacturing sector experienced a considerable slowdown between 2005 and 2015 as compared to the previous decade. Average annual firm-level TFP growth fell from 2.2 percent in 1995–2004 to 0.4 percent in the following decade (Syverson 2016). Within the manufacturing sector, the hardest hit was taken by firms manufacturing computers and electronics, whose TFP annual growth rate dropped from 10.7 percent during 1995 to 2004 to 3.7 percent from 2005 to 2014. It is argued that the fast-paced productivity growth of firms in the computer and electronics sector during 1995 to 2004—and more broadly, all ICT-using and ICT-producing sectors—is behind the rise in aggregate productivity for the United States during that same period. Yet, Japan and non-English-speaking European countries seem not to have benefited to the same degree from the vast innovation coming out of this sector, as their overall productivity growth did not accelerate during that period and also suffered from a slowdown in the following decade. In fact, slowdowns in productivity are observed in the United States and in twenty-four of the twenty-nine countries in the OECD (Syverson 2016), tracing to before the global recession in 2008, which is also consistent with findings in other studies (see Cette, Fernald, and Mojon 2016).

The post-2005 slowdown, however, goes beyond the manufacturing sector. In the United States, it also happened in other sectors, such as retail and wholesale, as well as the service economy as a whole. A striking pattern seen in the data is that industries that experienced fast-paced productivity growth in the 1995–2004 decade typically slowed down considerably in the following decade, as indicated in figure 3-1 (Baily and Montalbano

FIGURE 3-1 **Changes in TFP Growth for Acceleration and Slowdown, Major Sectors**



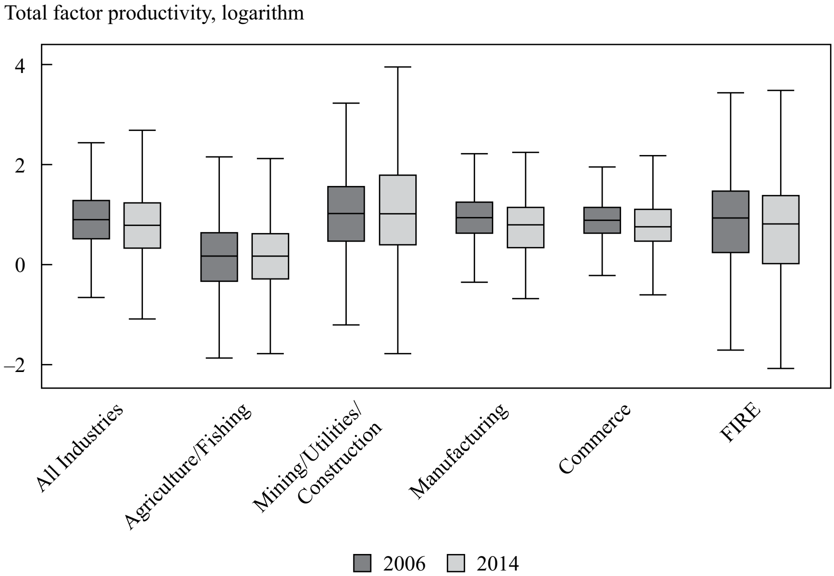
Source: Baily and Montalbano (2016).

2016). Besides firms in the construction, information, financial, insurance, and real estate (FIRE) sectors, which maintained a similar growth rate in both decades, all other sectors "reversed" their growth pace.

The pattern is consistent across many other countries, too. Bahar (2018) explores in detail the evolution of productivity of firms in a global data set and finds a number of interesting facts regarding the distribution of firms' TFP for years 2006 and 2014 by sector. Based on this analysis, two interesting facts arise, visualized in figure 3-2. First, median TFP in year 2014 is slightly lower than in year 2006, across all industries. In addition, dispersion in TFP has increased for most sectors, if not all.

Note that these facts are consistent across all industries, including services, which is frequently neglected because of lack of data. The importance of looking beyond manufacturing, however, is crucial when thinking about

FIGURE 3-2 **TFP Distribution by Sector, 2006 and 2014**



Source: Bahar (2018).

overall productivity growth in large economies such as the United States, Japan, and European nations. The service-oriented nature of these economies could present an important challenge for future growth. This is because the established unconditional convergence in the manufacturing sector does not necessarily hold in the service sector, for which international competition is less of an issue (Rodrik 2011). In fact, some economists have suggested that innovations in services are less relevant in producing dramatic changes in productivity and efficiency, claiming that the productivity of an artist, for example, is not very different today than centuries ago (Baumol and Bowen 1966).

But this view can be challenged. Take, for example, sports. There are shocks in productivity that might not represent the long-run trend. The Jamaican runner Usain Bolt won the gold medal in three consecutive Olympic games (2008, 2012, and 2016) for the hundred-meter run, each time with a slightly different performance (his 2012 time of 9.63 seconds remains his best, as well as the Olympic record). When looking at average performance of runners throughout the 1900s, the improvement has been dramatic. Before Jim Haines (United States), no Olympic athlete had run one hundred meters in less than ten seconds. In fact, if Bolt and Jesse Owens had raced together, Owens would still have had fourteen feet to go by the time Bolt arrived at the finish line.[2] These improvements probably have little to do with the fact that all humans are faster today than they were decades ago. It is, in fact, a consequence of athletes having improved their training techniques, as well as improvements in technologies that provide them inputs that fuel productivity, such as special clothing, nutrition, or improvement measurement precision.

These same ideas apply to all firms in the service sector that could innovate and use technology-embedded inputs that would make them more productive. The fast-food industry, for example, underwent a number of improvements in the past decades that allowed it to significantly reduce the time between ordering and serving food, incidentally reducing costs and human mistakes. In the retail sector, for example, stores have become more productive by innovating in providing tailored customer service by using data and expanding their platforms online. Innovation and the adoption of technology can improve the way service firms, as well as manufacturing ones, deliver to their customers.

A Framework to Understand Productivity Slowdown

In a nutshell, there are two components in the dynamics linking firm productivity to overall economic growth. First is the improvement in productivity for each firm in the economy over time, known as the "within" component. The second is the growth in size of the most productive firms relative to the least productive ones, known as the "reallocation" component. The reallocation component, in fact, reflects the process through which least productive firms shed labor and other resources—either because they exit the market or simply become smaller—toward the most productive ones. On the aggregate, the speed at which these two processes occur is the key factor that differentiates fast-growing countries from slow-growing ones (McMillan, Rodrik, and Verduzco-Gallo 2014).

Historically, the contribution of each component—within and reallocation—has been different depending on the period and the industry under consideration. A Brookings paper (Baily, Hulten, and Campbell 1992) studying productivity growth in the United States manufacturing sector shows that, overall, the reallocation effect has been positive and significant during every five-year period from 1972 to 1987. That is, a big chunk of productivity growth in the United States during that period can be attributed to the fact that the most productive firms took over a larger portion of the market share in the overall economy. The within component, however, did not always contribute to overall productivity growth. During the period from 1972 to 1977, for example, manufacturing firms became more productive, but this growth was driven exclusively by firms in the computer and the automobile industry. During the period from 1977 to 1982, firms experienced a decrease in their productivity that was compensated by the reallocation effect. Finally, during the period from 1982 to 1987, the within effect dominated overall productivity growth in manufacturing, and overall productivity was fueled by the reallocation component.

All in all, these two components are essential for overall productivity growth, and they all could play a role in explaining the productivity slowdown of the past decade. This framework is important to understand what could be behind the decreasing productivity growth. Even if some or even most firms experience improvements, overall productivity growth might suffer if workers and other resources flow from the most toward the least productive firms. This is, for example, what happened in Latin American during the period from 1990–2005, when in spite of productivity increases among active industries, overall growth was below potential given flows of workers to least productive industries, often in the informal sector (Pagés 2010). McMillan, Rodrik, and Verduzco-Gallo (2014) expand this decomposition during the same period for other regions and shows a similar case for African nations, whereas countries in Asia experienced unusually high productivity growth of almost 4 percent a year, due both to their industries becoming more productive and the reallocation of resources toward these industries.

In the context of the recent productivity slowdown, all components might play a role. If dynamism in the economy is hurt, then the reallocation and entry/exit components could hinder overall growth. This can be a result of firms not responding effectively to changes in their idiosyncratic productivity. If firms that are least productive are less likely to exit, or if more productive firms fail to attract resources from less productive ones, for example, then overall growth slows down.

Slowdown in Reallocation?

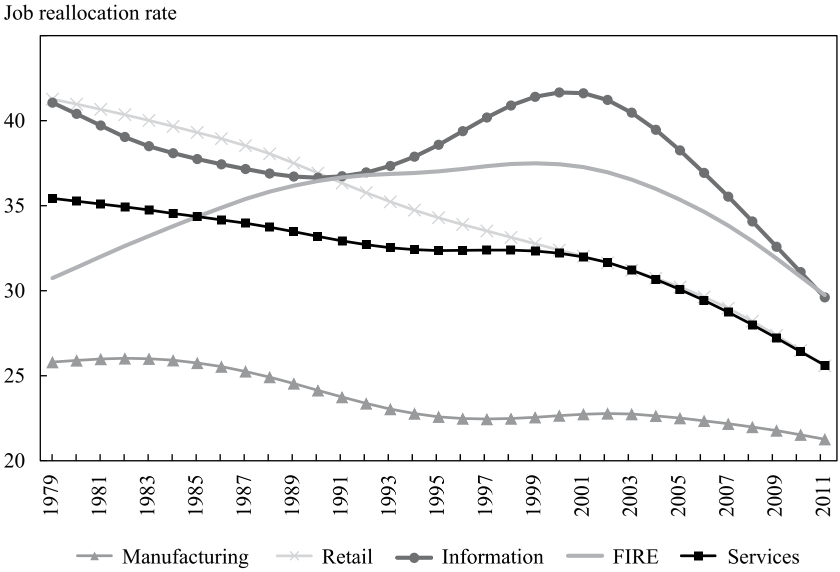
The historic importance of reallocation of labor and the role of entry and exit has been established by many economists. Yet, evidence suggests that dynamism in the United States has been declining in recent decades and, therefore, could play a part in the slowdown that started since the early 2000s. Firms have been less responsive to changes in their individual productivity levels, and this has significant implications for overall growth.

Slowdown in reallocation can play both a positive and a negative role on overall growth. In general, in sectors where it is more likely that any given firm can grow to dominate a big part of the market, dynamism plays an important role. A successful technology start-up with high potential to grow would require resources to flow toward it. A decrease of dynamism in this case would imply that resources aren't flowing toward firms with the highest potential to grow. On the other hand, once resources have moved to the fastest-growing firms, declining dynamism might contribute to overall growth, as happened with the retail sector in the United States during the 1990s and early 2000s. After having already employed a large share of the industry-wide workforce—most likely flowing from small and unproductive mom-and-pop stores—big-box stores kept a fast pace in their productivity growth, contributing to overall industry growth. Thus, reallocation is particularly important in industries where small firms can grow very fast by pioneering innovations, and compete with even the largest firms, such as ICT-producing or ICT-using sectors.

In the United States, declining dynamism in the high-tech industries since the 2000s can explain a significant loss in annual growth up to 2010 (Decker and others 2018). This decline in dynamism is a result of the inability of firms to respond to changes in their productivity, and this could be explained by frictions or high adjustment costs. For example, unnecessary subsidies or high closing costs for a failing enterprise would keep such firms in the market longer, occupying resources that, ideally, could be reallocated to more productive firms in the same sector. Similarly, inflexible labor markets could impede fast-growing firms from hiring more workers when needed and, thus, keep them from responding positively to productivity improvements.

Declining trends of job reallocation in the United States have been common across all industries since the early 2000s, as can be seen in figure 3-3.

FIGURE 3-3 **Sectoral Trends in Job Reallocation**



Source: Decker and others (2018).

Both the information and the FIRE industries have experienced a stable, even rising, rate in job reallocation since the 1980s until the early 2000s, after which the rate sharply declined. This post-2000 decline is consistent with the productivity slowdown seen across the economy.

In addition, data shows that young firms in the United States (less than five years old), across all sectors, employ a smaller share of the economy than they did in the early 1980s. If over the past three decades most of the productivity growth had concentrated more among mature firms—rather than the younger firms—then the shifting of resources from young to mature firms would be, in fact, optimal for overall productivity growth. This was, as discussed, the case for retail trade, but not for the other industries. The shifting of resources away from small firms goes hand-in-hand with the productivity slowdown. In fact, employment growth among firms that experienced improvements in productivity has weakened today as compared to the 1980s, both for young and mature firms. This pattern is consistent both for high technology and other plants in the manufacturing sector in the United States.

How important is reallocation in explaining the overall slowdown in productivity as compared to other components? The short answer: not much. A recent paper by Chang-Tai Hsieh and Peter Klenow shows that the decline in dynamism can explain up to 10 percent of the decline in productivity growth in the United States (Hsieh and Klenow 2018). The biggest chunk of what explains a loss in aggregate productivity is, then, the within component.

In fact, as shown by Bahar (2018) and visualized in figure 3-2, firms—on average—reduced their productivity between 2006 and 2014. Yet, firms becoming less productive, on the aggregate, is a difficult concept to digest. Are firms now doing less than they could do with the same resources than before? Some industries are. In the United States alone, for instance, during the 2004–14 period industries such as apparel and leather products, paper products, chemicals, plastics, as well as furniture, among others, experienced negative productivity growth (Baily and Montalbano (2016). Figure 3-2 reflects changes in productivity between 2006 and 2014, just around the Great Recession. Thus, part of this negative growth can be explained as a drop in demand for the industry as a whole, which resulted in reduced sales without immediate changes in the resources the firm employed. This will result in a productivity drop, following the standard measurement techniques. Yet, as noted, the slowdown in productivity preceded the recession in 2007 and, therefore, even if only suggestive, these results support the idea that, even during a period of crisis, reallocation played a positive role. The analysis that follows focuses on understanding firm-level productivity dynamics.

Innovation and Adoption

Simply put, improvements to the productivity of a single firm can be explained in one of two ways: innovation or adoption. Innovation implies the creation of a new and unique method, idea, or product that allows the firm to create more output using the same amount of resources. Adoption, on the other hand, implies that a firm gains access to methods, ideas, or products that were invented by other firms (normally within the same sector) to be able to do more with the same inputs. In fact, innovation is typically done by firms at the frontier who invest large amounts of their budgets in research and development (R&D) activities, while other, smaller firms grow due to access to previous innovation by other firms in the industry. Both components are crucial; in the absence of innovation there is no productivity growth, and in the absence of adoption not only would most firms not grow (hindering overall productivity growth), there would be less incentive to innovate for frontier firms, given the lack of competition.

The importance of adoption in the process of productivity growth is critical. Even if technologies exist and are available in the country, the process of aggregate growth requires the eventual diffusion of these technologies widely across firms and not only the ones that invented them or adopted them first. An example of an adoption of an already existing technology is the implementation of a customer relationship system that allows the firm to be more efficient in the management of customers, suppliers, and inventory and brings with it the ability to produce more output with the same resources.

The historic trend of both the availability of technologies and their penetration is quite striking. Diego Comin and Martí Mestieri Ferrer, two economists studying the historical diffusion of technologies, find that while diffusion of technologies across countries (what they call the extensive margin) is much faster than in the past, the penetration (the intensive margin) of those technologies within the country has slowed down (Comin and Ferrer, 2013). For instance, it took, on average, forty-five years for the telegraph to reach all countries in the world after it was invented in the 1830s. On the other hand, a newer technology, such as cell phones, took on average only five years to reach all countries after it was invented in the early 1970s. The speed of penetration within other countries relative to Western nations was, however, significantly faster for the telegraph than for the cell phone. In short, as compared to the past century, newer technologies diffuse faster across countries but much slower within countries. This implies that frictions for the adoption of technologies by firms have increased, which would have a direct result in the dispersion of productivity within industries.

Dispersion is precisely what is also documented in figure 3-2. Between 2006 and 2014, not only the median productivity declined but the dispersion in TFP increased as well, across all sectors (see Bahar 2018 for more details on this). This could be a result of a number of developments. First, the weakening of business dynamism; in a highly competitive environment, firms would be forced by the market to follow "up or out" dynamics. That is, small firms that don't grow because they have been proven to be unproductive would not be able to remain in the market. But in an environment with weak business dynamism, small unproductive firms will remain in the market longer, drawing down the average and increasing the dispersion. Second, the mix of continuous innovation by frontier firms, together with high adoption frictions for the rest of the firms within that industry, are consistent with the results of Comin and Mestieri. If the ability of firms at any part of the distribution to adopt technologies is different from firms at the top, for example, dispersion would increase too.

High productivity dispersion is consistent with the findings of the work by Andrews, Criscuolo, and Gal (2016). Their findings show how productivity grew much faster for firms at the technological frontier as compared to laggard firms within the same industry and that the productivity gap between the two groups of firms widened greatly (see figure 3-4). That implies that large firms, such as Google and Facebook, would become much more productive by the day relative to smaller firms who are not at the frontier, who for a variety of reasons are unable to adopt technologies that would make them grow fast too.

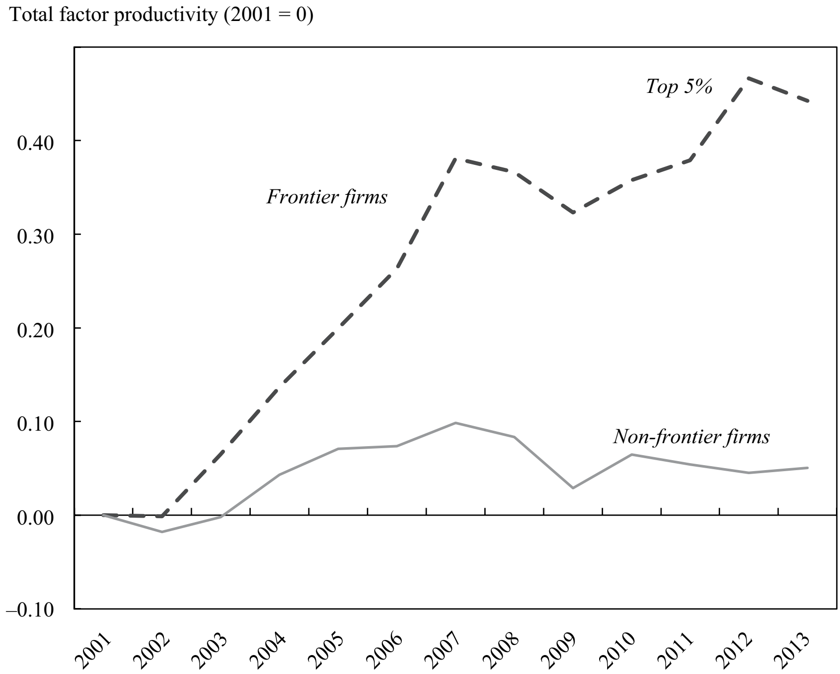
This might seem like an obvious result, but it is not quite, as it contradicts an important belief held by economists about growth: convergence. Since small firms start at a much lower level of productivity than large firms, the latter will tend to grow much faster than the former. But the results by Andrews, Criscuolo, and Gal (2016) show a picture that is consistent with divergence, not convergence. The most productive firms will keep becoming more and more productive relative to the least productive ones, increasing dispersion.

Before digging deeper into the concept of convergence and divergence, there is more to say about dispersion.

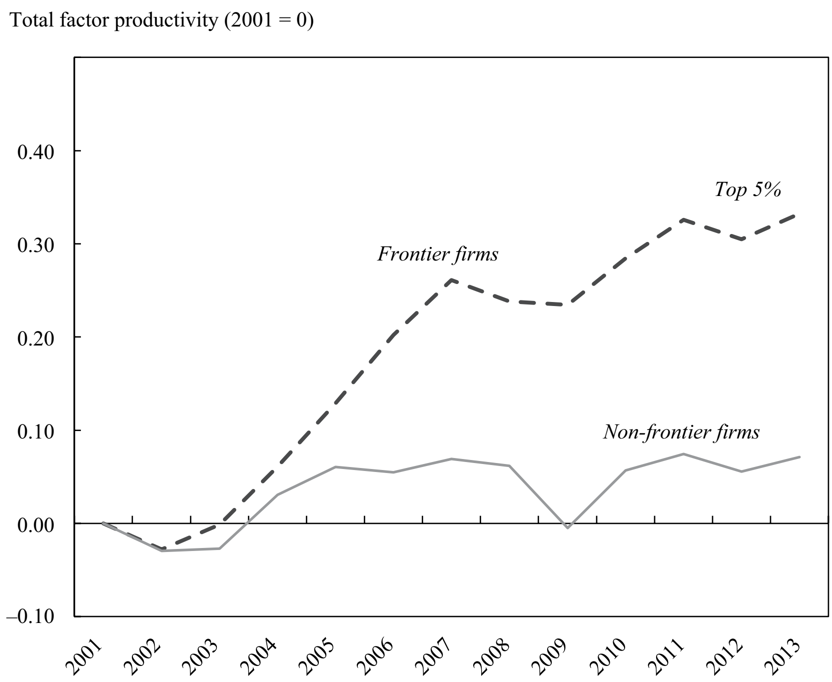
The first question to examine is whether dispersion has been increasing systematically or if it has changed in response to booms and recessions. Naturally, business cycles could explain some level of dispersion given heterogeneous changes in firms' response to booms and recessions in terms of investing or, on the contrary, cutting back on investment to adopt new technologies (Kehrig 2015). In fact, the average slowdown in TFP during and after the global recession can be partly attributed to the decline in the speed of adoption of new technologies in response to credit disruptions that

FIGURE 3-4 **Growth at the Frontier versus Laggards**

Services sector

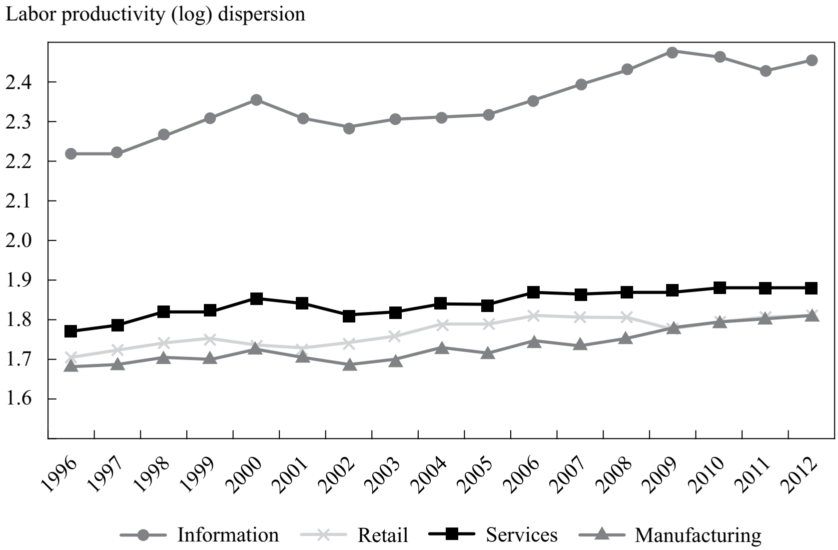


Manufacturing sector



Source: Andrews, Criscuolo, and Gal (2016).

FIGURE 3-5 **Productivity Dispersion within Industries Has Been Increasing**



Source: Decker and others (2016).

Note: Y axis does not begin at zero. Data reflect interdecile range of log labor productivity deviated from industry by year means. Sectors are defined on a consistent NAICS basis. Author calculations from the RE-LBD.

have shocked the U.S. economy since the beginning of the worldwide recession in 2007. Yet the slowdown prior to 2007 could be explained by a decline in the ability of R&D investment to bear fruit (Anzoategui and others 2016). Thus, both structural and cyclical factors have played a role in the technology adoption patterns of firms in recent decades and, with it, the trends in productivity dispersion.

Indeed, slowing productivity is a trend that precedes the Great Recession. The fact that productivity dispersion is persistent and large even within narrowly defined firms isn't new, either. For example, research that uses the 1977 U.S. Census of Manufactures show important differences in productivity across plants within a four-digit industry; plants at the 75th percentile were, on average, twice as productive as plants in the 25th percentile in terms of labor productivity.[3] This differential, however, has increased further since then, not only for manufacturing but for all other sectors, as shown in figure 3-5 from Decker and others (2016). Even though the service sectors have higher levels of productivity dispersion than manufacturing, increasing dispersion across time is common to all. In fact, within manufacturing, increasing dispersion since the 1980s is present for both high-technology firms as well as low-technology ones, and within younger and mature firms. Across the board, productivity dispersion is increasing.

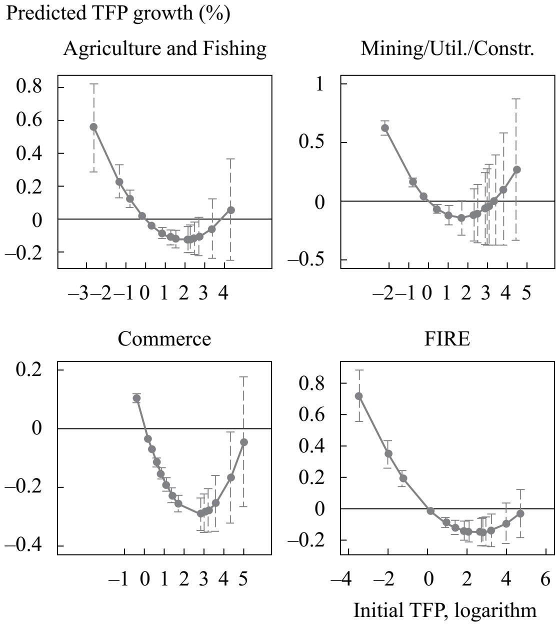
Convergence and Divergence

So what explains increasing dispersion and, perhaps most important, why should we care about it?

As mentioned, in the presence of frictions for adoption, this could affect the typical convergence patterns that economists would expect across firms. Firms at the bottom of the productivity distribution would be expected to grow faster, in relative terms, than those at the top of the distribution. Why? Because the process of adoption is much easier than that of invention. This is, in fact, the essence of convergence. Technology adoption costs, both in terms of resources and time, are smaller than technology discovery costs. As such, less productive firms can enjoy faster productivity growth just by adopting the technologies discovered by those firms at the frontier. The frontier—those firms at the top of the distribution—face a tougher challenge. They have already adopted all the innovations that took them where they are; therefore, to keep growing, they need to lead the innovation process. Even if they are successful, they likely won't be able to grow as fast as those that are only adopting technologies.

One way to examine divergence is to look at each firm's productivity growth trajectory, say, three years down the road, conditional on its initial level. Bahar (2018) found that firms with low initial productivity levels typically experienced faster TFP annual growth over the following three years than firms with a higher level of productivity, consistent with convergence. This process on its own would reduce dispersion, not increase it. Yet, the story doesn't end there. For the most productive firms, this pattern is reversed. It turns out that firms with very high levels of productivity tend to grow faster than their less productive peers, generating a U-shaped relationship between TFP growth and initial productivity levels, as shown in figure 3-6.

FIGURE 3-6 TFP Three-Year Growth Estimate Based on Initial TFP Levels

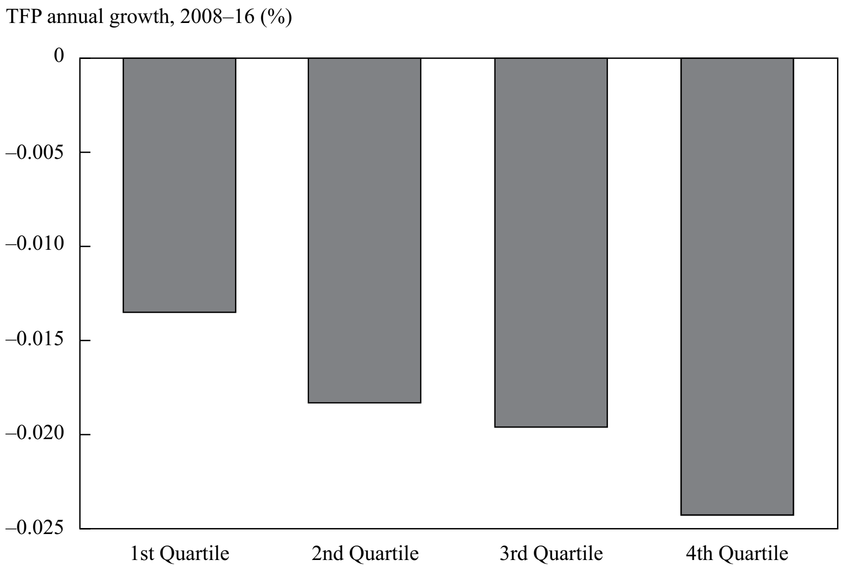


Source: Bahar (2018).

Thus, what we see in the data is a "middle productivity trap" problem. Firms starting low in the productivity scale experience fast-paced growth in TFP, and as they get closer to the productivity frontier, relative growth stagnates. But the top 1 percent keeps growing, and much faster than those in the middle. These dynamics create dispersion. The fast growth of the low productivity firms cannot offset the growth, of the ones at the top when looking at nominal increases. These convergence-divergence dynamics are present across most sectors in the economy, particularly in manufacturing as well as in FIRE sectors, where adoption is key to remain competitive. They are also particularly strong for developing countries.

The fact that some highly productive firms are able to maintain a fast pace when it comes to productivity growth suggests that innovation is, indeed, taking place among these few firms. Yet, these new innovations seem not to be trickling down to other, less productive firms. In other words, there seem to be some friction in the process of technology adoption. What these frictions could be is a key research question, but before we discuss the

FIGURE 3-7 **TFP Annual Growth 2008–13 by Initial Dispersion Quartile**



Source: Bahar (2018) and author's calculations.

why, there is an important question that is still up in the air: Does this matter?

It turns out it does. Frictions in the technology adoption process would result in larger productivity dispersion, which in turn has been associated with slower productivity growth. In fact, based on the sample used by Bahar (2018), growth is significantly slower among industries with the highest dispersion (fourth quartile) than for those industries with the smallest dispersion (first quartile) (see figure 3-7).

We can now trace back this productivity slowdown, partly explained by frictions in the adoption process, to economic growth. In the 1950s, Nobel laureate Robert Solow brought to economics a key insight that is highly relevant today: productivity growth is key to sustained economic growth. Countries grow by investing in acquiring more capital or in improving education attainment of their workforce, but the returns to these investments in the long run are limited; thus, without changes in productivity, according to Solow, economic growth would decline. In the long run, it is productivity that matters more. In fact, it has been shown in several studies that over half of cross-country income differences can be explained by productivity differences (see Hall and Jones 1999).

Concluding Remarks

In the presence of frictions, firms at the frontier will be able to gain larger market shares, which in the long run could turn into weaker competition, affecting output and prices in several markets. The growth of these few firms is not enough to fuel the rest of the economy. These dynamics could affect other trends, such as income inequality, which has also been growing within countries in recent decades.

Overall these patterns present a plausible explanation of the productivity slowdown experienced by most advanced economies since the beginning of the current century, and that has been documented by many. What could stand behind these patterns is out of the scope of this particular chapter, but a plausible factor could be the increasing presence of frictions in technology adoption by lower productivity firms. Under such a possibility, public policy could play an important role in helping to overcome the market failures causing such divergence.

Notes

1. Another widely used definition is "labor productivity," which measures how much output per worker a firm makes. Note that this measure does not take into account that two firms with the same number of workers could differ in the amount of machinery they use or in the way they use their materials. Yet, there usually is a large and positive correlation between TFP and labor productivity.

2. A story in the *New York Times* published on 08/15/2016 details this claim. See: www.nytimes.com/interactive/2016/08/15/sports/olympics/usain-bolt-and-120-years-of-sprinting-history.html.

3. Syverson (2004) and Hsieh and Klenow (2009) find wide dispersion within narrowly defined sectors in the United States, China, and India.

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FOUR

The Technology-Productivity Paradox

Why Has Productivity Growth Slowed?

DANY BAHAR *and* **KARIM FODA**

The paradox of seemingly rapid technological change and slow productivity growth has no single, master explanation, but a careful look at some key developments across advanced and major emerging economies reveals some consistent explanations. Many of these same developments are also correlated with high inequalities in many economies, such as those between rich and poor or educated and less educated. We focus specifically on possible reasons behind the productivity slowdown despite rapid technological progress.

Some of the reasons for weak productivity growth are cyclical in nature, but the slowdown has been under way too long to be explained by the short-term ups and downs of an economy. Ultimately, the declining trend in productivity growth is led by factors that do not come and go in cycles but are embedded in an evolving structure of the economy and the incentives that firms face when making decisions on investing, hiring, reorganizing, and, ultimately, producing.

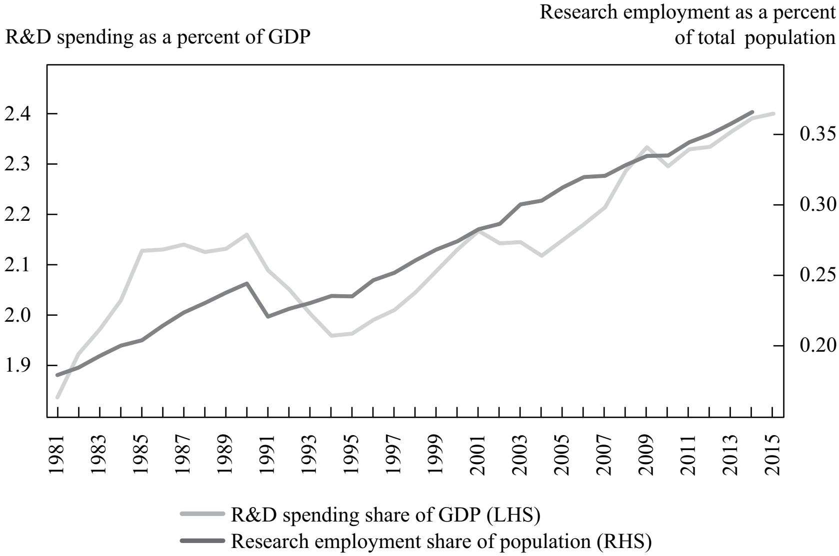
Before wading into the inner workings of the economy, a bigger question looms over the productivity puzzle: Is technological progress as rapid as we think it is? Improvements in productivity depend on the forward march of technological progress and innovation. It is the application of technology to the production process that yields productivity gains, but different ways of thinking about innovation can lead one to believe that the frontier of technology itself has, perhaps, reached its limits. It would follow, then, that the scope for productivity-enhancing innovation may be approaching its limits, too. If that were the case, the productivity slowdown would be with us whether the economy is firing on all cylinders or not. Let us investigate.

Is Innovation Slowing Down?

One does not need to look far to see the impact of innovation on our lives: smartphones with real-time traffic updates, intelligent machines providing investment advice and legal expertise, global digital networks and cloud computing, gene therapy and stem-cell transplants, self-driving cars. The list goes on. Optimism in Silicon Valley is unbounded, and by all appearances we are in a golden age of innovation (Aeppel 2015). But the slowdown in productivity growth has led many to wonder if the seemingly rapid pace of technological progress is just a façade, if today's progress pales in comparison to the transformative technological breakthroughs of the past. Is innovation advancing as rapidly as it appears, or is it actually slowing down and becoming less impactful, as the productivity trends might suggest?

There is some reason to believe that ideas are getting harder to find. The inputs to innovation have been growing, but the outputs do not appear to be keeping pace. In terms of inputs, spending on R&D has trended modestly higher over the last thirty years, and there are more scientists and engineers than ever before (figure 4-1).[1] The outputs are more difficult to measure, however. The number of patents granted is traditionally used as a quantifiable marker of innovation, but this is not always a reliable measure. Some patents may be more valuable in terms of their innovative novelty or in terms of their contribution to a company's output and productivity than others.[2] Anne Marie Knott of Washington University in St. Louis, Missouri, uses firm-level data on R&D investments, patents, revenues, and other characteristics to estimate the value of patents, finding that only 10 percent of patents comprise 85 percent of the total value of all patents in the United States. Knott estimates "R&D productivity" is essentially the ratio of a firm's revenues to its R&D investment, estimating that overall R&D productivity in the United States declined 65 percent over the last three decades (figure 4-2).

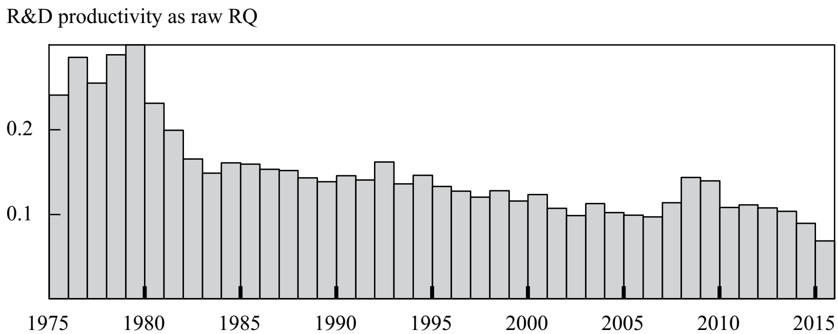
FIGURE 4-1 **R&D Spending and Share of Researchers in the OECD, 1981–2015**



Source: OECD Main Science and Technology Indicators.

Note: Some variation exists by country. For example, the U.K.'s share of R&D spending in GDP has declined since the early 1980s, but the majority of countries have increased their spending as share of their economies. OECD aggregates include Mexico.

FIGURE 4-2 **R&D Productivity in the United States, 1975–2015**



Source: Knott (2017).

Note: Raw RQ is a metric developed by Knott (2017) that stands for Research Quotient, which is essentially a ratio of firm revenues to R&D investment. See more detail in Cooper, Knott, and Yang (2015).

In other words, it is requiring more research effort to generate a similar amount of innovation. Consider Moore's Law—the doubling of the computing capacity of a semiconductor chip every two years since 1971. Economists at Stanford and MIT used data on semiconductor R&D from a number of semiconductor firms and equipment manufacturers to find that the research effort needed just to maintain Moore's Law today is around 78 times greater than it was in 1971. They found similar results of declining "ideas productivity" in other areas of the economy, from various agricultural crop yields to mortality and life expectancy (Bloom and others 2017).

There are a number of explanations for why this could be the case. One of them suggests a "burden of knowledge." As ideas accumulate and technology advances, it becomes more costly to innovate, taking longer for new researchers to catch up with the frontier in their area of expertise (Jones 2009). Another suggests that a decline in public spending on basic research has lowered the chances for new discoveries to be widely shared and built upon (box 4-1). A different explanation suggests that increasing environmental or safety regulations are raising barriers to commercializing new ideas. For example, meeting vehicle safety and fuel-emission standards gobbled up extra research effort that once helped make roads safer and the air less polluted, but those benefits do not translate into output (Ip 2016).

The most prominent explanation for why innovation might be slowing down asserts that there are simply no more major innovations to be found. Economic historian Robert Gordon, in his 2016 book *The Rise and Fall of American Growth*, argues that the impact of the transformative technological breakthroughs of the second industrial revolution cannot be repeated or rivaled. After cars and airplanes were introduced, for example, later innovations that improve speed, efficiency, and safety could not be nearly as impactful as the initial transformation from horses and railroads to wheels and wings. When productivity growth slowed in the 1970s, the broad majority of factories in advanced economies had been electrified, households already owned refrigerators and televisions, and medical breakthroughs had increased life expectancy faster than they are likely to in the future. Tyler Cowen of George Mason University (2011) suggests we have plucked the low-hanging fruits of innovation and are now stagnating in a technological plateau. Though the productivity-enhancing spread of ICT in

BOX 4-1 Innovation and Public Investment in Basic Research

Public investment in basic research tends to be positively related with private sector innovative activity and productivity growth. Basic research is experimental work aimed at acquiring new knowledge and discoveries without any specific application necessarily in view. Private firms are more actively engaged in applied research that focuses its efforts on a direct application that can provide a monetary reward. Basic research helps push the frontier of discovery and knowledge, which provides the foundation for applied research by all firms to offer innovative applications and enhance productivity growth. Some of these innovations that spawned from public investment in basic R&D include the Internet, Google's basic research algorithm, and key features of Apple smartphones.

However, public investment in basic R&D has declined in many major economies. In the US, government spending on R&D fell from 1.2 percent of GDP in the early 1980s to half that level in 2015. Furthermore, the share of basic research in the US supported by the federal government has fallen to its lowest level of 44 percent, compared to over 70 percent in the 1960s and 1970s. The overall rise in total R&D spending as a share of GDP shown in figure 4-1 is therefore driven by private investment in R&D. Recent research suggests that the decline in public R&D and its focus on basic research is a contributory factor to the decline in the productivity of overall R&D (Bloom and others 2017).

1996–2004 in the United States made its impact, the wave was short-lived and is now over.

But there is a totally different view of innovation that lends itself to the opposite conclusion—that we are in the midst of rapid technological progress that will only accelerate. It does not see innovation as ideas that "get used up" but rather as blocks of ideas that combine with other blocks to produce even more innovation. This combinatorial or recombinant view of innovation challenges the notion that ideas are getting harder to find by suggesting the opposite—that the number of available ideas only grows over time as they combine and recombine with each other.

MIT economists Erik Brynjolffson and Andrew McAfee (2014, p. 81) argue that the unique properties of digital technology as well as its role as a general-purpose technology—one that can be applied across a broad range of sectors and activities—will result in an exponential rise in ideas. In their book, *The Second Machine Age*, they write:

> Digital innovation is recombinant innovation in its purest form. . . . Moore's Law makes computing devices and sensors exponentially cheaper over time, enabling them to be built economically into more and more gear, from doorknobs to greeting cards. Digitization makes massive bodies of data relevant to almost any situation, and this information can be infinitely reproduced and reused because it is non-rival. As a result of these two forces, the number of potentially valuable building blocks is exploding around the world, and the possibilities are multiplying as never before.

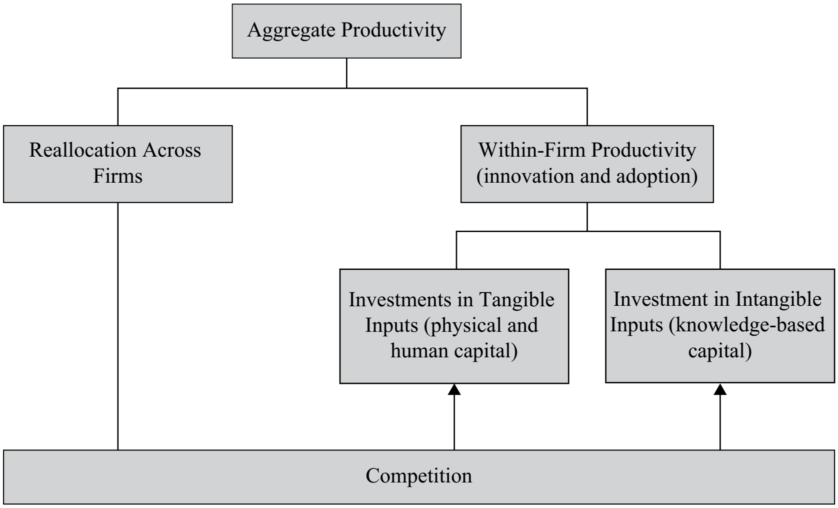
The biggest limit, they say, is to identify which combination of building blocks will be valuable, requiring more eyeballs and even bigger computers to sift through ever-increasing amounts of data.

This is consistent with the fact that some firms in the economy—typically those at the frontier—have become more and more productive relative to the rest, as shown in several studies, including Dan Andrews and others (2016) and Dany Bahar (2018). This is likely the result of innovation at the frontier, which, even if more difficult, is still happening. Yet, for aggregate productivity growth to pick up the pace, it is not enough for some firms to innovate; it requires a broad range of firms to adopt new technologies and best practices. It is this adoption process by laggard firms that appears weak.

The Determinants of Productivity Growth

A 2015 survey by *Fortune* magazine of the CEOs of the biggest 500 companies in the world found that 72 percent of them view the rapid pace of technological innovation as their company's biggest challenge, and 94 percent believe their company will change more in the next five years than it has in

FIGURE 4-3 **A Framework for Explaining Productivity**



the last five years. While these large firms wrestle with the expanding technological frontier, the rest of the economy seems to be lagging behind. As shown in Bahar (2018), firms at the frontier of productivity growth within each narrowly defined sector have continued apace, suggesting continued robustness in innovative activity. The widening productivity gap between frontier firms and lagging firms suggests a weakening of the diffusion of new technologies across the broad landscape of small, medium, and other large firms. For technological progress to have an impact on overall growth and productivity, its adoption by a broad range of firms and industries throughout the economy is critical.

Before diving straight into the reasons behind the weakening diffusion of technological progress, let us first take a step back to ensure we cover all the major bases for what drives productivity growth and what could explain its slowdown. Let us begin with a framework for what determines aggregate productivity to guide us through its key drivers. Figure 4-3 isolates the two key components that affect a country's productivity—the reallocation of resources from low- to high-productivity firms and the productivity growth of the firms themselves. Under each of these two components are key determinants that can ultimately facilitate productivity growth or slow it down.

Reallocation

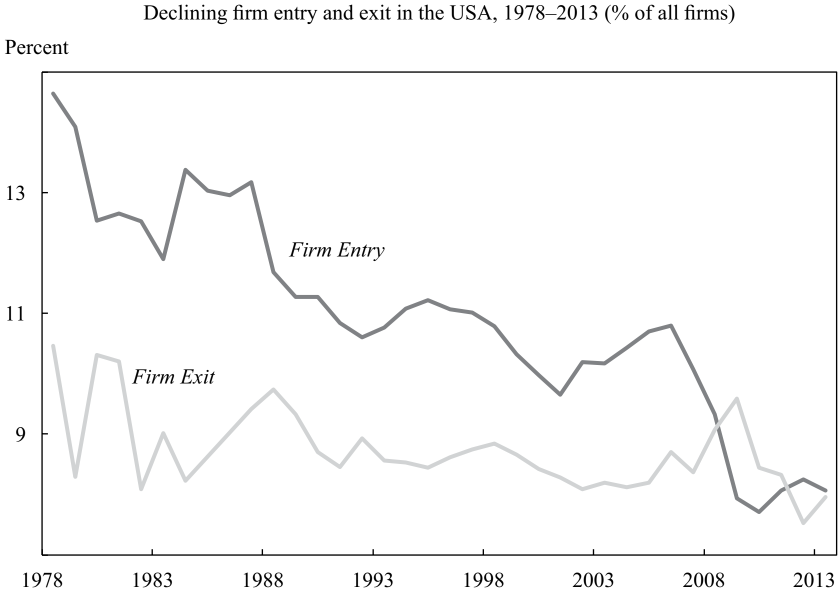
The first component in figure 4-3, reallocation, is directly affected by one subcomponent: competition; that is, the Darwinian selection process that takes place through which less productive firms exit the market and shed resources (labor, capital) that are—ideally—reallocated toward more productive firms. Conceptually, an economy can increase its aggregate productivity without a significant degree of technological progress at all by constantly reshuffling resources to where they can be most productive, as the firms that die are replaced by new, more productive ones.

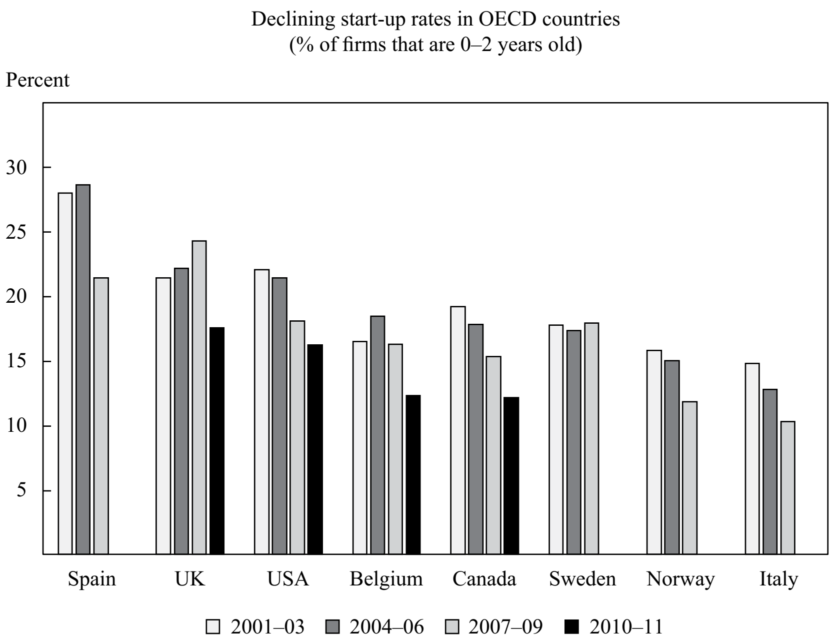
Over the last two decades, there has been a slowdown in this competitive selection process. The rate of new business formation has been on a declining trend since the late 1970s in the United States and more recently across other OECD economies. In 2013, business start-up rates were around 30 percent lower than the annual average in the 1980s, and the decline has affected nearly all business sectors. The rate at which firms exit the market has also slowed, resulting in a larger share of older firms that face less competitive pressure from fewer new entrants. In the late 1970s, new firms accounted for 16 percent of all firms in the United States. By 2011, that share had been cut in half, to 8 percent. This trend has been most pronounced in the United States but has also been under way in most other OECD countries (figure 4-4).

That there are fewer new entrants suggests there has been a decline in reallocation of resources from less to more productive firms. In a dynamic economy, it is typically young, productive firms that tend to generate new ideas and create jobs. However, in addition to the fact that there are fewer new entrants, post-entry growth of new entrants has also slowed. A 2014 study by Steven Davis of the University of Chicago and Jon Haltiwanger of the University of Maryland (2014) reports that, after 2000, start-up rates in high technology and information-processing firms fell, and those firms that did enter did not experience the same rapid growth as earlier cohorts.

The magnitude of diminished business dynamism and the direct impact of competitive selection processes on aggregate productivity growth is not so clear, however. Critics point out that the acceleration in productivity growth in the United States in the late 1990s and early 2000s is inconsistent with the continued decline in business dynamism over that time period, suggesting that older firms may be just as innovative as newcomers.[3]

FIGURE 4-4 Declining Business Dynamism





Source: U.S. Census Bureau (top panel) and Criscuolo, Gal, and Menon (2014) (bottom panel).

A 2017 paper by Chang-Tai Hsieh and Peter Klenow suggests that the decline in dynamism (as defined by job reallocation and the contribution of new entrants to job creation) has contributed as much as 10 percent to the decline in productivity growth in the United States, a notable amount but leaving most unexplained.

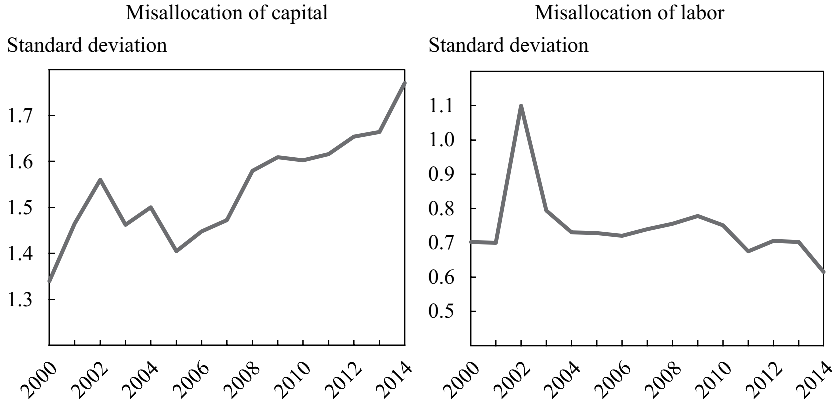
The type of competition that drives Darwinian survival dynamics can come in many forms beyond the pure entry and exit of firms. For instance, unequal access to capital could hinder the allocation of capital to small but highly productive firms in need of more inputs to keep growing. Alternatively, subsidies on inputs that benefit thriving low-productivity firms would tend to drag machinery from firms without subsidies that could use such machinery much more efficiently. For some developing countries, such as China and India, eliminating these inefficiencies could result in increases in aggregate productivity of up to 60 percent (Hsieh and Klenow, 2009).

Misallocation of Capital and Labor

At the heart of the reallocation story stands the ability of all firms to get the optimal allocation of resources. In reality, small and medium-sized enterprises (SMEs)—many of them with high growth potential—typically face stronger financing constraints than larger firms, mostly due to high financing costs and increased perceptions of riskiness by investors. In 2014, the OECD reported that SMEs across OECD countries continued to suffer relative to larger firms from both reduced availability of internal funding after the Great Recession and low credit availability from the banking sector after the Great Recession. In the United States, for example, the share of loans to small firms out of total business loans dropped from 30.1 percent in 2009 to 23.7 percent in 2012. According to the report, bank lending continues to be the most common source of external finance for small firms (OECD 2014). Since 2007, SMEs experienced tougher credit terms than larger firms, in the form of shortened maturities, increased requests for collateral, and higher interest rates. Between 2007 and 2013, the median interest rate spread between loans to SMEs and to large enterprises across twenty-four advanced economies rose from 0.8 to 1.3 (OECD 2016c).[4]

For firms with weaker balance sheets before the financial crisis, tight credit conditions after the financial crisis had a more acute impact on their

FIGURE 4-5 Rising Capital Misallocation in Advanced Economies



Source: IMF (2017); Duval, Hong, and Timmer (2017).

Notes: Standard deviation of factor return, median across countries using the Hsieh and Klenow 2009 approach. An increase in the standard deviation denotes larger misallocation.

productivity than other firms with less overall debt and lower short-term financing needs, especially in countries most affected by the euro area crisis. Research by the IMF finds that, on average across countries, the decline in average post-crisis TFP growth (2008–13) was 1.01 percentage points greater for firms with high financial leverage than for low-leverage firms. In countries where credit conditions deteriorated more (sharper increases in bank credit default swap spreads), the same gap was 1.31 percentage points (IMF 2017; Duval, Hong, and Timmer 2017). This "missing growth" of the low-leverage firms due to credit market frictions is, naturally, reflected in lower aggregate productivity growth.

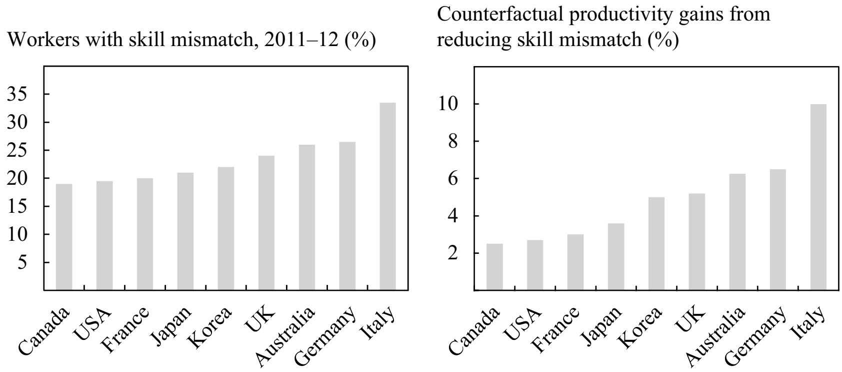
More generally, all market inefficiencies create misallocations that keep the "right" firms from getting the resources they need to compete in the market while, at the same time, allowing low-productivity firms to survive longer than they should.

In advanced economies, there is evidence that the misallocation of capital began to rise before the financial crisis, and rose further in its aftermath (figure 4-5) (IMF 2017). In Europe, the inception of the Eurozone in the late 1990s and the resulting decline in interest rates for many of its members triggered a sharp rise in poorly intermediated capital inflows that drove a notable misallocation of capital across southern Europe (Gopinath and others 2017). Estimates for Italian manufacturing firms suggest that TFP levels would have been 12 percent higher in 2007 if the efficiency of resource allocation had remained at its 1997 level (Calligaris 2015), while estimates for Spain suggest that rising misallocation held down TFP growth by 1.0 to 1.5 percentage points a year between 1995 and 2007 (Garcia-Santana and others 2016). After the financial crisis, capital misallocation worsened more broadly across advanced economies. The productivity growth of financially constrained firms grew more slowly relative to financially healthier firms. Making matters worse, many of these financially constrained firms stayed alive as "zombie firms," as banks may have extended "evergreen" loans to weak firms to delay recognition of losses (IMF 2017). An OECD study estimates that the rise in the share of the industry capital stock stuck in zombie firms can account for around 15 percent of the decline in the efficiency of capital allocation across a set of OECD economies (Adalet McGowan, Andrews, and Millot 2017).

On the other hand, misallocation of labor—conditional on the observed allocation of capital—has remained steady since the mid-2000s in advanced economies, and thus it is not a likely candidate to explain the productivity slowdown. However, when taking skills into the picture, as technological change pushes ahead, the difficulties in matching the right workers with the right jobs is another important source of misallocation.

Areas with tight labor market regulations, like strict rules for hiring and firing in Europe or the rise in the number of licenses and certifications required to do certain jobs in the United States, have contributed to sizable skill mismatches that have helped suppress faster productivity growth. Figure 4-6 shows how sizable productivity gains from reducing skill mismatches and improving the allocative efficiency of skills alone could be. In Europe, a growing body of research finds that lower flexibility in labor markets has limited the ability of firms to reorganize with new business models and skill requirements to take full advantage of productivity-enhancing ICT and digital technologies.[5] In the United States, state-level licensing regulations grew by a factor of five in the second half of the twentieth century with the intention to protect health and safety but in some cases at the expense of increased inefficiency, especially for smaller firms or entrepreneurs. Zoning restrictions in U.S. cities have also heightened housing supply constraints, reducing the efficiency of labor allocation at the state and national levels.

FIGURE 4-6 Skill Mismatches and Productivity, Selected Advanced Economies



Source: Adalet, McGowan and Andrews (2015).

Note: Simulated gain in allocative efficiency by lowering the skill mismatch to the best practice level of mismatch.

Firm Productivity Growth

The second component in figure 4-3 directly links the process of productivity growth to the ability of individual firms to grow mainly by innovating and adopting new technologies or innovations. In addition to entry and exit dynamics, the degree of competition in an industry heavily influences both the ability and the willingness of firms to make productivity-enhancing investments in both tangible and intangible inputs that enable faster technology adoption. When confronted with stiff competition, firms must often invest to raise their productivity to retain their market share, or to survive at all.

Investment in tangible inputs—like equipment, fixed capital, and workers with a range of skills—and intangible inputs—like business processes, organization design, patents, ideas, and copyrights—are critical for all firms to improve their productivity and grow. Over the last two decades, however, private investment rates have been falling, and small to medium-size firms have faced growing credit restrictions, limiting their capacity to invest in themselves.

Figure 4-7 shows the overall decline in private investment since the 1980s in the United States with the exception of the 1990s, when productivity

FIGURE 4-7 Declining Investment by Private Non-Financial Firms, United States 1980–2015

Source: Gutierrez and Philippon (2017).

growth in the United States accelerated, private investment has been on a downward trend. After the shock of the financial crisis, investment rates bounced back to around 10 percent across private non-financial firms, just half of the longer-term average from the 1960s until the turn of the century.

In addition, firms' investment (or lack of it) is also determined by factors other than access to capital. In fact, when we focus only on access to capital as a driver limiting firms' investment, there is a direct link between the reallocation and the within-firm components of aggregate productivity growth. In some sense, one becomes the mirror image of the other. In the presence of financial market inefficiencies, small firms with high potential might not have access to resources that are in the hands of less productive firms (thus generating misallocation), and without such investment their full potential won't be realized (that is, no growth due to no investment).

While access to finance and other critical resources, like skilled workers, for example, mostly determines the ability of firms to invest, there are other factors—competition being a crucial one—that determine the willingness of firms to invest. In this section we focus on the latter, as the former can also be seen from the reallocation lens. First, let's delve into the details of what these tangible and intangible inputs are, how they are a key for a firm's productivity, and what the evidence has to say about why firms are not investing as much as they could.

Investing in Tangible Inputs: Physical and Human Capital

Firms can adopt technologies by accessing tangible inputs, in particular, knowledge-embedded tangible inputs like sophisticated machinery or better managers and trained workers. Yet, evidence consistent across countries suggests there is unequal access to such inputs across firms of different sizes. This generates frictions in the ability of small firms to adopt technologies from the frontier.

Knowledge-Embedded Physical Capital

Upgrading to ICT capital and other forms of modern infrastructure—for example, data servers for storage, devices, networks, and other technology-embedded capital—allows firms to compete in a digital marketplace and to connect with suppliers at home or abroad. The technologies embodied in physical equipment can go a long way in improving productivity of firms, not only by increasing their efficiency in production but also by boosting their ability to adopt best practices and know-how from around the world by connecting them to other firms that otherwise they might not have been exposed to. Investment in the necessary equipment and digital infrastructure is becoming a growing prerequisite for firms to engage digitally and be linked into larger, even global networks. Box 4-2 touches on the importance of public investment in infrastructure at the macro level.

More broadly, there is very little understanding of what keeps many firms from investing in new equipment that could boost their productivity, but it is known that, indeed, the slowdown in capital investment is strongly related to slower productivity growth. According to IMF estimates,

BOX 4-2 The Macro Barriers to Investment and Productivity

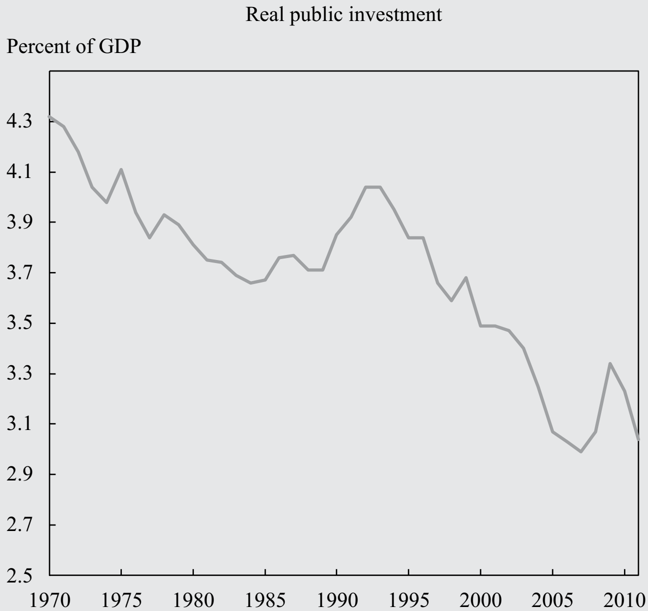
In the short run, investment can stimulate economic activity and demand. In the long run, it can raise potential output by raising productivity. The role of investment in enhancing productivity is structural in nature, though firms' investment decisions are driven by both short- and long-run factors. Weak aggregate demand in the post-crisis period, declining public investment, and heightened levels of policy uncertainty are some major macro-level factors that encourage firms to delay investment decisions.

Weak Aggregate Demand. Several studies by the IMF, OECD, and others have established that weakness in aggregate demand has been a major contributor to weak investment in the post-crisis years. Many economies have been stuck in a low-growth, low-investment equilibrium, generating concerns that the shock of the financial crisis may lead to permanent declines in the productive capacity of the economy. Estimates by researchers at the OECD suggest that the shock to demand after the crisis may have reduced the aggregate capital stock by about 3¼ percent across OECD countries (Ollivaud and others 2016). Reduced capital investment not only reduces the contribution of capital to labor productivity, but it also reduces the diffusion of technological progress embodied in capital.

Declining Public Investment. Public investment, particularly in infrastructure, has generally been linked to faster productivity growth when done effectively. A study by John Fernald of the San Francisco Fed finds that road investment boosted productivity in the United States in the 1950s and 1960s, and a more recent 2014 study in the *Journal of Economic Surveys* finds that public investment, especially by local or regional governments into roads, railways, and utilities, can also stimulate private investment. However, over the last few decades in advanced economies, public investment has been declining as a share of GDP.

Heightened Policy Uncertainty. Economic policy uncertainty in the post-crisis period appears to have played a significant role in delaying investment decisions by firms and generating an adverse

FIGURE B4-2 Declining Real Public Investment in Advanced Economies



Source: IMF (2014).

effect on productivity. The "wait and see" approach by firms led them to cut investment and shift their focus toward shorter-term, lower-risk, and lower-return projects. A 2016 paper in the *Quarterly Journal of Economics* estimated that this effect of increased uncertainty contributed to the post-crisis slowdown in TFP growth by around 0.2 percent a year for Europe, 0.1 for Japan, and 0.07 for the United States compared to pre-crisis years (Baker, Bloom, and Davis 2016).

the impact that declining fixed capital formation has had on total factor productivity has been significant, particularly since the 2008 financial crisis. The evidence is clear that in advanced economies the slowdown in investment began before the crisis, but its contribution in explaining the slowdown in productivity growth has become more important since. Extrapolating from this evidence one can argue that, for firms, investment in capital has become more important in explaining productivity growth over the past decade.

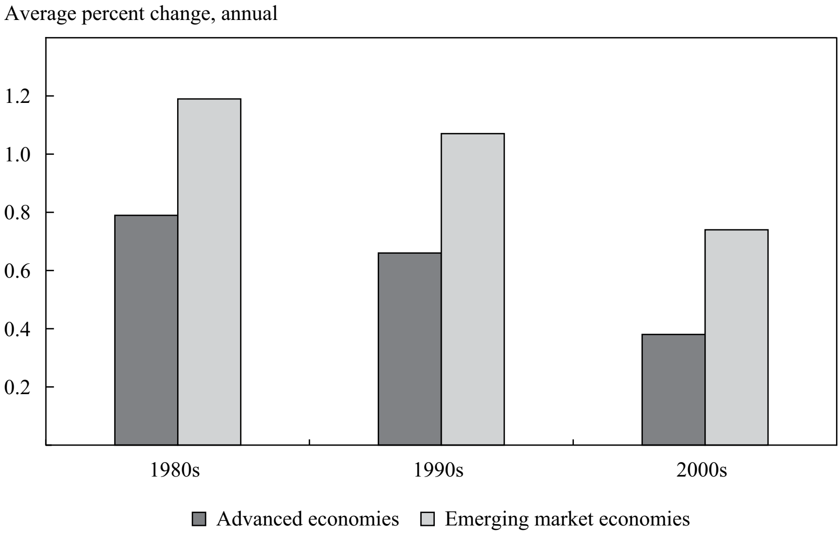
According to the OECD, fewer than 30 percent of SMEs in OECD countries use cloud computing. They are discouraged by both the high costs of upgrading to digital infrastructure and concerns over costly security risks (OECD 2016b). There is an important distinction between the two reasons. The first relates to access to capital, which we have discussed. The second relates to uncertainty on the returns to that investment due to high risks. Clearly, this might be an important component explaining the lack of investment in productivity-enhancing equipment for firms, in particular small ones. The benefits of upgrading to a digital infrastructure could be outweighed by the costs of something going bad, which is not unusual even for firms that invest highly in digital security. For instance, in the early fall of 2017, it became news that Equifax—a firm with over $3 billion in annual revenues and about 10,000 employees—had a serious digital security breach compromising private data of about 143 million U.S. consumers (Gressin 2017). If large and established firms struggle with their digital infrastructure, it is clear that investing in productivity-enhancing equipment of this new era comes with risks that could well outweigh the returns. Gartner Inc., a publicly traded research and advisory company, estimates that worldwide spending on information security reached $90 billion in 2017 and will top $113 billion by 2020 (Gartner Inc. 2017).

Human Capital and Skills

Workers and the skills they bring in are a crucial input of productivity growth. Workers are inherently different in the skills they bring to the workforce, and some—if not most—firms struggle to recruit the best-suited workers.

But even when looking at skill accumulation from a macro perspective, we can understand some of the current trends. Take schooling, for example, which provides a basic set of skills useful across all industries. Given that levels of schooling have increased significantly across the globe, naturally, the rate of human capital accumulation is now slower. The IMF estimates that this slowdown in the accumulation of human capital can explain up to 0.3 percentage points a year of "missing" productivity growth (see

FIGURE 4-8 Contribution of Human Capital to Labor Productivity Growth



Source: IMF (2017).

figure 4-8). In addition, population aging in advanced economies and major emerging economies like China adds more friction to the pace of human capital accumulation and the supply of labor across firms.

When assessing the skill level of workers in a particular firm, an important indicator is wages. When looking at average wages across firms and, in particular, the growing gap between firms that pay more and those that pay less for the same position, it becomes apparent that the most skilled workers are in the firms that pay more. The fact that some firms pay higher wages to their employees might also reflect the fact that these employees are simply more productive, but that would be the case when there is fully fledged competition (more on this later).

On the other hand, if the reason some firms are able to retain workers by paying them more is because these firms' profit margins are much larger than the sector average, then this would reduce labor turnover and, with it, the ability of smaller firms with high potential to attract better workers. A 2018 paper published in *Econometrica* (Eeckhout and Kircher 2018) uses German employer-employee data to find that technological change is helping to drive "assortative matching" at large firms, where skilled workers are joining firms where other skilled workers are, which is, increasingly, in large productive firms, leaving less space for other firms to hire skilled workers with knowledge in the industry. In addition, a 2017 study by economists at Harvard University, the U.S. Census Bureau, and the Institute for Social Research in Norway found that productivity is higher in manufacturing firms with a higher share of scientists and engineers involved in business operations (that is, not in R&D roles), facilitating the adoption of some technologies in the production process. The earnings of these employees tend to be higher than the earnings of their counterparts in other plants with a lower share of scientists and engineers (Barth and others 2017).

A body of economic literature shows that the skill and effectiveness of managers, in particular, has an impact on productivity, with notable variation between high- and low-productivity firms. In a neatly run experiment across Indian textile firms, economists measured the effect of improving management practices on productivity (Bloom and others 2013). Some firms, randomly selected, received five months of customized guidance on how to improve management practices—like factory operations, quality control, inventory management, and human resources management—from a large international management consulting firm, while the other Indian firms, which served as the control group, received one month of diagnostic consulting but no help in implementation.

The results were striking. First, plants that received the most guidance improved their overall productivity by an average of 11 percent (in this example, primarily through improved quality and efficiency and reduced inventory). They also became less decentralized in the decisionmaking process as owners delegated more tasks to middle managers and invested more in computers for data gathering and monitoring day-to-day activities. Among all the plants in the control group who received one month of diagnostic and no help in implementation, only about 10 percent ended up adopting best management practices. Thus, the problem goes beyond information on the existence of the technology. For a firm, possession of such information does not directly translate into adoption.

Research has shown vast differences in managerial skills across firms. A survey of about 700 manufacturing firms across the United States, the United Kingdom, France, and Germany shows strikingly large differences in management scores (Bloom and Van Reenen 2007). The score is based on managers' knowledge of things such as operations; and their practices in terms of monitoring, defining targets, and providing incentives to workers. Better management scores are found in firms exposed to the strongest competition and that have higher-quality workers. They tend to be lower in family firms where management is hereditary from generation to generation. Differences in management practices strongly explain differences in gross output, growth, and the probability of exit from the market. These are all variables that strongly correlate with productivity.

It is not clear, however, why firms—small firms in particular—would decide not to adopt best managerial practices to begin with. There are two possible explanations put forward by experts that seem important: first, the lack of belief by the current management that adopting best practices would actually result in better outcomes; and second, lack of time due to understaffing and other competing demands.

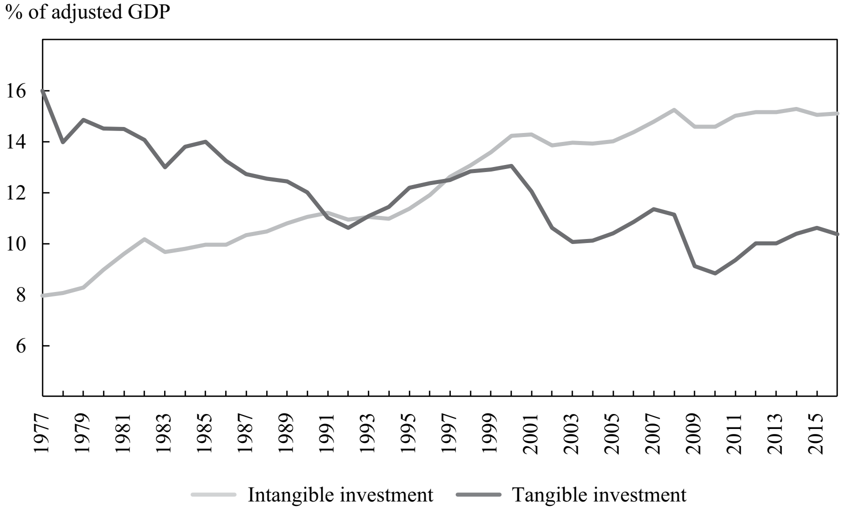
Investing in Intangible Inputs: Knowledge-Based Capital

Since the 1980s, business investment has shifted away from investments in machinery and equipment to investment in knowledge and other intangible knowledge-based capital (KBC) such as organizational capital (for example, internal decisionmaking and business processes), training, branding, supplier and distributor relationships, software, databases, design, and other forms of intellectual property. Even after the investment shock of the 2008 financial crisis, investment in KBC held up better than investment in tangible capital (figure 4-9). Investment in intangibles has emerged as increasingly important to underpin innovative activity and adoption. In a 2002 Brookings paper, Erik Brynjolffson, Lorin Hitt, and Shinkyu Yang estimated that for every dollar of investment in computer hardware, firms needed to invest an additional $9 in software, training, and business process design.

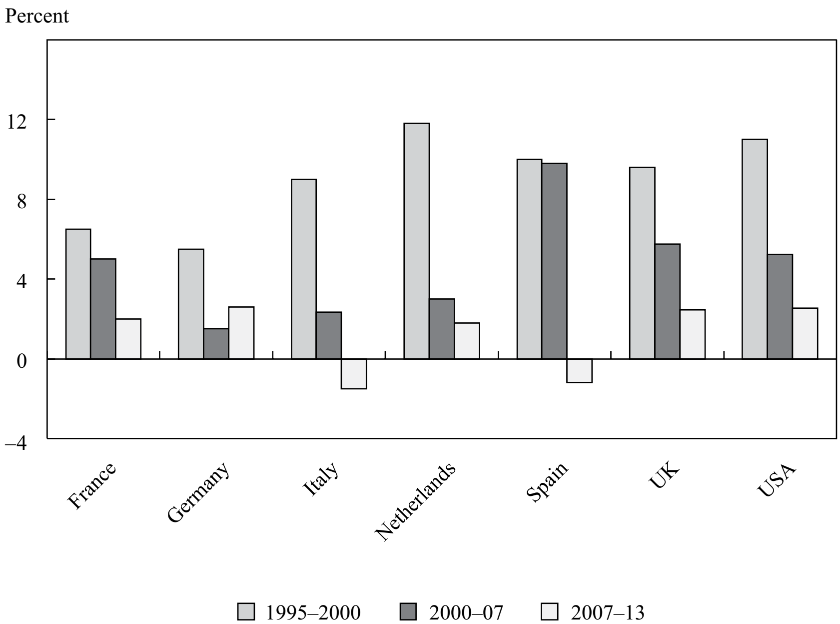
The process through which firms innovate requires investment in organizational knowledge—like reorganizing production lines, business processes, or organization structures—or even in a firm culture that engages workers and enhances productivity. From the standpoint of an economist, these investments should always be worthwhile as long as the returns raise profits. The challenge to these investments is that there are plenty of

FIGURE 4-9 **Intangible Investment in Knowledge-Based Capital**

Business investment in KBC and tangible capital, US, 1977–2015



Average growth in investment in KBC



Source: Based on Corrado and Hulten (2010) and OECD (2016a).

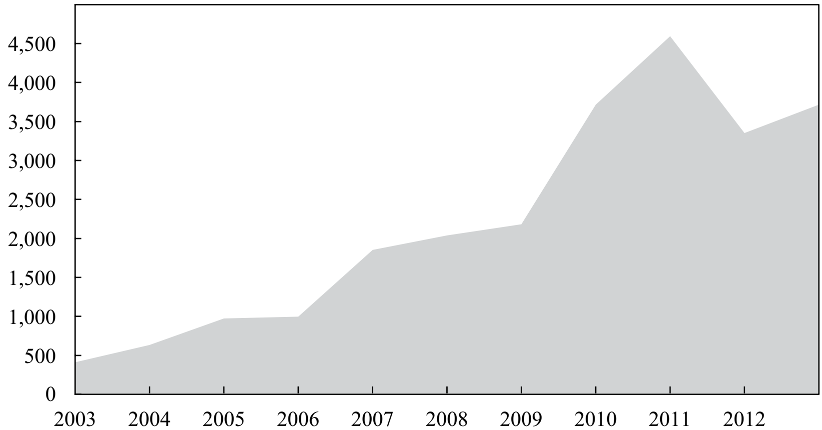
market failures related to investing in knowledge, and the intellectual property system used to address some of these failures has not been working as intended, especially over the last ten to fifteen years.

For example, the returns to investment in R&D, a component of knowledge-based capital, can easily be appropriated by copycat firms that have not made the original investment. Consider a winery that decides to grow a type of grape that no other winery in its geographic area grows. This involves costly research, training, and a lot of trial and error in adapting existing methods implemented by other wineries in remote locations to local conditions, such as quality of land and weather. Even after those expenses, typically more investment in marketing and, if necessary, reinventing ways to deliver the new product to nearby and remote consumers will follow. After all this investment, the winery will be able (if successful) to enjoy the rents of selling its new wine.

Yet, the knowledge generated by the winery in growing this unique grape in the local climate could easily be imitated by competing wineries with similar geographic conditions. In the absence of any patent or intellectual property system, the winery will have no incentive to make such costly investments if its competitors will appropriate the returns. On the other hand, under the current regime, the process of registering and enforcing intellectual property can be quite costly, particularly for smaller firms. The costs associated with globally protecting a patent quickly add up with the number of countries where the patent is to be registered in, and could reach, in some cases, hundreds of thousands of dollars. These costs could be prohibitive for small and medium firms relying on R&D investment to adopt technologies that could then be appropriated by others.

Difficulties associated with adoption of technologies from the frontier can also be associated with too much patent protection, which slows the pace of technological diffusion. Given that large firms are able to protect their intellectual property much more effectively, this would discourage small firms from adopting existing technologies originated by large firms in order to avoid the risks associated with legal battles that may follow. In the United States, the number of firms involved in patent conflicts, being sued by "patent trolls" (companies that are fully devoted to initiating legal battles against firms, mostly small ones, that are, presumably, violating intellectual property laws) grew by a factor of nine in the decade that followed 2004 (figure 4-10). Research suggests that firms that have been sued

FIGURE 4-10 **Rise of Patent Trolls: Number of Unique Defendants in Patent Troll Lawsuits**



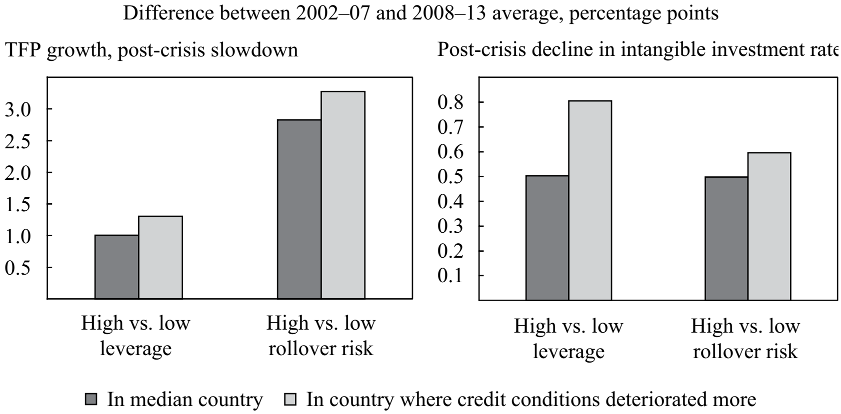
Source: Bessen (2014).

on the basis of intellectual property violation by patent trolls reduce their R&D investment and get less external funding following the episode (Bessen 2014).

It is clear how complicated the system of intellectual property protection can be. Without proper protection of intellectual property, there is underinvestment in R&D, but abuse of the system can make adoption of existing technologies legally problematic and costly. Some authors have suggested rethinking the patenting system to deal with possible frictions faced by small firms when adopting innovations in the industry (Baily and Montalbano 2016). A more efficient patenting system, which allows small firms to adopt technologies without risking losing all their capital in legal battles, could fuel productivity growth.

When it comes to investing in KBC more broadly, credit constraints and access to finance have played a role in slower intangible investment growth and productivity. Firms that face credit crunches tend to respond by cutting nonessential expenses, and R&D investment is typically one of them. In fact, tighter credit conditions after the 2008 financial crisis played a role in reducing financially vulnerable firms' investment in intangible assets. An IMF study found that firms with weaker balance sheets (higher

FIGURE 4-11 **Impact of Tight Credit Conditions on Post-Crisis TFP Growth and Intangible Investment**



Source: IMF (2017).

leverage and greater short-term external financing needs) reduced their investment rate (as a share of total value added) by 0.5 percentage points more than less financially vulnerable firms. In countries where credit conditions tightened even more, the difference increases to 0.8 percentage points (figure 4-11).

Furthermore, having the ability or incentive to invest in knowledge is one thing, and having the capability and knowledge to effectively use that knowledge is another. A report by the McKinsey Global Institute estimates that, in the United States, lagging sectors are less than 15 percent as digitalized as the leading sectors, but the report finds that this gap has less to do with investment in IT equipment than it does with the ability of firms to engage digitally with their suppliers and customers (McKinsey Global Institute 2015a). This kind of engagement encompasses digital payments, advertising, or interactions on social media and in virtual marketplaces. The gap is, therefore, more a result of know-how in using digital technology than in having digital technology. Developing an effective digital engagement strategy often requires training, new business processes, a branding strategy, new designs, and other forms of knowledge-based capital—the kind that laggard firms could benefit from.

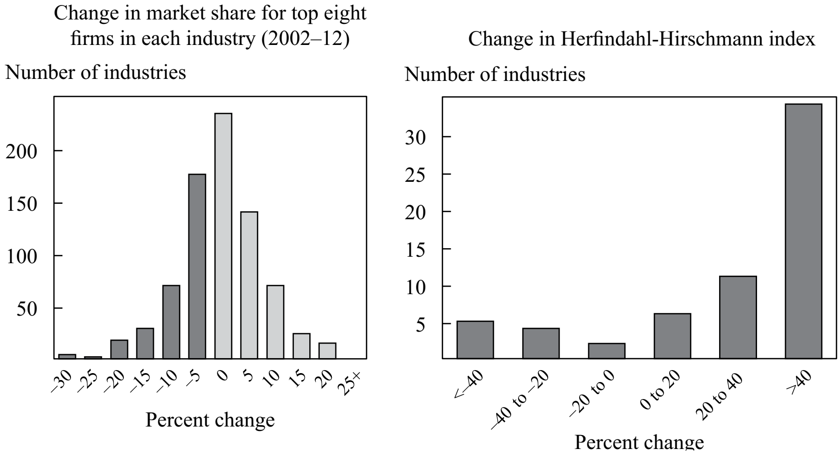
Putting the Focus on Competition

During almost a century since the early 1880s, the iron ore mines of Minnesota were the main supplier of iron ore to the American steel industry located mainly in the Great Lakes area. There was one reason for this: other iron ore producers in other locations, such as Brazil and Australia, could not compete with American miners given the high transportation costs. But this changed in the early 1980s when Brazilian producers began delivering iron ore to steel producers in the United States at lower prices than Minnesota could manage. Unexpectedly for the American iron ore producers, competition had arrived.

In response to increased competition, the iron ore industry in the United States underwent important changes that led it to increase its productivity.[6] After being unchanged for decades, iron ore producers doubled their productivity within five years following the arrival of competitors. Capital and material productivity increased as well (for example, the efficiency with which producers use machines and materials, respectively). These improvements came mostly as a result of a relaxation of work practices that had been in place for decades and had led to overstaffing and the underuse of machinery in significant amounts. These changes, which allowed the American iron ore industry to thrive, were not necessarily innovative on their own, but rather an adoption of best practices from other firms in the industry. It was competition that provided the incentives for these firms to adopt best practices to remain relevant by investing in organizational knowledge.

The link between competition and firm productivity is widely established in the literature. With no competition, even if the firms have the ability to invest, they might not have the willingness to invest if there is little competition that threatens their profitability. Thus, competition incentivizes firms to invest in the adoption of new knowledge, whether by hiring better trained workers, acquiring new and more efficient physical capital like IT systems, or investing in organizational knowledge and best practices. A recent study by researchers at New York University concluded that one of the key forces explaining up to 80 percent of the recent decline in private investment in the United States is less competitive markets (Gutierrez and Philippon 2017).

FIGURE 4-12 U.S. Rising Market Concentration



Sources: OECD (2016); Grullon, Larkin, and Michaely (2017).

Note: HHI index data is based on Compustat data (Grullon, Larkin, and Michaely 2017).

Rising Market Power and Falling Competition

Over the last two to three decades, levels of competition have been declining across a range of industries. First, rising levels of market concentration suggest that monopoly power is rising across industries (figure 4-12). In the United States, the market share of the fifty largest companies increased in three-fourths of broad industry groups between 1997 and 2007. The market share of the top four firms in six broad sectors (manufacturing, finance, services, utilities, retail, and wholesale) increased by 4 percent to 15 percent between 1982 and 2012 (Autor and others 2017).

Rising market concentration by itself, however, is not enough to conclude a decline in competition. For example, consider an industry protected by regulations that block the entry of large, highly productive firms—like some towns blocking Walmart to protect local businesses. Suppose this entry barrier is suddenly removed, and the large firm enters the market and forces the other small, less productive firms to close because they cannot compete with the more productive firm's low prices (a classic example of the Darwinian selection process). We now have a situation where the elimination of an entry barrier made the market more competitive, but the result was an increase in market concentration as the most productive firm began to dominate. Note that the competitiveness of the big firm came from its ability to lower prices, thanks to its scale and higher productivity, enough that smaller firms would be unable to compete and would be forced to exit the market.

Over the last few decades, however, it has not been the case that prices and profit margins have declined as one would expect with stronger competition. In fact, price markups have been growing and corporate profits have been rising at record rates. Price markups, the difference between the price and the cost of a product, have grown while costs have generally declined with lower costs of labor and more globalized supply chains. For the thirty years between 1950 and 1980, U.S. firms' markups of prices over costs had been roughly stable. Since then, however, they increased from 18 percent in 1980 to 67 percent in 2014 (De Loecker and Eeckhout 2017). Across all global corporations, profits have more than tripled, from $2 trillion in 1980 (7.6 percent of world GDP) to $7.2 trillion in 2013 (9.8 percent of world GDP), with companies from advanced economies earning more than two-thirds of the total (McKinsey Global Institute 2015b).[7]

A University of Chicago study finds that rising markups and profits in the United States have been most pronounced in industries with large increases in market concentration (Barkai 2016). The study finds that the declining labor share of income that has been under way in the United States since the early 2000s does not necessarily mean that the capital share has risen. After paying workers their salary, the remainder is usually considered the capital share of national income. The study, however, splits this capital share into two parts. The first is the returns from capital (what it calls the capital share), and the other part is the level of profits. This exercise revealed that the profit share of national income has risen from 2 percent in 1984 to 16 percent in 2014 in the United States, while both the capital and labor shares have fallen. The implication is that firms' profits are not coming from capital accumulation and returns on productive investments but from higher markups, reduced competition, and increased barriers to entry. In those industries that have become most concentrated, the profit share has risen the most.

Higher price markups and record corporate profits suggest that the rise in concentration is indicative of weaker, not stronger, competition. The slowdown in business dynamism described earlier weakens competitive pressure coming from relatively fewer new entrants. Across the OECD, small firms accounted for around 20 percent of all firms in 2002. Over a decade later, that share had fallen to just 12 percent. With less competitive pressure, the incentive for making costly productivity-enhancing investments wanes.

What Could Be Holding Back Competition?

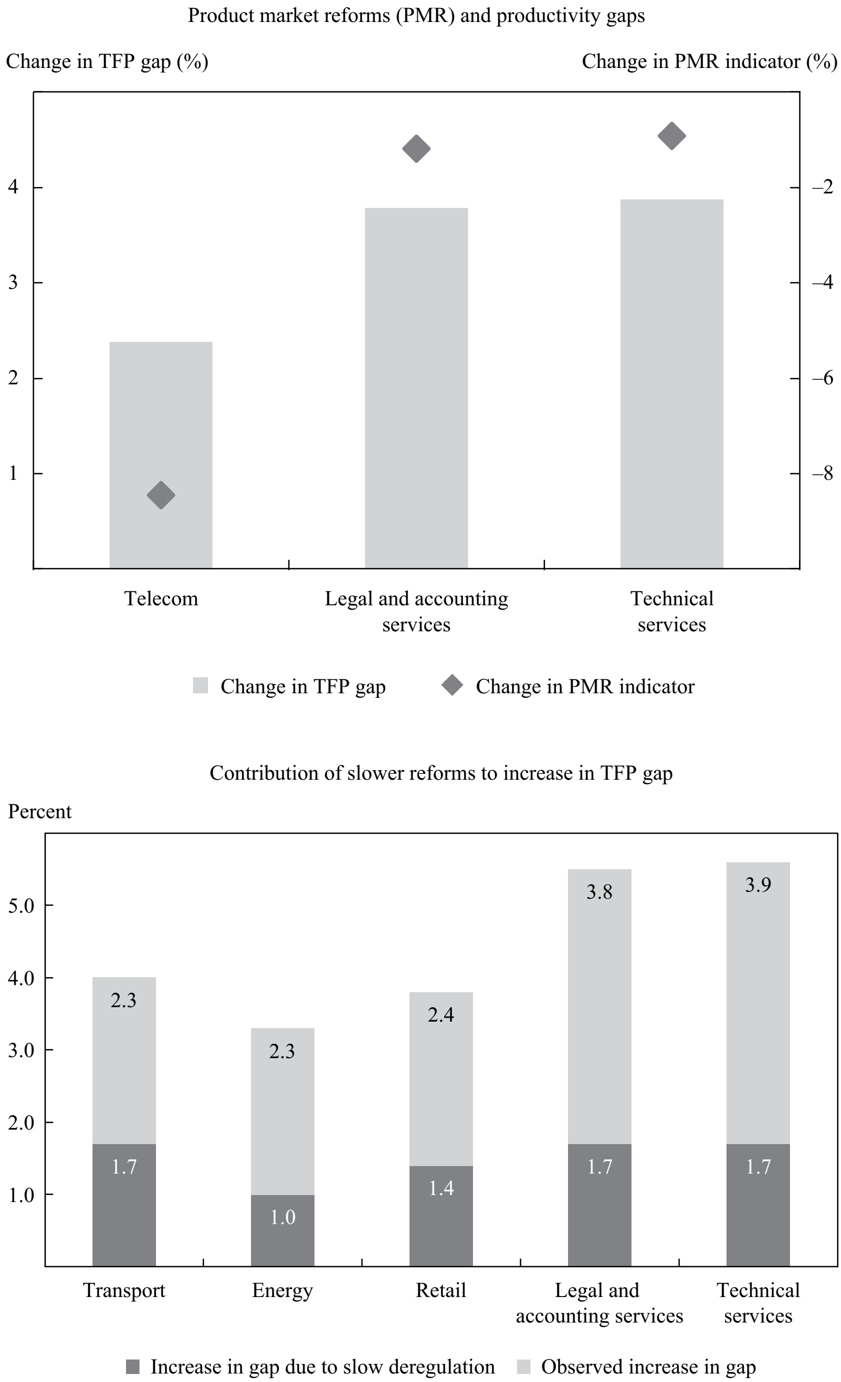
The weakening of competition overall is partly a result of the slow pace of pro-competition national reforms, the slowdown of international trade, winner-take-most dynamics taking hold especially in IT-intensive industries, and a wave of industry consolidation.

The slow pace of regulatory reforms in product and labor markets has helped weaken the competitive pressures on firms to make productivity-enhancing investments. Empirical studies by researchers at the OECD find that competition-promoting reforms in product markets tend to boost investment and capital intensity, which as we know can be a source of technology adoption through capital-embodied technologies (figure 4-13). Other studies have shown that lower levels of competition resulting from outdated or ineffective regulations has notably slowed down the diffusion of general-purpose IT technologies in continental Europe.

Data on product market reforms (PMR) in service industries reveal that the divergence between high- and low-productivity firms is greater where the pace of reform is slower. Across these sectors, up to half of the increase in the gap between high and low productivity may have been avoided with faster market liberalization in services. The top panel of figure 4-13 shows the relatively faster pace of reforms in the telecommunications industry and the lower dispersion of firm productivity in that industry in comparison to the slower pace of reform and wider productivity gaps in other industries (in the figure, lower value of the PMR indicator denote more reform—reduced restrictiveness of regulation). The bottom panel of the figure estimates by how much the pace of reforms actually contributed to the increased gap between high- and low-productivity firms across services industries.

Another plausible contributor to the overall slowdown in competition and productivity is the slowdown in international trade. Prior to 2012, world trade grew twice as fast as world GDP. Since then, it has barely kept pace. On one hand, higher levels of international trade can add pressure on firms to adopt technologies and best practices by simply promoting more

FIGURE 4-13 Slowing Pace of Product Market Reforms in the OECD, 1998–2013



Source: Andrews, Criscuolo, and Gal (2016).

competition to local firms. But it goes beyond that. Often, intermediate inputs—through global value chains—in the production process play an important role in the ability of firms to produce at lower costs. A growing body of evidence suggests that increased trade in intermediate inputs boosts productivity growth by increasing the variety of inputs or allowing firms to specialize in narrower and more defined tasks in the production process.[8]

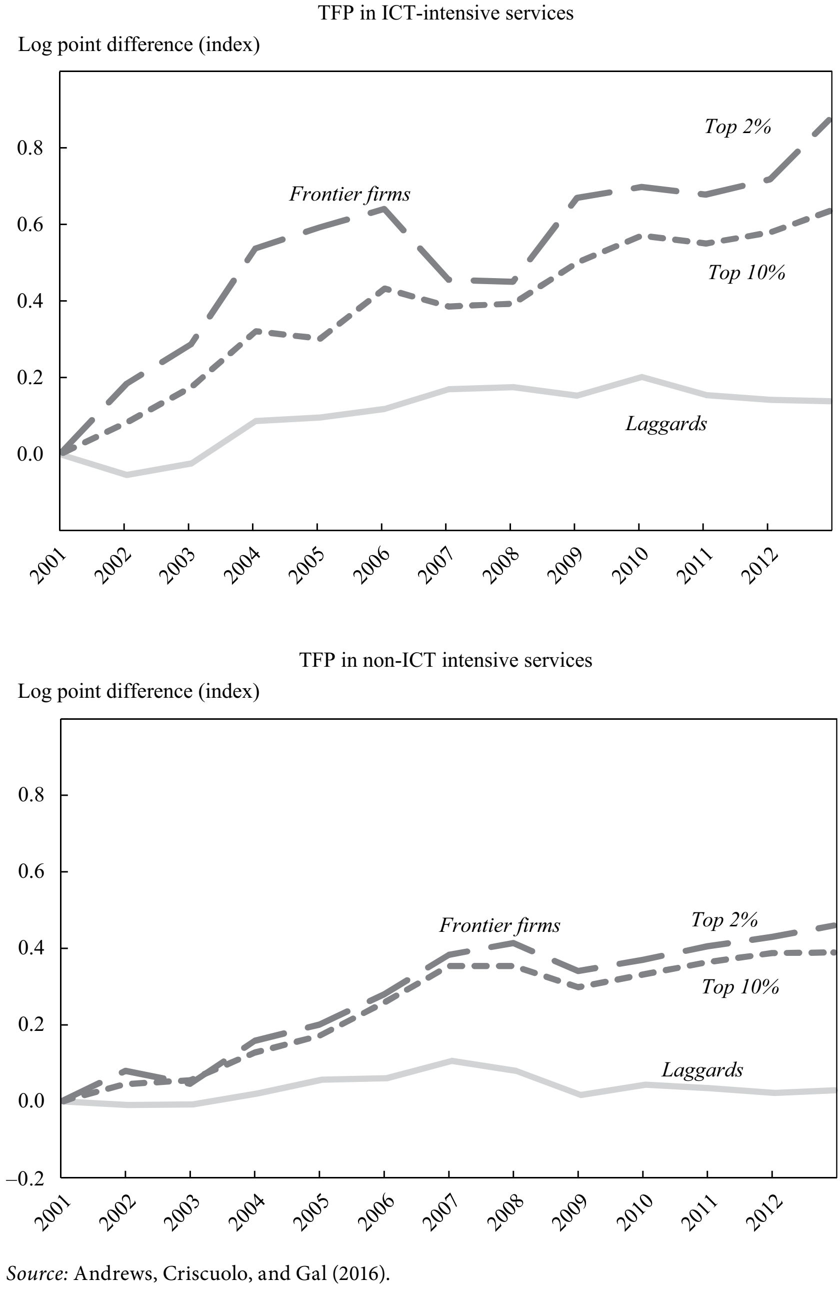
However, the slowdown in international trade since 2012 and the general maturation of global supply chains, or of China's deeper integration into the world trading system, could imply a slowdown in productivity gains from trade going forward. With less competitive pressure from foreign firms, either through import penetration where the pressure grows on domestic firms to innovate or through export penetration where domestic firms are competing at the global level, incentives for firms in tradable sectors to make productivity-enhancing investments chip away.

More fundamentally, the nature of competition itself is changing with fast-growing digital platforms and rising ICT intensity across industries. In services industries with high levels of ICT intensity, there is a significantly larger productivity gap between leading and lagging firms than in other services industries with low levels of ICT intensity (figure 4-14). This could reflect that the winner-take-most dynamics in these markets is changing competition and making it difficult for a broader range of small firms to compete.

In markets with winner-take-most dynamics, massive scale is often required to remain competitive. In an online marketplace, for example, where these properties are strongest, consumer choice is plentiful, and the ease of choosing one product over another often takes little more than a click of a mouse or the lure of a new network whose popularity has gone viral. Indeed, we see natural monopolies most clearly where there are network effects. For example, Facebook owns 77 percent of mobile social traffic, Google has 88 percent of search advertising, and Amazon.com has a 74 percent market share in the e-book market (Foroohar 2017).

More broadly, however, increased digitization has generated an explosion of data on consumer habits and preferences that firms are in a race to collect and own for competitive advantage. The more data a company has on a consumer, the more it can cross-sell customized and personalized services across traditional industry boundaries. Small firms are at an inherent disadvantage when data is owned by the larger firms that have the scale and IT infrastructure to collect it.

FIGURE 4-14 Higher TFP Dispersion in IT-Intensive Services



Source: Andrews, Criscuolo, and Gal (2016).

The large firms that have come to dominate these markets (as of April 2018, Google's parent company Alphabet, Amazon, Apple, Facebook, and Microsoft are the highest-valued publicly traded companies) have also created ecosystems where small firms can operate at lower costs but, ultimately, face high barriers to actually compete at scale. For example, Google and Amazon offer platforms and services like cloud computing and open-source software that small firms can use to start-up at low cost and operate globally with video conferencing, code repositories, and mobile phones. Most large tech firms also offer financing and venture investing for start-ups and promising small firms (Varian 2016). In these ecosystems, however, small firms are reliant on the large providers that may have seats on their boards or acquire them should they develop a capability that would allow them to expand their reach, or if they become a competitive threat.

In fact, a wave of mergers and acquisitions has consolidated a variety of industries and contributed to the rise in market concentration and divergence between high- and low-productivity firms. Some of these acquisitions have been by the large tech firms as they expand their reach, such as Facebook acquiring Instagram for $1 billion in 2012 and WhatsApp for $19 billion just two years later, which gave Facebook immediate scale in the messaging market (Rusli 2012; Kuchler and Bradshaw 2014). Perhaps the most notable example of large tech firms blurring industry boundaries is the entrance of Amazon.com into the grocery market with its acquisition of Whole Foods in 2017 for $14 billion in 2017 (Turner, Wang, and Soper 2017).

The scale of M&A activity in recent years is much larger than the activity of a few firms, however, revealing the growing importance of size in remaining competitive and securing a larger share of profits and stronger market power. In 1990, there were 11,500 M&A deals globally, with a combined value of 2 percent of world GDP. Between 2008 and 2014, there were around 30,000 deals each year, totaling roughly 3 percent of GDP. In 2015 alone the value of M&A deals exceeded $5 trillion, the highest amount in any year on record. Thirty-seven percent of the value of these consolidations surpassed $10 billion, almost double the average of 21 percent in the five preceding years.[9]

Critics in the United States, where about half of the $5 trillion in global M&A deals took place, suggest lax antitrust enforcement due to shifts in political priorities, shrinking fiscal budgets, or insufficient capacity to investigate a rising number of transactions has facilitated the size and frequency of successful mergers. The underlying issue of the changing nature of competition in the digital age looms large over antitrust and competition policy more broadly.

Taking Stock

The wide gap between high- and low-productivity firms points to a central feature of the productivity paradox—small firms' lack of adoption of productivity-enhancing technologies. A broad range of evidence comes together to suggest that this lack of adoption could be the result of underinvestment in the tangible and intangible inputs to adoption. This underinvestment is largely a result of reduced incentives from lower competition and of growing frictions in the supply of the inputs themselves.

It is difficult to decisively point to a single source driving the underinvestment in technology adoption. Declining competitive pressures—as seen by fewer start-ups, rising market concentration, rising markups, and fewer small productive firms growing into large firms—suggest reduced incentives for small firms to make costly productivity-enhancing investments. On one hand, incumbents can focus on protecting their market power and on raising prices. On the other hand, smaller and newer firms are finding it difficult to justify costly investments if their chances to make a decent return or gain market share are low. More competition could, therefore, play an important role in encouraging some firms to invest in their productivity. Some policy levers include public-private risk-sharing efforts in R&D investments and other forms of knowledge (including workforce training), a restructuring of the patenting system, smart antitrust enforcement, faster product market reforms, and a new framework for competition policy in winner-take-most markets.

Frictions in the supply and access to the key inputs of technology adoption also contribute to the observed underinvestment by small firms. While financing constraints after the global financial crisis in 2008 have persisted for many years and constrained the ability of some small firms to raise capital, evidence suggests there are also constraints in what they can actually invest in. Most notable is the slowing growth in the supply of human capital and the observed tendency for highly skilled workers to cluster among high-productivity firms, making it harder for smaller firms to hire and keep these workers. This is especially important given the growing role of intangible and knowledge-based capital in firm productivity. At the national level, greater or more effective investments in infrastructure, education, and R&D could play a significant role in ensuring that access to quality inputs are available to a broad range of firms in an ecosystem of innovation, adoption, and knowledge.

Notes

1. An important caveat, however, is that there is a limitation to R&D data; it only captures some of what economists would consider research. For example, in the United States, 70 percent of measured R&D happens in the manufacturing industry, while some big companies, like Walmart and Goldman Sachs, report doing zero R&D (Jones 2015, Wolfe 2014).

2. A rapid increase in the number of domestic and foreign patents granted by the U.S. Patent and Trade Office began in the 1980s, but a significant portion of that increase can be explained by new legislation that extends patent protection to business models and software as well as changes in the judicial appeals process for patent cases (Jaffe and Lerner 2006).

3. Respondents to this point show that, prior to 2000, declining firm entry rates were predominantly driven by retail and services sectors, where the shift from small establishments to fewer large firms who took advantage of IT and globalization accounts for the rise in U.S. productivity in the late 1990s and the concurrent decline in business dynamism. Meanwhile, the high tech sectors were experiencing an increase in business dynamism until 2000, when start-up rates and the number of initial public offerings (IPOs) began to slow down (Decker and others 2016).

4. Some variation exists across countries. For example, spreads in the United States and United Kingdom have declined since 2007 where credit has tightened through other channels.

5. Cette, Fernald, and Mojon (2016) cite several studies.

6. See Schmitz (2005) for a comprehensive study of this episode.

7. Profits before interest and taxes.

8. Amiti and Konings (2007) use plant level data from Indonesia to find that the productivity effects of a reduction in tariffs on intermediate inputs were twice as large as a reduction in tariffs on final goods. Goldberg and others (2008) find productivity gains in India from reduced tariffs on intermediate goods, which increased input variety, and Ge and others (2011) find similar results for China. From Kowalski and Buge (2013).

9. As pointed out in a report by the U.S. Council of Economic Advisors in 2016, waves of mergers and acquisition tend to occur when stock market valuations are

high, and between 2010 and 2015 the stock market valuation of the S&P 500 index on the New York Stock Exchange increased by almost 60 percent. This suggests that the added intensity of M&A activity in recent years may have been exacerbated by cyclical factors, but nevertheless markets will remain consolidated, all else equal.

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FIVE

Rising Inequality

Is There a Technology-Productivity-Distribution Nexus?

ZIA QURESHI

Previous chapters have documented the slowdown in productivity growth and the concurrent rise in income inequality in most advanced economies, as well as in many major emerging economies, over the past two to three decades. The previous chapter explored factors that help explain the paradox of slowing productivity growth in a period when technology seems to have been booming. This chapter seeks to understand the causes of the rise in income inequality within countries, based on a synthesis of recent and ongoing research. Specific factors affecting income distribution differ from country to country, of course; the aim here is to identify and evaluate key factors that have been at play more or less broadly across countries. The focus in this chapter is more on advanced economies, which have seen larger and more consistent increases in inequality in recent decades, but several of the factors discussed are relevant in varying degrees to the rise in inequality occurring in some major emerging economies.

A theme that runs through the chapter is the interconnectedness of the productivity slowdown and the rise in income inequality. There is a growing body of recent research that suggests important common foundations, policy developments, and linkages connecting these two trends, with technological change playing a key crosscutting role (OECD 2016a, 2017a).

This research points to a nexus between technological change and the productivity and distributional dynamics. Not only can higher inequality entail adverse consequences for longer-term growth, as research over the past couple of decades has increasingly shown, but rising inequality and slowing productivity—the main driver of longer-term growth—may be linked by common causes.

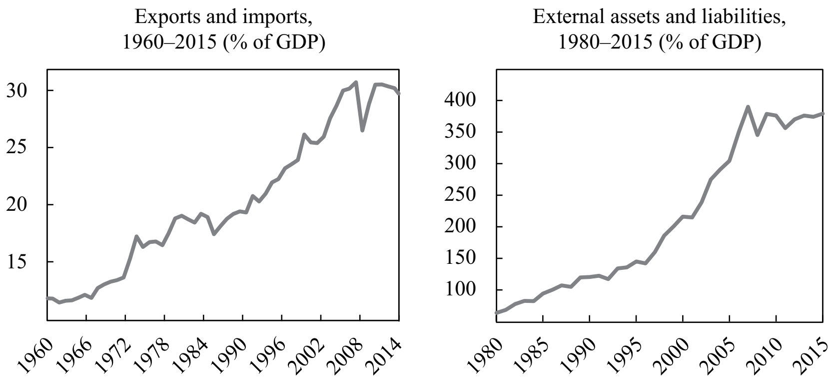
Globalization, Technology, or Policies

It is commonplace to see the debate on the causes of rising inequality, especially in advanced economies, couched in a binary way: globalization or technology. While the simplicity of this question is appealing, this framing is misleading. The reality is much more complex. Globalization and technological change have, indeed, been two major global forces affecting how gains from economic growth have been shared over the past two to three decades. But there also have been important policy and institutional factors that have affected distributional outcomes, including influencing how potential distributional impacts of globalization and technological change actually play out in specific country contexts.

The period since the 1980s, when income inequality rose in most advanced economies, also saw an acceleration in globalization. The increase in international trade integration was especially strong in the 1990s and 2000s until the growth in trade slowed in the wake of the global financial crisis and the ensuing recession. Globally, the ratio of exports plus imports of goods and services to GDP rose from 39 percent to 61 percent between 1991 and 2008 (figure 5-1, left panel), a period characterized as one of hyperglobalization (Subramanian and Kessler 2013). Financial globalization also advanced rapidly over this period as international capital flows, both cross-border direct investment and bank lending and portfolio investment, surged (figure 5-1, right panel).

The expansion of international trade and investment has been an important engine for economic progress in both advanced and emerging economies, spurring efficiency and productivity and creating new markets and opportunities for growth. In emerging economies, globalization, complemented by a pick-up in domestic policy reforms, helped launch a period of accelerating growth that saw incomes in these economies begin to converge

FIGURE 5-1 Globalization: Trade and Finance



Source: World Bank and IMF data.

on incomes in advanced economies. It generated significant positive net economic benefits for both groups of economies while also contributing to some reduction of the high-income inequalities between them.

The gains from globalization, however, have not been distributed evenly within countries. As national income inequalities rose, an active debate developed on the role of globalization as a responsible factor. This debate has featured both analyses by prominent economists (for example, Stiglitz 2002, Krugman 2008, Bourguignon 2015, Maskin 2015, Milanovic 2016, Rodrik 2017) and a contentious discourse in the political domain. Perceived concerns about the impact of globalization on inequality have given rise to a populist backlash against international trade in many countries in recent years.

A challenge in evaluating the impact of globalization on income inequality is the difficulty of disentangling its effects from other factors, notably technology. Globalization and technology are intertwined. Globalization owes much to innovations in transportation, information, and communication technologies that made more international commerce in goods and services possible; and globalization acts both as a spur to technological change and a conduit for its wider dissemination. For example, offshoring of some of a firm's processes and services owes much to advances in information and communication technologies. Increased competition from trade with low-wage countries might push firms to innovate and automate production processes (Bloom and others 2016).

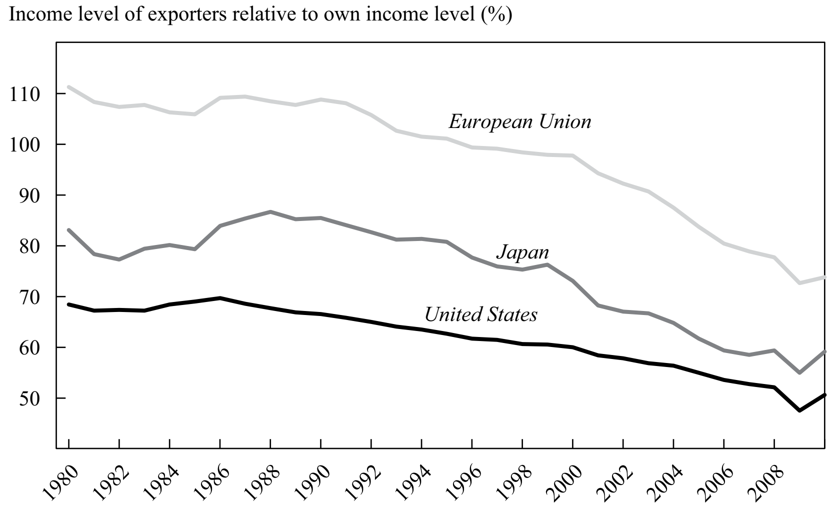
Notwithstanding these challenges, researchers have attempted to assess the impact of globalization on inequality. On balance, research shows that globalization has contributed to the rise in inequality in advanced economies, but overall its role has been limited relative to the more pervasive role of technological change and developments in national economic policies (Dabla-Norris and others 2015, Obstfeld 2016, Helpman 2016, IMF 2017a, OECD 2017b).

In advanced economies, trade integration put downward pressure on wages, particularly of lower-skilled workers, contributing to a rise in wage inequality and loss of labor share in national income (Autor and others 2013a, Geishecker and Görg 2013, Ebenstein and others 2014). This effect became stronger in recent decades, as not only did trade integration pick up pace but the nature of trade also changed. An increasing proportion of imports in advanced economies originated in developing economies with average income and wage levels well below those of advanced economies, in contrast to earlier decades when trade expansion largely took the form of increases in intra-industry flows between economies at roughly similar levels of development (figure 5-2). Offshoring and outsourcing expanded trade channels. Unevenness in the sharing of rewards from financial globalization added to pressures pushing national income inequalities higher (Furceri and Loungani 2015).

However, a much stronger force raising the premium on higher-level skills and increasing wage inequality in advanced economies appears to have been skill-biased technological change, such as automation and digitization that favored higher-skill workers. Although the industrial and occupational composition of employment did shift toward more skill-intensive sectors, much of the increase in relative demand for higher-skilled workers, and associated rise in wage inequality, took place within sectors and industries rather than between them (Autor and others 2015a). Moreover, income and wage inequalities tended to increase in many of the exporting developing economies as well. For example, wage and income inequalities rose in both the United States, a major importer of low-skill manufactured products, and China, a major exporter of those products. These developments contradict the predictions of the standard trade theory about the distributional effects of trade.[1]

To be sure, trade may still be a factor explaining part of the increase in relative demand for skilled labor and the rise in wage inequality broadly

FIGURE 5-2 Relative Income Level of Exporters to EU, Japan, and United States, 1980–2010



Source: Subramanian and Kessler (2013).

across industries and groups of countries. Exporting firms within industries typically employ more skilled labor than other firms. Trade can contribute to higher skill premia and wage inequality between firms within industries, and in both advanced and developing countries, through two channels: selection of firms with higher technology and skill levels—and higher productivity—into exporting; and access of exporting firms to a larger, global market size (Baumgarten 2013, Sampson 2014, Helpman and others 2017). Research finds that foreign investment can have similar effects by raising the premium on higher-level skills—and possibly also returns to capital (Chari and others 2012, Jaumotte and others 2013). Offshore outsourcing can also have the effect of raising skill premia everywhere (Feenstra and Hanson 2003).

Nonetheless, research points to a more dominant role for skill-biased technological change in causing wage inequalities to rise. Moreover, it is not only the pattern of the rise in wage inequalities that suggests that factors other than growth in trade have been at play. The share of labor in national income fell not only in most advanced economies but in many emerging economies as well, with much of the fall reflecting declines within industries rather than shifts from high-labor-share industries to those with lower labor shares. The labor share fell in traded sectors but in many non-traded sectors as well (Autor and others 2017a, IMF 2017a). While the share of capital in national income rose, its distribution also became more unequal, similar to the rise in labor income inequalities. These developments point to a mix of factors besides trade contributing to the rise in income inequality, notably technological change and but also national economic policies and institutions that affect growth and distributional outcomes.

Globalization and technological change boost economic progress but inevitably have different impacts on different segments of economies and workforce. The distributional outcomes, however, are not preordained. Much depends on how these processes are managed (Tyson and Spence 2017). The role of policies is important, both in cushioning the impact on workers who face job loss or skill devaluation and in preparing them for new jobs. Such policy response has been lacking. The following sections look further into the interplay of various factors causing the rise in income inequality within countries, setting the stage for later chapters on how policies should respond to achieve more inclusive growth outcomes.

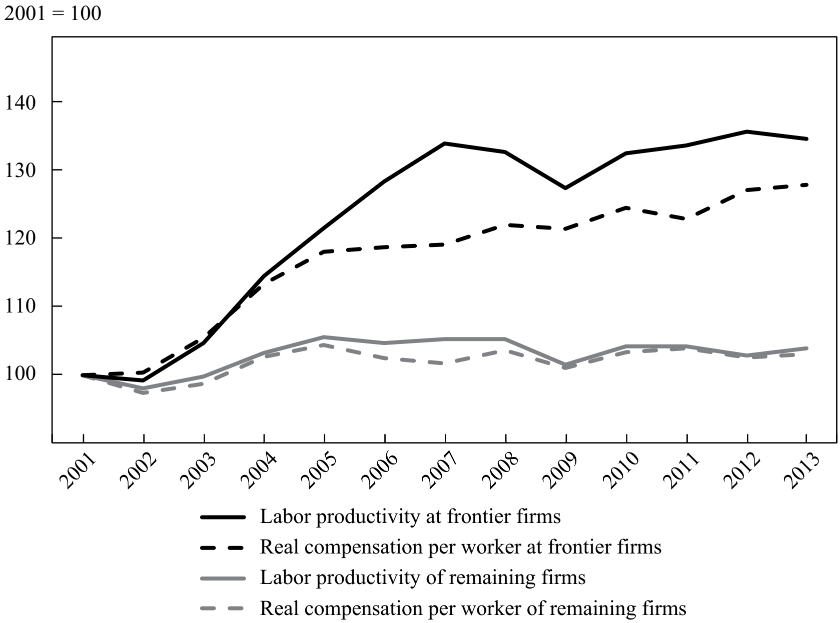
Technology, Skills, and Market Conditions

The mix of technological change, shifts in the demand for skills and gaps in supply, and market conditions as influenced by policies has been a key crosscutting factor impacting the evolution of both productivity and income inequality.

Widening Productivity and Wage Gaps

How technological innovation diffuses within economies and interacts with labor skills and market conditions has important implications for income distribution (Comin and Mestieri 2013, Aghion and others 2015, OECD 2016a). We saw in the previous chapter that the slowdown in aggregate productivity growth in major economies reflected a widening divergence in productivity performance between firms. Productivity growth remained fairly robust in a relatively small number of firms at the technological frontier but slowed considerably in the vast majority of other firms, suggesting

FIGURE 5-3 Productivity and Wage Dispersion: OECD Countries, 2001–13



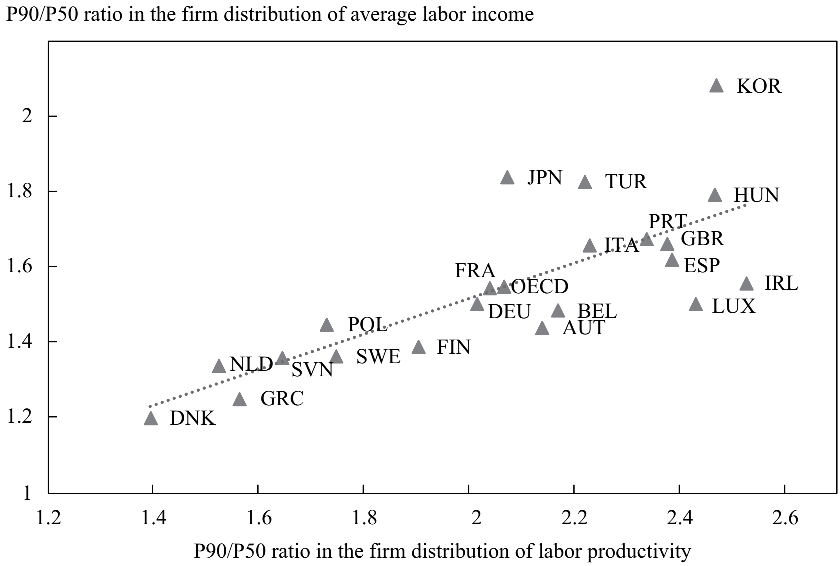
Source: OECD (2017b).

Note: Frontier firms are the top 5 percent firms with the highest labor productivity within each two-digit industry. Non-frontier firms include all the other firms. Data cover firms in twenty-four OECD countries, operating in manufacturing and business services (excluding financial services) and employing twenty or more workers.

that the benefits of new technologies were not diffusing broadly across economies. Wage trends show a similar pattern, with widening wage gaps between more and less productive firms (figure 5-3).

Across OECD countries, inequality in firm productivity performance is closely correlated with wage inequality, with countries experiencing higher dispersion in productivity between firms also experiencing higher dispersion in wages (figure 5-4). Increased productivity divergence across firms appears to have contributed not only to a slowing of overall productivity growth but also to a rise in inequality in labor incomes. This suggests that promoting a broader diffusion of technological innovations and improving the productivity of lagging firms would both boost aggregate productivity growth and lower wage inequality.

FIGURE 5-4 **Productivity Dispersion and Labor Income Inequality: OECD Countries, 2013**

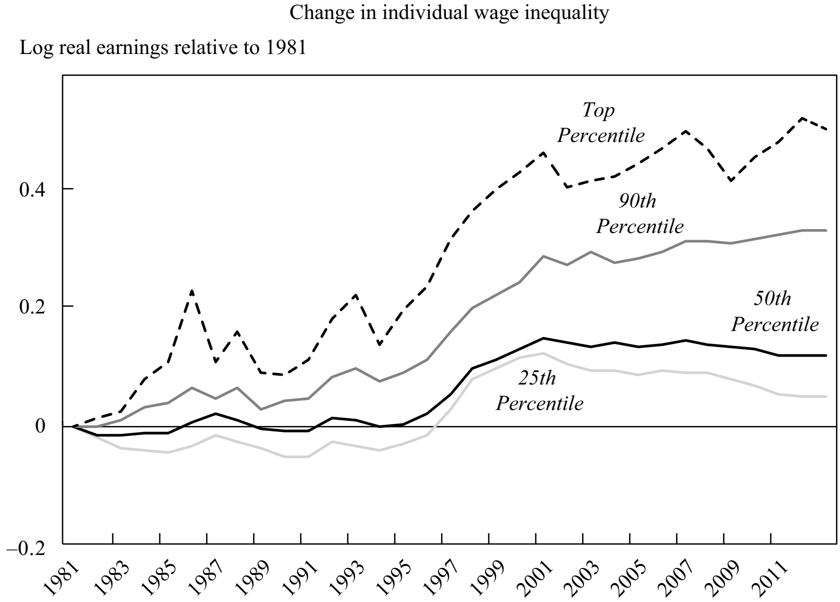


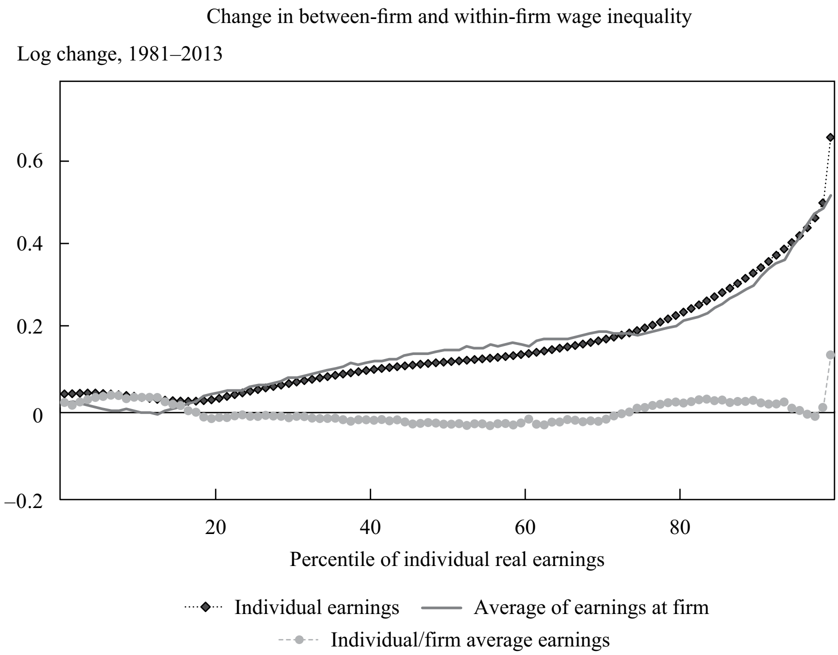
Source: OECD (2016b).

Note: The P90/P50 ratio is labor productivity or labor income of the 90th percentile firm divided by corresponding value of the median firm. Firm-level data cover twenty-one OECD countries. The data point for Japan refers to 2008.

The rise in overall wage inequality is explained to a large extent by increased wage differences between firms rather than within firms. For example, in the United States, wage inequality increased sharply between 1982 and 2013 (figure 5-5, top panel). However, except at the very top of the wage distribution, the rise in wage inequality was driven predominantly by increased disparities in wages between firms rather than within firms (figure 5-5, bottom panel).[2] Average wages in the most profitable firms rose, while those in the rest of the firms tended to stagnate. Moreover, the increased wage disparities between firms stemmed, for the most part, from increased dispersion within industries rather than between industries—mirroring the increase in productivity dispersion that has also been driven largely by differentials within industries rather than between industries (Barth and others 2014, Song and others 2015). Similar results have been found for Brazil (Helpman and others 2017), Germany (Card and others 2013), Italy (Card

FIGURE 5-5 **Wage Inequality and Wage Divergence between and Within Firms: United States, 1982–2013**





Source: Song and others (2015).

and others 2014), the United Kingdom (Faggio and others 2010), and Sweden (Håkanson and others 2015).

Public debate on rising income inequality has tended to focus predominantly on the top 1 percent versus the rest—CEOs, super managers, and top professionals versus other workers. Steep increases in incomes at the very top have, indeed, been an important factor. However, a large part of the rise in earnings inequality is linked to widening wage gaps more broadly across the workforce and, particularly, between more and less successful firms.

Wage differentials between firms driven by productivity differentials linked to uneven gains from new technologies were accentuated by the complementarity between the new technologies and worker skills. The revolution in information and communication technologies has increased the positive assortative matching between technology and skills, and between higher-level skills, resulting in higher-skilled workers flocking to more technologically sophisticated and skill-intensive firms that are more productive and profitable (Kremer and Maskin 1996, Dunne and others 2004, Bagger and others 2013, OECD 2017a). While skill-skill and skill-technology-capital matching and consequent skill segregation across firms appears to have occurred broadly across economies, it appears to have been stronger in the technology and finance sectors, producing even sharper earnings differentials. Between-firm wage inequality has grown more in industries that invest more intensively in information and communication technologies (Bloom 2017).

In addition to such skill sorting across firms, rent sharing has contributed to increasing wage differences between firms. Better-performing firms increasingly reaped a higher proportion of total profits and shared a part of their supernormal profits with their workers (Bagger and others 2014, Card and others 2014). Increased fissuring of the workplace through outsourcing added to the clustering of high-skill workers in high-paying firms and the increase in their rewards, with non-core activities typically employing low-skill workers being farmed out to other firms, cutting such workers from the rent sharing (Goldschmidt and Schmieder 2015). Labor market frictions also played a role in the rise and persistence of between-firm wage differentials, especially in markets with less flexible labor markets (Davidson and others 2008, Helpman and others 2010).

Shift in Income from Labor to Capital

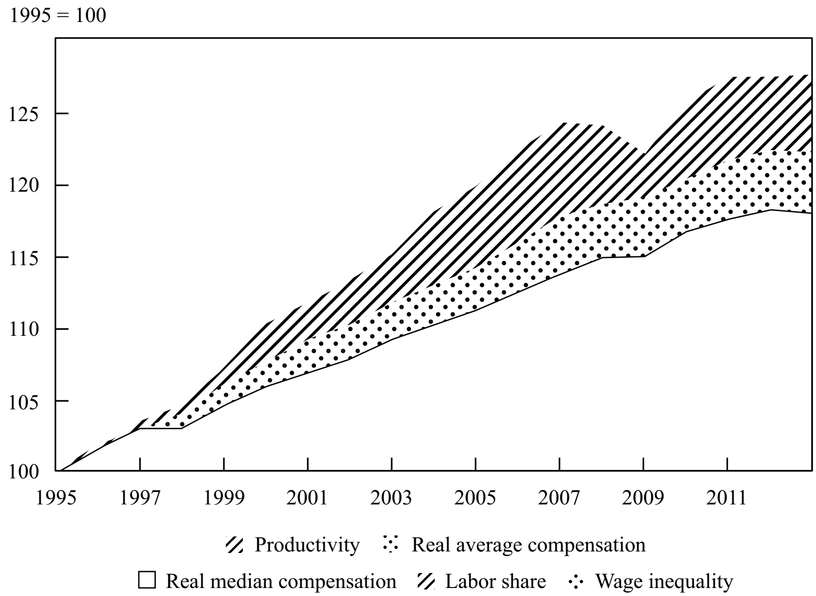
Workers employed in firms at the technological frontier earned more than those in other firms, but gains from higher productivity at these firms were unevenly shared, with wage growth lagging labor productivity growth. Figure 5-3 shows this pattern for OECD economies. Wages rose in the better-performing firms but by appreciably less than the rise in productivity. For most other firms, limited wage growth in large part mirrored limited productivity growth, although even at these firms wage growth tended to fall short of the relatively meager gains in productivity. The decoupling of wages from productivity has contributed to a steady decline in the share of labor in total income.

Most OECD economies experienced both increasing inequality of labor earnings and declining labor income shares over the past two decades (figure 5-6). Over several preceding decades, the labor income share had been relatively stable, consistent with Kaldor's stylized facts (Kaldor 1957). In the United States, the labor share of income dropped from the mid-60s around 2000 to the mid-50s around 2015 (Shambaugh and others 2017). U.S. productivity and wages began to diverge increasingly after the 1970s, having grown closely together in much of the post-war period. Between 1973 and 2014, net labor productivity grew 72 percent while real hourly compensation of the median worker rose just 9 percent (Bivens and Mishel 2015). This shift of income from labor to capital increased inequality, as capital ownership is highly uneven.

Indeed, in most advanced economies, the labor income share has been trending down since around 1980 (figure 5-7).[3] Data are more limited for emerging and developing economies, but in a majority of them—especially the larger economies in this group—labor income shares have also declined since the early 1990s (IMF 2017a).

Analysts have identified a range of causes for the decline in the labor income share: international trade and offshoring (Elsby and others 2013, Basu 2016); labor-substituting technological change (Karabarbounis and Neiman 2014, Autor and Salomons 2018); slowdown in productivity growth (Grossman and others 2017); capitalist forces that make wealth and capital income grow faster than economic output (Piketty 2014); increase in product market concentration and weakening of competition (Autor and others

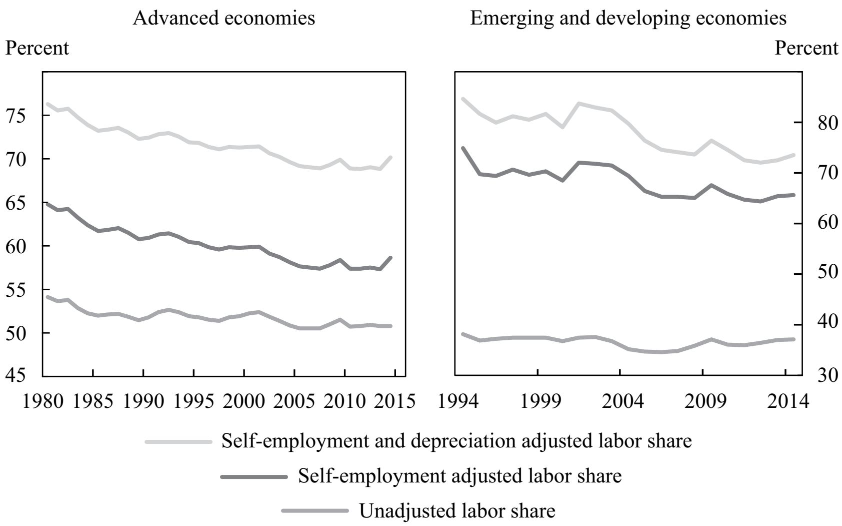
FIGURE 5-6 **Decoupling of Wages, Labor Income Share, and Wage Inequality: OECD Countries, 1995–2013**



Source: Schwellnus and others (2017).

Note: Data are unweighted averages of twenty-four OECD countries. Decoupling between labor productivity and average compensation reflects declines in labor income share. The gap between average and median compensation is a partial measure of wage inequality.

FIGURE 5-7 **Labor Share of Income: Advanced and Emerging Economies, 1980–2014**



Source: IMF (2017a).

2017a); and changes in labor market institutions such as a decline in unionization (Jaumotte and Buitron 2015).

For advanced economies, the research findings, on balance, point to technological change to have been the dominant factor behind the decline in labor income shares (IMF 2017a). For emerging economies, the findings present a more mixed picture about the relative roles of different factors, with trade (and in particular participation in global value chains) on average playing a stronger role than in advanced economies.[4]

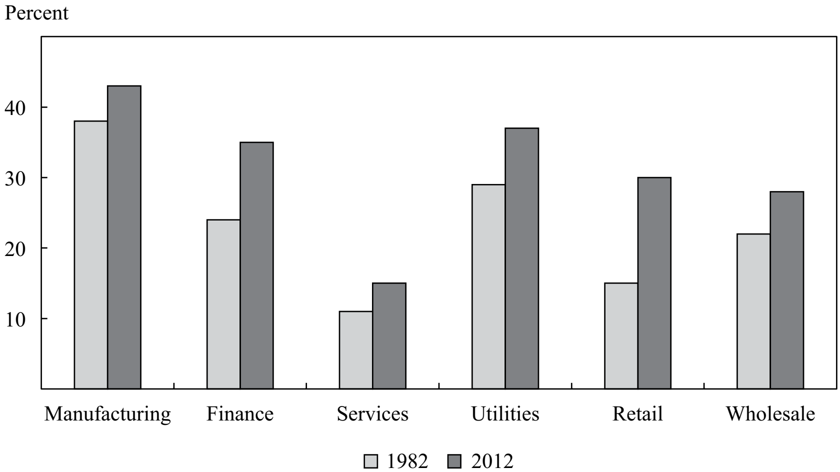
An important focus of recent research, much of it covering advanced economies, has been the role of the interplay of new technologies with market conditions—competition, policies, and institutions—in shifting income from labor to capital as well as producing more skewed distributions within both labor income and capital income. As discussed below, the interplay of these forces affected both productivity and distributional outcomes.

Widening Gaps in Returns to Capital and Rise of Rents

Market concentration has risen in most industries in advanced economies. The rise is particularly marked in the United States. The share of the top four companies in total sales increased in all of the six sectors of the U.S. economy, shown in figure 5-8, with the increase being largest in retail trade and finance. Other statistics corroborate this evidence. In financial services, the loan market share of the top ten banks increased from 30 percent to 54 percent between 1980 and 2012. Wireless providers saw increased concentration, with the average Herfindahl-Hirschman Index (HHI) increasing from under 2,500 in 2004 to over 3,000 in 2014.[5] In the airline industry, four carriers now collect 65 percent of total revenue, up from 41 percent ten years ago. Four brewers now hold nearly 90 percent of the beer market (Wessel 2018). Business dynamism, as indicated by firm entry and exit, has declined. In 1982, young firms (five years old or less) accounted for about half of all firms and one-fifth of total employment; by 2013, these figures had fallen to about one-third and one-tenth, respectively (CEA 2016a, Decker and others 2016, 2017). The prevalence of "zombie firms" has increased (Adalet McGowan and others 2017).

As market concentration increased, the distribution of returns to capital became more unequal. In the United States, available data for non-financial

FIGURE 5-8 Change in Sales Concentration of Top Four Companies: United States, 1982–2012



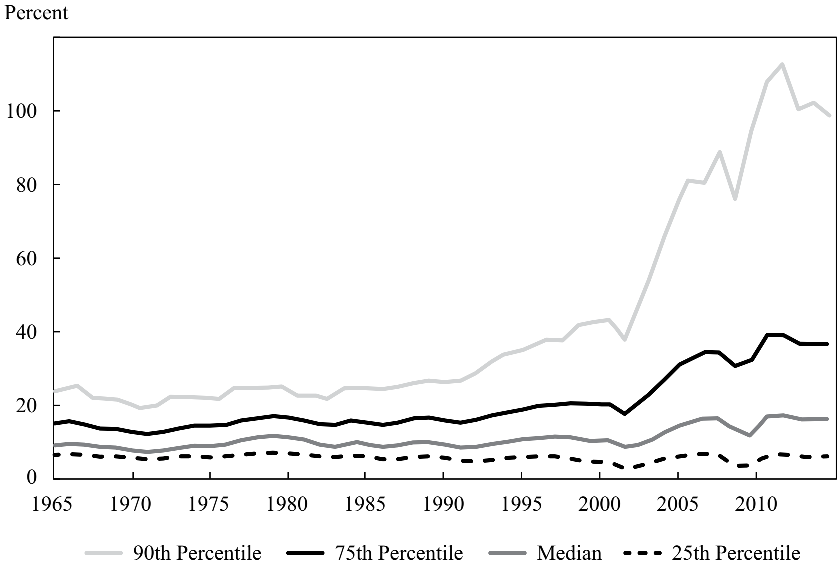
Source: Autor and others (2017b).

Note: Figure shows the share of total sector sales accounted for by the top four firms in the sector.

firms show that the return on invested capital has diverged sharply across firms, with the typical firm seeing only a modest increase in return but a relatively small number of firms seeing large increases (figure 5-9). The 90th percentile firm earns a return on capital that is more than five times the median; this ratio was around two about twenty-five years ago. Returns on capital rose to supernormal levels at the top end of the distribution, reaching around 100 percent at the 90th percentile—and around 35 percent even at the 75th percentile. Among nonfinancial firms, the uneven distribution of returns to capital was evident broadly across industries, but it was particularly marked in technology industries and also in some other industries, including health and housing. Data underlying figure 5-9 also reveal relatively low churning among high-return firms, with a large proportion of such firms persistently achieving high rates of return.

These trends suggest shifts in markets toward oligopolistic structures and a rise in economic rents. The rise of superstar firms in part reflects the nature of digital technologies that can produce winner-takes-most outcomes and a highly concentrated power-law distribution of returns to digital capital (Gabaix and Landier 2008, Brynjolfsson and McAfee 2014, Autor

FIGURE 5-9 **Return on Invested Capital : U.S. Publicly Traded Non-financial Companies, 1965–2014**



Source: Furman and Orszag (2015) and McKinsey & Company.

Note: Figure shows return on invested capital excluding goodwill (an intangible asset reflecting the excess of the price paid to acquire a company over the value of its net assets).

and others 2017a). Goods and services that are intensive users of ICT and have high up-front fixed costs but low marginal costs offer large economies of scale and outsize rewards to successful firms. Strong network effects of products using digital technologies, such as software platforms and online services, and the advantages of big data reinforce these scale economies. The combination of digital technologies and globalization facilitates the scaling up of success to the global level.[6] Moreover, the new technologies increase consumer sensitivity to price and quality differences by greatly easing access to information. Firms controlling large consumer data can use sophisticated pricing algorithms and customized offerings to capture more of the consumer surplus. The rise of superstar firms and the related increase in product market concentration is more pronounced in higher-tech industries, as measured by the intensity of industry investment in digital technologies (Bessen 2017). Technology giants such as Amazon, Facebook, and Google are examples of such superstar firms.

The success of the booming firms creating and exploiting new technological innovations would be better news if it also lifted industry averages on productivity growth. But this has not been the case; overall productivity growth has tended to be slower in industries with wider divergence in performance between top firms and other firms, indicating that growth in lagging firms has been very weak. Research on OECD countries finds that the winner-takes-most feature of the new technologies is not solely to blame for these unequal outcomes; decreased competition in markets has prevented the fruits of technical progress to be more broadly shared, allowing dominant firms to protect their advantages. The gap in performance between leading and lagging firms is greater in industries with less competition (Andrews and others 2016). Industries marked by weaker technology diffusion across firms (as measured, for example, by patent citations) have experienced larger increases in product market concentration (Autor and others 2017a).

Several factors appear to have contributed to a weakening of competition: flaws in the patent system; regulation and licensing restricting competition; increased consolidation through mergers and acquisitions; lax antitrust enforcement; deregulation unsupported by competition policy safeguards; rise in overlapping corporate ownership by large institutional investors; increased rent-seeking through translation of market power into political power; firm behavior showing increased adeptness in erecting barriers to entry through product differentiation and other means; and also creeping protectionism. Less competitive markets reduced pressures on firms to innovate. They also limited the diffusion of innovation and increased economic rents (Hacker and Pierson 2010, Baker 2015, Furman and Orszag 2015, Blonigen and Pierce 2016). A recent study for the United States estimated that reducing monopoly power, as reflected in high firm markups, could raise aggregate productivity by about 40 percent (Baqaee and Farhi 2017). Increased product market concentration impacted investment as well, as decreased competition reduced incentives to make new investment (Gutiérrez and Philippon 2016).

Increased concentration of market power and prevalence of economic rents have not only contributed to inefficient outcomes—slower overall growth of productivity and investment—but also to more unequal distributional outcomes. Joseph Stiglitz (2012) finds the rise in monopoly power and economic rents as a leading cause of increased inequality in the United

States. Research shows that industries with higher market concentration have lower shares of income going to labor. Not only has rising concentration made the distribution of returns to capital more unequal, it has also shifted income from labor to capital by reallocating labor within industries to dominant firms with supernormal profits and lower labor income shares (Autor and others 2017b).

The shift in income from labor to capital in the more concentrated industries is, to a large extent, due to high markups and profits of the leading firms rather than increased investment and capital; companies are investing less and making a lot more on existing assets in less competitive markets. An increasing portion of the high corporate profits reflected monopoly power rather than productivity of investment (Barkai 2016, Eggertsson and others 2018).[7] The average markup above marginal costs in publicly traded U.S. firms rose more than 350 percent between 1980 and 2014 (De Loecker and Eeckout 2017).

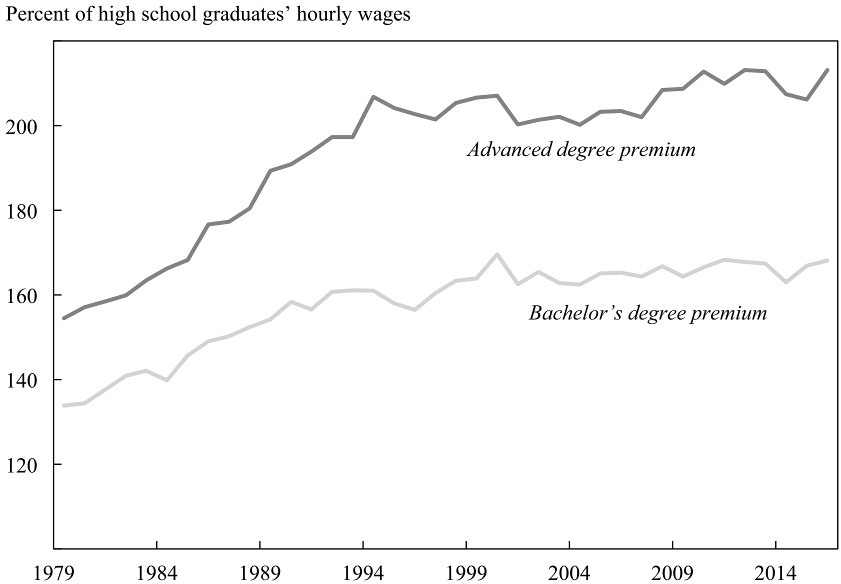
Dominant firms not only acquired more monopoly power to set prices in product markets but also monopsony power to dictate wages in the labor market (CEA 2016b). Recent studies of the U.S. economy find that employer concentration in the labor market has increased and that higher labor market concentration is associated with lower wages (Azar and others 2017; Benmelech and others 2018). Research also finds a high degree of market power in digital labor markets—online jobs platforms such as Uber, Task Rabbit, and Amazon Mechanical Turk—that are an increasingly important part of the "gig" economy (Dube and others 2018).

Increased disparities in firm profitability also contributed to increased disparities in labor income as the most profitable firms paid their workers more, while most workers in lagging firms saw little growth in earnings. As noted earlier, the rise in wage inequality has been driven more by increased divergence in wages between firms than within firms.

Widening Skill Gaps, Rising Skill Premia, and Job Polarization

Shifts in income from labor to capital and increased disparities within labor and capital income have all contributed to the rise in overall income inequality. The largest part of the rise in income inequality is accounted for by an increasingly unequal distribution of labor income (Furman and Orszag 2015, Francese and Mulas-Granados 2015). New technologies,

FIGURE 5-10 Higher Education Earnings Premium: United States, 1979–2016



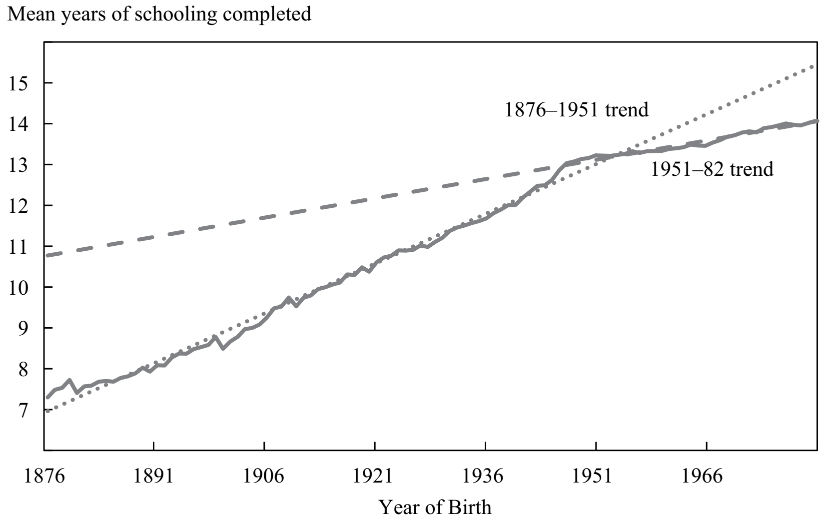
Source: Shambaugh and others (2017).

Note: Earnings premia are the ratios of median wages of each educational attainment group to median wages of those with a high school diploma only.

notably digital technologies, increased the demand for higher-level skills that commanded high rewards in firms successfully exploiting the new technologies. The relative scarcity of the new skills increased wage differentials and also hindered a broader adoption and diffusion of the new technologies across firms.[8]

How the supply of skills responds to changes in the demand for skills caused by technological change—the race between education and technology—is a key determinant of wage structure (Goldin and Katz 2008, Acemoglu and Autor 2012). The premium on skills has risen sharply, and the rise was particularly sharp between 1980 and 2000.[9] This is reflected in widening gaps between the earnings of college-educated workers and those with only a high school education (figure 5-10). The skill premium for post-graduate education rose even more sharply. Skill premia rose across countries. Among OECD countries, they increased in all of

FIGURE 5-11 Mean Years of Schooling Completed by Year of Birth: United States, 1876–1982

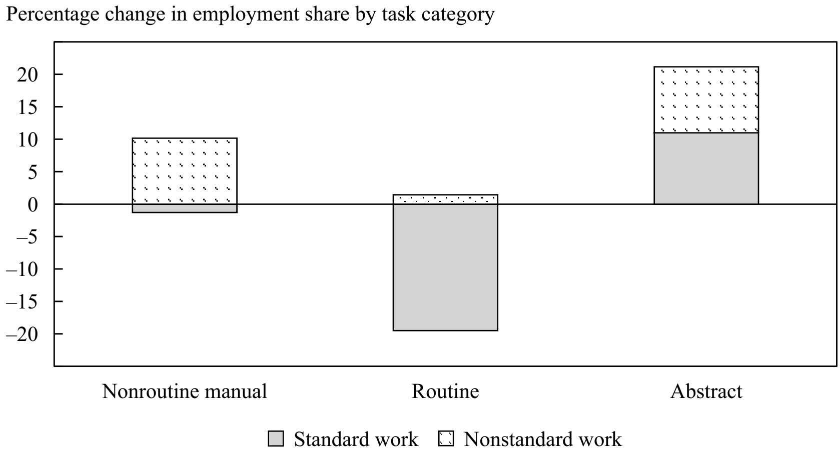


Source: Furman (2016a), based on calculations by Goldin and Katz.

them, with the increase being the largest in the United States, which stands out as having the highest premium on skills in this group of countries (Hanushek and others 2013, Autor 2014a). Some studies find that the increase in the education wage premium can account for between 55 percent to 70 percent of the rise in wage dispersion in the United States between the 1980s and the mid-2000s (Lemieux 2006, Goldin and Katz 2008).

Both supply and demand factors explain the sharp rise in skill-based wage differentials. On the supply side, the rate of increase in educational attainment dropped. In the United States, growth in the years of education completed slowed considerably toward the end of the twentieth century. Individuals in the cohorts born between 1875 and 1950 completed 0.4 more years of education by age thirty on average than those born five years ago. Starting with those born after 1950, the rate slowed to just 0.2 years (figure 5-11). So for the cohorts reaching age thirty in 1980 and after, the pool of higher-skilled workers grew at a much slower pace. The slowing of the pace of improvement in educational attainment is observable more broadly across countries over this period; on average, such human capital

FIGURE 5-12 **Job Polarization and Increase in Nonstandard Work: OECD Countries, 1995–2010**



Source: OECD (2016a).

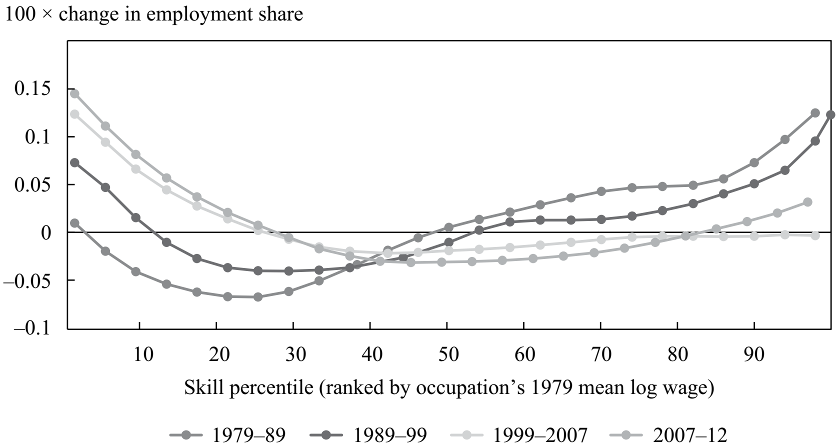
Note: Data cover twenty-three OECD countries.

accumulation slowed across both advanced and emerging economies (Barro and Lee 2013; Morrisson and Murtin 2013).

Growth in the supply of higher-level skills slowed just when demand for them picked up. Digital technologies increased the demand for skills to work with computers, software, and more sophisticated processes. They also began automating jobs of a routine nature, which are typically jobs in the middle of the skill-wage distribution performed by workers without post-secondary education, such as bookkeeping, clerical work, and repetitive production. These shifts in relative demand for different skill levels produced both rising wage inequality and rising job polarization.

Across OECD countries, the employment share of middle-skill routine jobs fell while that of high-skill abstract jobs (technicians, professionals, managers) and low-skill nonroutine manual jobs (mainly in service occupations such as personal care and food services) rose (figure 5-12). Between 1995 and 2015, the share of middle-skilled workers in total employment declined by around 9 percentage points in these countries. Across advanced economies, the decline in the labor income share has been borne disproportionately by middle-skill workers (IMF 2017a). While international trade and offshoring have played a role in this job polarization (Keller and

FIGURE 5-13 Changes in Employment Share by Skill Percentile: United States, 1979–2012



Source: Autor (2014b).

Note: Figure plots changes in employment shares by occupational skill percentile rank using a locally weighted smoothing regression.

Utar 2016), the dominant factor has been technological change (OECD 2017b).

A concurrent development has been the rise of the "gig" economy—nonstandard forms of work such as temporary or part-time contracts and own-account self-employment—especially at lower skill and wage levels. Across twenty-six OECD countries, between the mid-1990s and the onset of the global financial crisis, almost half of all job creation was in nonstandard work; including the post-crisis years up to 2013 brings the share to around 60 percent. In 2013, nonstandard work on average accounted for about a third of total employment in OECD countries (OECD 2015a). While imparting more flexibility to the labor market, nonstandard work also contributed to increased earnings inequality, as nonstandard jobs at low-skill levels typically carried much lower earnings than standard jobs.

Employment growth in the United States shows a pattern similar to the U-shaped changes in employment shares by skill level seen broadly across OECD countries (figure 5-13), with the shares rising at the low and high ends of the skill distribution and falling in the middle. It also shows that the rise in employment share at higher skill levels began to flatten out after

2000. This suggests that the locus of job displacement started to move beyond middle-level skills into the lower-end of higher-level skills. It also suggests a “skill downgrading” process, with higher-skill workers, both new entrants and those displaced from routine jobs, increasingly moving into lower-skill, manual jobs, particularly in the services economy (Autor and Dorn 2013b, Autor 2014b, Beaudry and others 2016). Also, similar to the general trend in OECD countries, the share of nonstandard work in total employment rose in the United States (Katz and Krueger 2016, McKinsey Global Institute 2016).[10]

The new technologies did not displace low-skill workers in nonroutine manual jobs (with their employment share, in fact, rising), but neither did they do much to boost their productivity and wages. The productivity and wage benefits of these technologies accrued mainly to high-skill workers, who were increasingly clustered in higher profitability firms at the technological frontier.

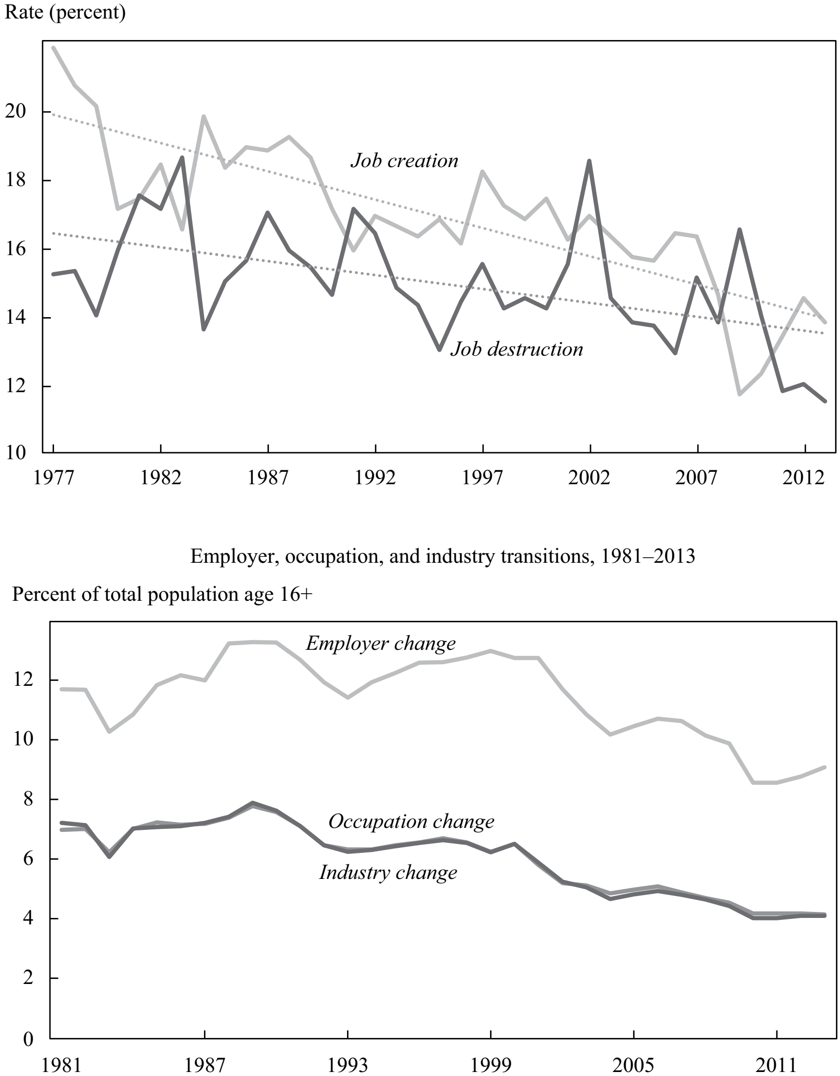
Changes in Labor Market Institutions

Flexible labor markets, supported by adequate institutional frameworks, can foster labor mobility and job creation, contribute to higher productivity through better resource allocation, as well as promote inclusive distributional outcomes. However, labor market developments in recent decades in many cases appear to have delivered both less flexibility and less worker protection.

Labor market dynamism has declined in many major economies in recent decades, with workers less likely to move between jobs, industries, occupations, and locations. In the United States, the decline is evident in both job creation and job destruction rates and in worker mobility between industries and occupations (figure 5-14). Some decline in labor fluidity may be due to better matching in job markets or increased efforts by firms to reduce employee turnover. But the decline also reflects barriers to labor mobility, with adverse implications for labor productivity and labor income distribution (Molloy and others 2016). Labor mobility declined at a time when shifts in the demand for skills caused by the new technologies called for more rather than less mobility.

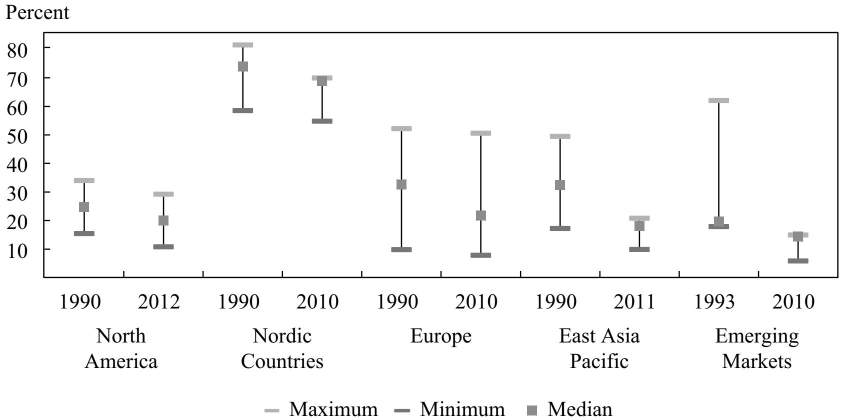
FIGURE 5-14 **Labor Market Dynamism: United States**

Job creation and destruction, 1977–2013



Source: Furman (2016b) and Molloy and others (2016).

FIGURE 5-15 **Union Rate by Country Group, 1990–2012**



Source: Dabla-Norris and others (2015).

One factor is the reduced business dynamism and increased market concentration in product markets noted in the previous section; an increasing proportion of workers were employed in older and larger firms that typically have lower job fluidity (Hyatt and Spletzer 2013, Davis and Haltiwanger 2014). Also, the rise of dominant firms making supernormal profits reduced worker incentives to leave firms earning high rents. Another factor is regulatory barriers, which appear to have increased labor market frictions, including occupational licensing requirements, non-compete clauses in employment contracts, "job lock" from employer-sponsored health insurance, and land use/housing restrictions. The share of the U.S. workforce covered by occupational licensing laws increased from less than 5 percent in the early 1950s to 29 percent in 2008 (Kleiner and Krueger 2013, CEA 2016b).

There has been a general decline across countries in the degree of labor unionization (figure 5-15). In the United States, the fraction of private-sector workers who belong to labor unions fell from around 25 percent in the mid-1970s to 7 percent in 2011 (Autor 2014a). The decline in unionization has been found, in several studies, to have contributed to recent trends toward lower labor income shares and higher wage inequality (Card and others 2004, Western and Rosenfeld 2011, Jaumotte and Buitron 2015, Machin 2016).

FIGURE 5-16 Real Value of U.S. Federal Minimum Wage, 1960–2015

Source: CEA (2016b).

In addition to lower union density, decentralization of wage bargaining and lower employment protections have been found in some studies to have contributed to lower and unequal labor income outcomes (Dahl and others 2013, OECD 2017a). These developments in labor market institutions reduced workers' bargaining power at a time when the rise of dominant firms and increased market concentration strengthened the hand of employers in setting wages, including through greater opportunities to collude, explicitly or tacitly.

A parallel development has been a weakening of minimum wage laws and their application, which affected especially the lowest earners, who are often the most vulnerable to employers' wage-setting power. Many countries saw an erosion of minimum wages. In the United States, for example, the real value of the federal minimum wage declined by about 25 percent from its peak in 1968 to 2015 (figure 5-16). The erosion of the minimum wage contributed to increased inequality in labor income (Autor and others 2015b). Some U.S. states did provide larger increases in minimum wages, and recent research finds that the higher compensation did not come at the expense of employment (Card and Krueger 2016, Cengiz and others 2018). Similar findings linking minimum wage erosion to higher labor income inequality have been reported for several other OECD countries (OECD 2017a).

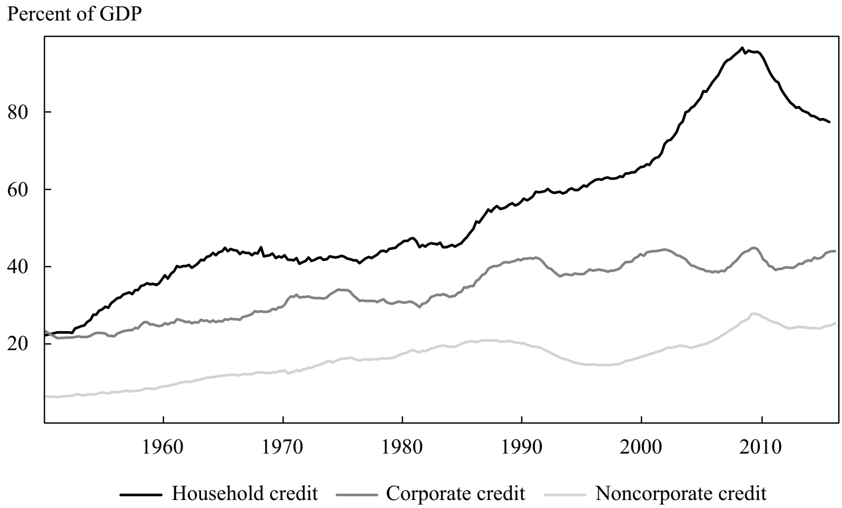
Financialization

Finance plays an important role in economic growth, channeling savings to investment and balancing risk with reward. However, "too much finance" can hurt productivity and growth, fuel economic instability, and also increase income inequality (Cecchetti and Kharroubi 2012, Arcand and others 2015). In emerging economies at relatively low levels of financial development, financial deepening boosts growth and is likely to reduce inequality by broadening opportunity. In advanced economies with already well-developed financial systems, further large financial expansion can have the opposite effect. Starting from a high level of financial development, OECD economies experienced rapid further financialization in recent decades, with credit and other financial intermediation growing three times as fast as economic activity. OECD analysis finds that this further financialization slowed rather than boosted long-term economic growth, increased vulnerability to crises, and also contributed to rising income inequality (OECD 2015b).

An increasing proportion of credit went to households rather than to firms and businesses, boosting stock and real estate markets rather than productive investment—an allocation of credit with negative implications for growth, stability, and income distribution. In the United States, credit rose sharply relative to GDP in the lead-up to the global financial crisis of 2007–08, but this was concentrated predominantly in the household sector (figure 5-17). The credit boom was associated with a rising misallocation of capital in advanced economies more broadly (Adler and others 2017). When the boom burst with the financial crisis, it was not only the household sector that faced a correction; credit disruptions affected investment as well, particularly by smaller firms (Anzoategui and others 2016).

Research also finds that increasing corporate stock ownership by financial institutions, in particular, large institutional investors, shifted corporate decisionmaking toward short-termism, favoring short-term financial gains (such as through share repurchases) at the expense of longer-term investment in innovation and new capacity (Asker and others 2015, Gutiérrez and Philippon 2016, Erixon and Weigel 2016). Overlapping corporate ownership by institutional investors may also have played a role in diluting competition (CEA 2016a, Azar and others 2018). Institutional investors now own more than two-thirds of the stock of U.S. publicly traded companies.

FIGURE 5-17 Distribution of Credit to Non-financial Sectors: United States, 1950–2013



Source: Philippon (2016a).

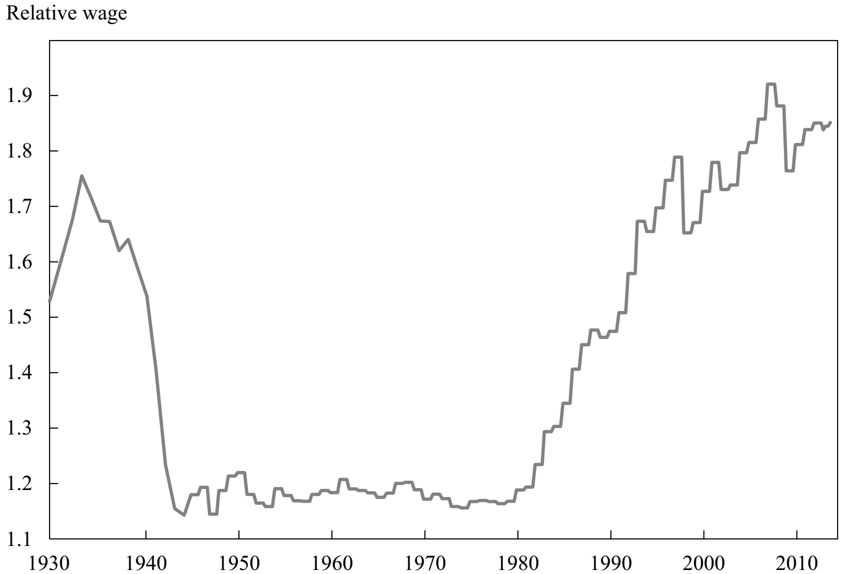
Note: Household credit is mortgage and non-mortgage debt; corporate credit is credit to non-financial corporate (mostly large) firms; and non-corporate credit is credit to non-financial non-corporate (mostly small) firms.

Asset price bubbles inflated by the credit boom, decline in lending standards, and overexposure of the financial sector played an important role in causing the global financial crisis. The financial sector was at the center of the fault lines that underlay the crisis (Rajan 2010, Schularick and Taylor 2012).

There was much innovation in finance based on the new information and communication technologies, including new financial products and business models. However, this did not translate into significant boosts to productivity, either in the economy at large because of misallocation of capital or in the financial sector itself, as much of the innovation was concentrated in areas such as trading that are unlikely to have first-order effects on productivity or welfare (Philippon 2016b).[11] The shortcomings of the financial sector contributed to the paradox of rapid technological change but slowing productivity growth, as analyzed in the previous chapter.

Rising finance contributed to increasing income inequality directly as earnings in the sector rose sharply relative to rest of the economy. The

FIGURE 5-18 **Financial Sector Relative Wage: United States, 1930–2013**



Source: Philippon (2016b).

Note: Figure plots the ratio of average wage in finance to average wage in private sector as a whole.

financial sector captured 35 percent to 40 percent of all corporate profit in the United States in the years leading to the global financial crisis. In European countries, on average, financial sector workers in 2010 accounted for one in five of the top 1 percent of earners even though they accounted for only one in twenty-five of the total workforce (Denk 2015). In the United States, the ratio of average wage in the financial sector to that in the private sector as a whole rose from less than 1.2 in 1980 to almost 1.9 just before the global financial crisis (figure 5-18). Over the twenty-five-year period to 2005, finance professionals accounted for a quarter of the increase in the share of national income going to the top 1 percent earners.

Part of the higher rewards in finance reflected higher skills, illustrating positive assortative matching between technology and skills that has already been noted. Part reflected economic rents, as much as 30 percent to 50 percent, caused by a combination of market liberalization, lack of regulatory oversight, and rent-seeking. The high rewards lured talent away from sectors where it could have been more productively used (Philippon and Reshef 2012, Bakija and others 2012).

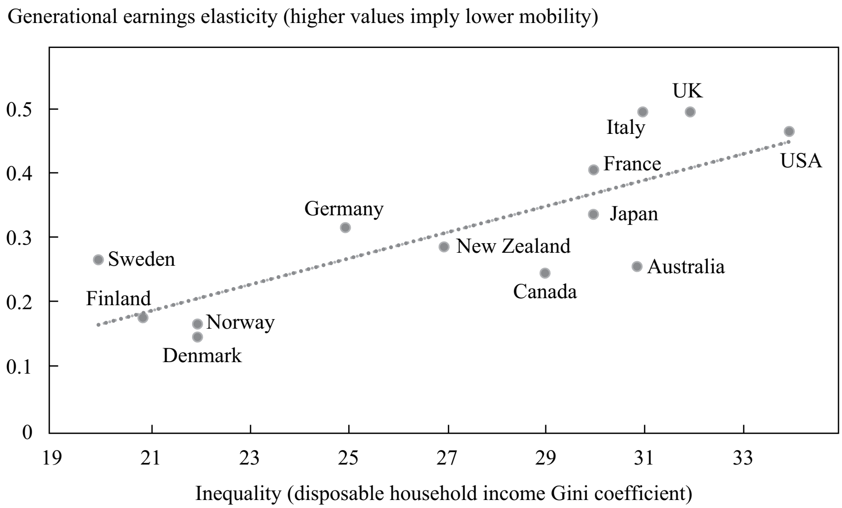
The growth of finance also contributed to inequality indirectly, as its services disproportionately benefited upper-income groups who captured dominant shares of credit expansion and, even more so, the rewards from greater stock market capitalization. Stock market ownership is yet more skewed than income distribution; in euro-area countries, for example, the top quintile receives close to 40 percent of national income but owns more than two-thirds of stocks (Denk and Cazenave-Lacroutz 2015). In the United States, in 2013, the top 1 percent of the wealth distribution held half of stock and mutual fund assets, and the top 10 percent held more than 90 percent of those assets (Wolff 2014). The richer households also hold higher-return products, enjoying average returns on wealth that are a multiple of those accruing to lower-income households (Fagereng and others 2016).

Much of innovation in finance to date has gone into the design and provision of specialized products and services tailored to rich households. The application of new digital technologies in finance, often referred to as FinTech, has the potential to improve financial services more broadly for firms and households, but its realization will depend on appropriate policy choices and regulatory framework.

Rising Inequality of Opportunity

Inequality begets inequality if it is reflected not just in more unequal outcomes today but also more unequal distribution of opportunities for economic mobility. Inequality can, therefore, persist and even be self-reinforcing. Cross-country evidence shows that countries with higher income inequality tend to have lower intergenerational income mobility. Figure 5-19, covering thirteen OECD countries, shows this negative relationship between inequality and mobility in what has come to be known as the "Great Gatsby Curve" (Krueger 2012).[12] High income inequality can be both a symptom and a cause of low economic mobility. High income inequality produces still higher inequality of wealth, which adds to mobility challenges. In advanced economies, wealth inequality is, on average, twice as high as disposable income inequality. Recent decades have seen sharp

FIGURE 5-19 **Income Inequality and Economic Mobility: OECD Countries**

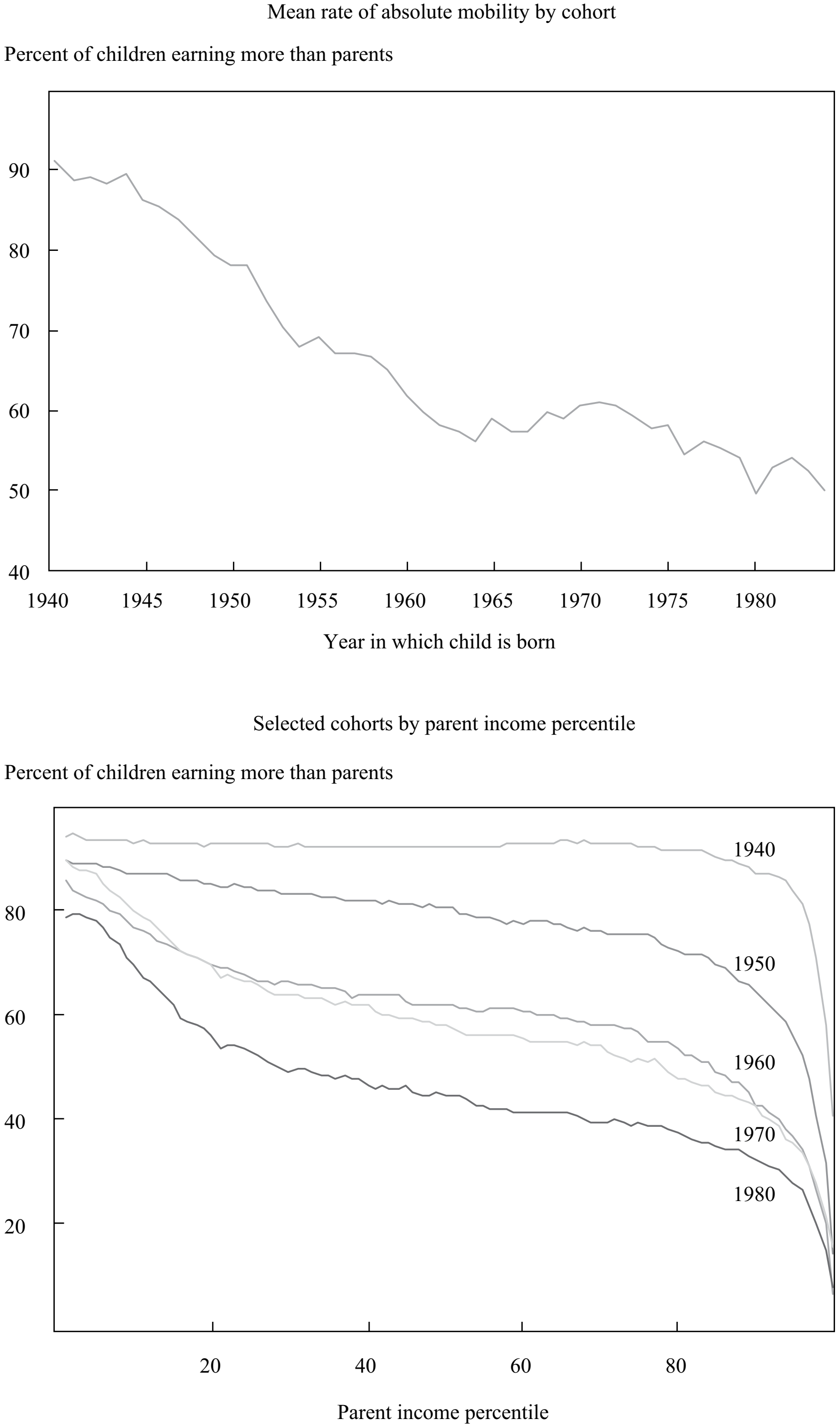


Source: Corak (2013).

increases in wealth relative to national income and in inequality of wealth ownership.

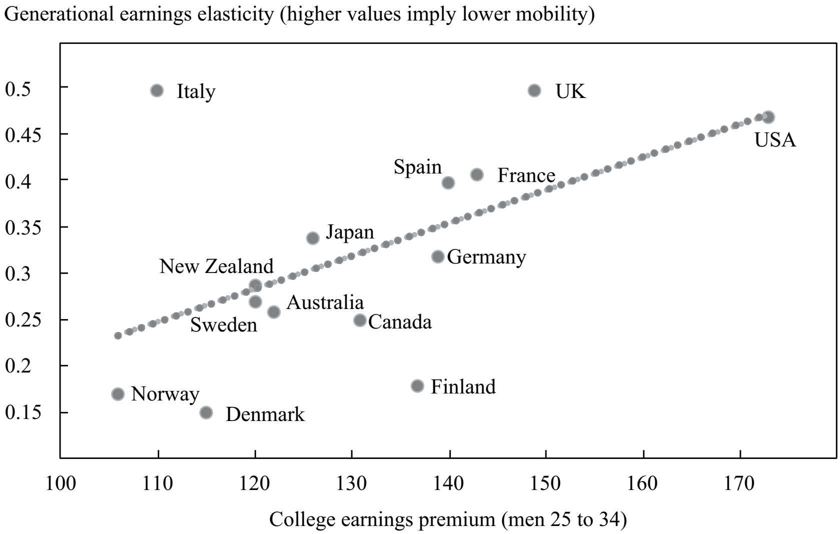
Research on the U.S. economy finds that intergenerational income mobility has declined as income inequality has risen. The proportion of children who earn more at age thirty than their parents did at the same age has fallen to about 50 percent for the cohort born in 1980; this proportion was as high as around 90 percent for the cohort born forty years earlier (figure 5-20, top panel). The largest decline in mobility has occurred for families in the middle of the income distribution (figure 5-20, bottom panel). This finding aligns with the decline of middle-skill jobs already discussed and the shrinkage of the middle class in many advanced economies noted in chapter 2. Rising income inequality emerges as the main reason for the decline in intergenerational income mobility, explaining about 70 percent of the decline, with slower economic growth accounting for about 30 percent (Chetty and others 2016). So stronger growth alone will not restore mobility to previous levels; both stronger and more broad-based growth will be needed. In countries experiencing large increases in inequality, the consequences of the "birth lottery" (the parents to whom a child is born) have increased, and the playing field has become more tilted for the next generation.

FIGURE 5-20 **Changes in Economic Mobility: United States**



Source: Chetty and others (2016).

FIGURE 5-21 **College Earnings Premium and Economic Mobility: OECD Countries**

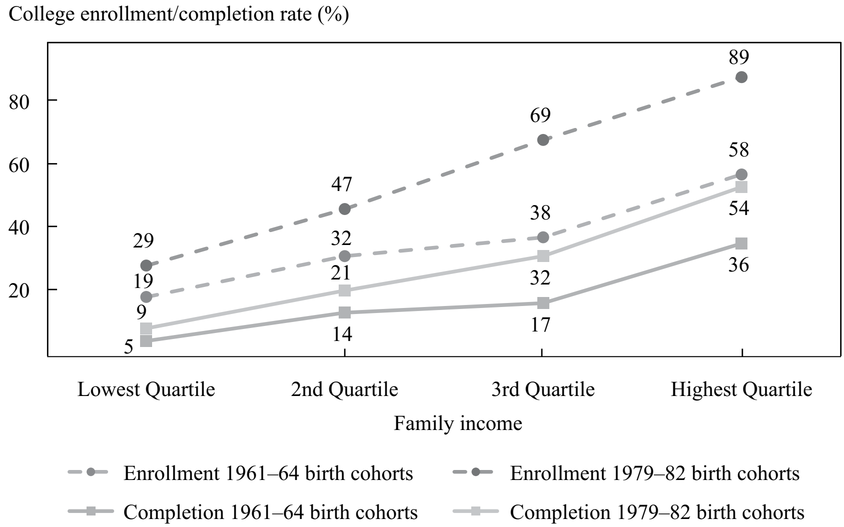


Source: Corak (2013).

Reduced opportunities for mobility because of higher income inequality can reflect a range of factors, but an important one is disparities in access to education—the "great equalizer."[13] OECD studies have found that countries with higher income inequality generally have lower enrollment ratios for upper-secondary education (OECD 2015a). As noted, the premium on education has risen as the supply of skills has lagged growth in demand resulting from skill-intensive technological change. Increased college earnings premia are associated with lower intergenerational income mobility (figure 5-21). When the premium on higher education is high, children of richer parents are doubly advantaged—by their parents' income and, therefore, better access to higher education, and by increased returns on educational attainment.

In the United States, even as pre-collegiate achievement gaps by family income have narrowed somewhat, gaps in college education have widened (Greenstone and others 2013, Turner 2017). While gains in college enrollment and completion have accrued across all family backgrounds, they have been much larger for those in higher-income quartiles (figure 5-22). The col-

FIGURE 5-22 College Enrollment and Completion by Family Income: United States



Source: Bailey and Dynarski (2011).

lege enrollment rate gap between the highest and lowest family income quartiles increased from 39 percentage points for the cohort born in 1961–64 (starting college in 1979–83) to 60 percentage points for the cohort born in 1979–82 (starting college in 1997–2000). The corresponding completion rate gap increased from 31 percentage points to 45 percentage points. These raw differences do not factor in differences in the quality of college education across income groups; only 15 percent of college students with family incomes below $25K are in private or flagship public institutions (the remainder are in two-year community colleges and four-year open-access public institutions) compared to nearly 45 percent of those with family incomes exceeding $125K (Turner 2017). While gaps in college educational attainment have widened, the consequences of these gaps are yet greater as market opportunities for those lacking higher-level and broad-based skills have eroded.

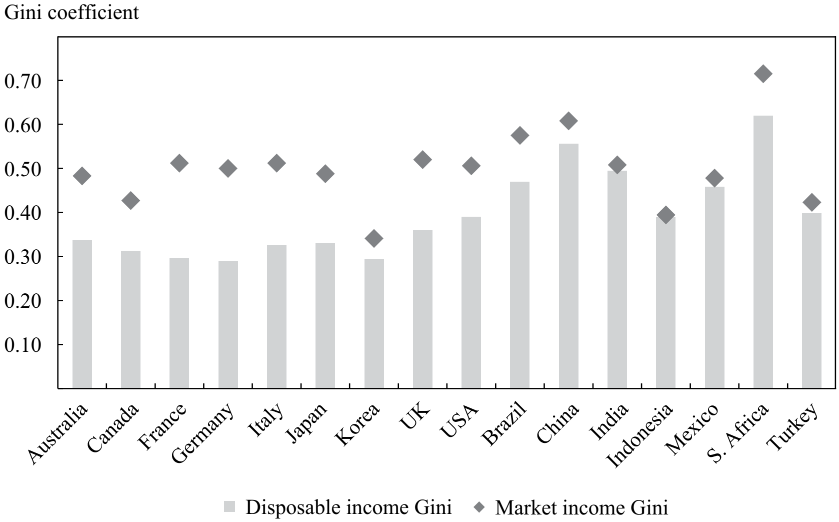
Digital technologies have enormous potential for enhancing economic capabilities broadly across populations by facilitating the flow of information and knowledge. Disparities in access to and use of these technologies can, however, exacerbate uneven distribution of opportunities for economic mobility. Despite much progress, a substantial digital divide persists even in advanced economies. Research finds that Internet use improves labor market outcomes but, in the United States, fewer than 50 percent of households in the bottom income quintile use the Internet at home, compared with 95 percent in the top quintile (CEA 2016c). A study of European countries found that 20 percent of individual users capture 60 percent of all consumer surplus from digital services, while the bottom 50 percent capture just 20 percent (Interactive Advertising Bureau Europe 2010). Affordability, access, and digital literacy explain the disparities in usage. Similar disparities exist among firms. Most sectors of the U.S. economy are less than 15 percent as digitalized as the leading sectors. Workers in the most digitalized businesses enjoy wage growth that is twice the national average. Conversely, those without digital skills face narrowing job prospects (McKinsey Global Institute 2015).

Weakening Redistributive Role of the State

The foregoing discussion shows how the interplay of technological change, developments in product and labor markets, and related policies drove the rise in income inequality in major economies. Government taxes and transfers play an important role in ameliorating the inequality of market incomes arising from the interplay of these forces. In advanced economies, progressive taxes and transfers such as public pensions and social assistance benefits have reduced inequality by an average of close to one-third; the Gini coefficient for income after taxes and transfers (disposable income) is on average about two-thirds of that for market income inequality (figure 5-23). The redistributive role of taxes and transfers varies across countries; it is stronger in European countries than in the United States. In emerging economies, tax and transfer policies typically play a smaller redistributive role than in advanced economies, reflecting lower average levels of both taxes and social transfers.[14]

The redistributive role of taxes and transfers in advanced economies has weakened in the last couple of decades, with the result that fiscal policy has been unable to counteract the rise in market income inequality and prevent sizable increases in disposable income inequality (Caminada and

FIGURE 5-23 **Market versus Disposable Income Distribution: Selected Countries, Circa 2013**

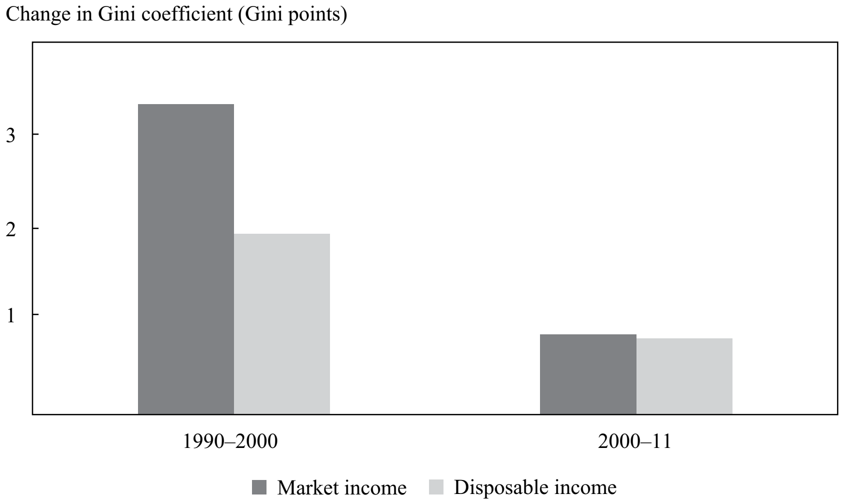


Source: OECD Income Distribution Database and OECD (2015a).

others 2012, Clements and others 2015, IMF 2017b). The redistributive impact of fiscal policy rose somewhat in the aftermath of the global financial crisis as spending on unemployment and other benefits increased because of automatic stabilizers and fiscal stimulus measures, but only temporarily, as countries soon shifted to fiscal consolidation even though still faced with a weak economic recovery (OECD 2015a). Among OECD countries, the Gini coefficient for market income rose substantially in the 1990s but that for disposable income rose much less. In the following decade, however, the Gini coefficients for market and disposable income increased about the same, although less than in the previous decade (figure 5-24). Redistribution through taxes and transfers hardly offset any of the rise in market income inequality in the 2000s.

The redistributive power of fiscal policy has declined as a result of reduced marginal tax rates on higher incomes and lower taxes on capital, as well as tighter spending on social protection programs as many countries took steps to rein in fiscal deficits and rising public debt. Much of the rise in income inequality in advanced economies in recent decades has been driven by an increasing concentration of income at the top. Reduced

FIGURE 5-24 Redistributive Impact of Taxes and Transfers: OECD Countries



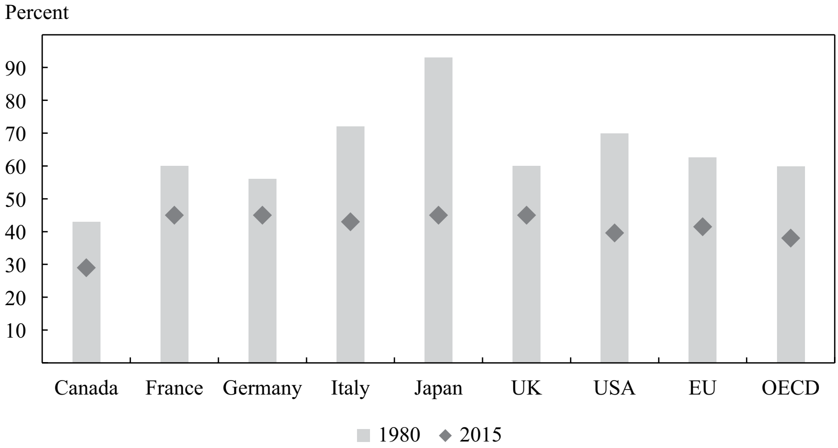
Source: OECD (2016b).

Note: Data cover twenty-three OECD countries.

progressivity of tax systems contributed to that outcome. In OECD countries, the average top statutory personal income tax rate fell from 62 percent in 1981 to 35 percent in 2015 (figure 5-25).

International tax competition encouraged by financial globalization and increased mobility of capital has contributed to a sharp decline in corporate income tax rates as well. The average corporate income tax rate in advanced economies fell from around 45 percent in 1990 to 26 percent in 2015 (IMF 2017b). In the United States, the 2017 Tax Cuts and Jobs Act lowered the corporate income tax from a top rate of 35 percent to a flat rate of 21 percent. Taxes on wealth, which can play a useful role in limiting intergenerational persistence of inequality, have also declined. Already at low levels in most countries, they have not kept pace with the surge in wealth relative to GDP and the rising inequality in wealth ownership. Among OECD countries, the effective tax rate from various taxes levied on wealth dropped from around 0.9 percent in 1970 to 0.5 percent in the early 2010s (Clements and others 2015). Effective tax progressivity is also undermined

FIGURE 5-25 **Top Statutory Personal Income Tax Rate, 1980–2015**



Source: IMF (2017b).

by sizable tax avoidance and evasion from shifting capital income and assets to offshore tax havens.

Taxes and transfers do not capture the entirety of the impact of fiscal policy on redistribution. Access to and cost of public services, such as education and health, also have important distributional consequences. Inequality in a country that provides most education almost free for everyone is likely to be much lower than inequality in a country where most education must be paid for, even though their disposable income Gini coefficients may be similar. The same goes for health. Spending on infrastructure also matters, as it affects the cost and availability of infrastructure services. The redistributive role of such in-kind benefits is particularly important in emerging economies that, as noted, typically have lower levels of direct taxes and transfers than do advanced economies. For example, in-kind education and health benefits are estimated to reduce the Gini coefficient by an average of 5.8 percentage points in the United States and five European countries (Belgium, Germany, Greece, Italy, and the United Kingdom) compared with an average of almost 10 percentage points in Chile, Brazil, and South Africa.[15] Like direct transfers, in-kind transfers have felt the pressure of fiscal consolidation efforts in recent years. Also, in many countries, the potential redistributive role of transfers, both direct and in-kind, is limited by insufficient progressivity, and even regressivity, of sizable parts of such spending (Clements and others 2015).

Conclusion

In most major economies, productivity growth has slowed and income inequality has risen over the past couple of decades. These trends have been particularly marked and protracted in advanced economies. The trends in productivity and inequality have been the subject of intense scrutiny by economists. Much of the analysis has looked at them in isolation. More recently, however, analysts have explored possible linkages between these trends. The foregoing review of research finds that the slowdown in productivity growth and the rise in inequality are interconnected.

The chapter documents the important common drivers behind the slowing productivity growth and rising inequality. These include: the weakening diffusion of technological progress and widening gaps in productivity and profitability across firms; the erosion of competition, decline of business dynamism, and rise of economic rents; the shortcomings of rising finance producing outcomes that were both inefficient and unequal; the lags in the supply of skills in adjusting to the shifts in demand caused by technological change and the rising differentials in labor earnings; deficiencies in the functioning of labor markets; and the rising inequalities of opportunity coupled with a weakening role of the state in offsetting those. These factors go a considerable way in helping to explain both the slowdown in productivity and the concurrent rise in inequality.

Not only do slowing productivity and rising inequality have important common causes, research also finds feedback loops and reinforcing mechanisms between them. It finds that rising inequality reduces economic growth and undermines its sustainability (Berg and Ostry 2011, Cingano 2014, Kumhof and others 2015, Grigoli and Robles 2017).[16] Higher inequality can weaken growth by depressing aggregate demand, but it can also have negative consequences for longer-term growth by hurting productivity, for example, by reducing the ability of lower-income groups to invest in education and skill-building. Inequality arising from high economic rents also undermines efficiency and productivity (OECD 2015a).[17] A complementary finding is that well-designed redistribution can be pro-growth (Ostry and others 2014).

What are the implications of these findings for policy? One clear implication is that policies to revive productivity growth and policies to reverse the rise in national income inequalities are interlinked. An integrated approach is needed to address these challenges, harnessing synergies between policies as well as tackling potential conflicts. We turn to this policy agenda in the final two chapters.

Notes

1. The Stolper-Samuelson theorem implies that trade between advanced and developing economies would shift the demand for labor toward skill-intensive activities in advanced economies and less skill-intensive activities in developing economies, raising relative wages of high-skilled workers and increasing wage inequality in advanced economies and, conversely, raising relative wages of low-skilled workers and reducing wage inequality in developing economies (Stolper and Samuelson 1941).

2. In figure 5-5 (bottom panel), the black dotted line shows the log change in individual earnings arranged by earnings percentiles. The gray solid line arranges individuals in the same percentile groups as the black dotted line based on their own earnings but plots the log change in average earnings at firms where they worked. The gray dotted line plots, for the same percentiles, the change in individuals' earnings relative to average earnings at their firms. This line is equal to the difference between the black dotted and gray solid lines. In all three cases, the change is measured between 1981 and 2013. The upward sloping black dotted and gray solid lines show roughly matching increases in inequality in earnings between individuals and in inequality in average earnings between firms where they worked. The largely flat gray dotted line shows that within-firm earnings inequality remained relatively unchanged, except at the very top of the earnings distribution.

3. In figure 5-7, the middle line shows labor income share adjusted for self-employment, which plays a larger role in emerging and developing economies. The top line includes an additional adjustment to show labor share in terms of income net of depreciation of capital.

4. The stronger impact of technology on labor income shares in advanced economies relative to emerging economies reflects both greater technological change in the former group of economies (sharper declines in relative prices of investment goods) and higher elasticities of substitution between labor and capital, including higher exposure to automation of routine tasks. Participation in global value chains can have the effect of lowering labor income shares in emerging economies as the

tasks that are offshored are relatively capital intensive in the context of these economies (IMF 2017a).

5. The HHI Index is a commonly used measure of market concentration. Antitrust agencies generally consider markets in which HHI is between 1,500 and 2,500 to be moderately concentrated and markets with HHI higher than 2,500 to be highly concentrated.

6. Besides superstar firms, information and communication technologies and their global reach have increased the leverage of highly skilled individuals, such as top business and finance executives, artists, and athletes.

7. Another study covering G7 economies finds that the fall in labor's share of income is less due to a shift of income to productive capital and more to a shift to housing capital and land rents (Rognlie 2015).

8. Skill constraints dampened productivity growth through both slower growth in needed human capital (Adler and others 2017) and increase in skill mismatches (Adalet McGowan and Andrews 2015).

9. The rise in the higher education wage premium flattened after 2000. Studies attribute this flattening to the maturation of the initial investment boom in information technology (and related surge in demand for higher-level skills) and rising competition between education groups for increasingly scarce well-paid jobs (Valletta 2016, Beaudry and others 2016).

10. The percentage of workers engaged in alternative work arrangements in the United States—defined as temporary help agency workers, on-call workers, contract workers, and independent contractors or freelancers—rose from about 10 percent in 2005 to 16 percent in 2015 (Katz and Krueger 2016). In a recent study of the rise of the gig economy, those engaged wholly or partly in independent work either by choice or necessity are estimated to account for 20 percent to 30 percent of the working-age population in the United States and fifteen advanced European Union countries (McKinsey Global Institute 2016).

11. In the United States, for example, estimates of the unit cost of financial intermediation do not show a significant decline despite the introduction of new technologies over the past three decades (Philippon 2016b).

12. Intergenerational earnings elasticity in figure 5-19 measures the average proportional increase in a son's adult earnings predicted by this father's adult earnings measured approximately three decades earlier. A higher intergenerational elasticity implies lower intergenerational mobility.

13. "Education then, beyond all other devices of human origin, is the great equalizer of the conditions of men, the balance-wheel of the social machinery" (Horace Mann).

14. Social programs directed at the lower end of income distribution have been strengthened in emerging economies in recent years, notably through the adoption of conditional cash transfers (CCT)—though total social spending remains

much lower than in advanced economies. Pioneered in Latin America, the developing region with the highest level of income inequality, CCT programs have been credited as a factor contributing to the region's success over the past decade in beginning to reduce its high inequality (World Bank 2016).

15. Incorporating in-kind benefits of public spending into income distribution accounting, however, presents difficult challenges of valuation of these benefits and their fiscal incidence.

16. Grigoli and Robles (2017) estimate that the relationship between inequality and economic growth switches from positive to negative at a net (post-taxes and transfers) Gini of 0.27. In 2015, the net Gini in more than 80 percent of OECD countries was in excess of this threshold. The average net Gini for OECD countries as a whole was 0.32 in that year.

17. For nineteen OECD countries for which long-term data are available, inequality rose by an average of more than two Gini points between 1985 and 2005, an increase estimated to have reduced cumulative growth between 1990 and 2010 by an average of 4.7 percentage points (OECD 2015a).

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SIX

Boosting Productivity and Reducing Inequality

An Interconnected Policy Agenda

ZIA QURESHI

Slowing productivity growth and rising income inequality present two major challenges of our times. Together, these trends have produced weaker and less inclusive economic growth, caused a slower and unequally shared rise in living standards, and contributed to adverse sociopolitical developments. While growth picked up in most economies in 2017 and near-term economic prospects have improved, deeper, longer-term productivity and inequality challenges remain. The prospects for a sustained strengthening of economic growth and the achievement of a more inclusive pattern of growth will depend on policies to address these challenges.

Previous chapters documented and analyzed the trends of slowing productivity and rising inequality over the past couple of decades. One key finding is that the slowdown in productivity and the concurrent rise in inequality are interconnected, with important common drivers and mutually reinforcing mechanisms. Policies to combat and reverse these trends are interconnected as well.

Reviving stronger productivity growth and reducing income inequality present enormous policy challenges, and the political economy of reform is difficult and complex. But there is some good news. To the extent slowing productivity and rising inequality are driven by common factors, there is potential for win-win policies. Productivity and equity are often seen in terms of a trade-off in economic policy debates. However, research on recent trends points to important synergies and complementarities between the two, suggesting scope for policies that can help promote both productivity and equity. We refer to this interconnected policy agenda as an agenda for productive equity.

Inevitably there will be trade-offs. Forces such as globalization and technology always produce winners and losers, but policies can play an important role in balancing these and aiming for growth that is more robust as well as more inclusive. The linkages among policies and their impacts call for an integrated approach to formulating the policy agenda that captures reform synergies and addresses potential conflicts through appropriate prioritization, sequencing, and packaging of policies. The 2017 OECD report on economic policy reforms makes a strong case for implementing reforms in packages that improve policy coherence and help integrate the agenda for stronger and more inclusive growth (OECD 2017a).[1]

The agenda ahead will require innovation in policies. Technology is changing the economic landscape in many ways. For example, it is changing how firms compete and grow in markets, and it is changing the nature of work and job dynamics. These changes will call for new, out-of-the-box thinking, experimentation, and learning in competition and technology policies; and in policies affecting skill-rebuilding, worker mobility, and social protection. Policymaking will need to be responsive to a context of significant and continuing change.

Drawing on the findings of the previous chapters, this chapter sets out the main elements of an integrated policy agenda to address the twin challenges of slowing productivity and rising inequality—the agenda for productive equity. The focus here, as in the preceding analysis, is on advanced economies and major emerging economies, although much of what is presented here would apply also more broadly across economies. Specific policy needs and priorities depend on individual country circumstances. The intent here is to sketch out a broad framing of the main areas requiring the attention of policymakers.

The policy agenda spans national and international reforms. Figure 6-1 presents a schematic summary. The bulk of the reform agenda concerns policies at the national level. But in a globalized world, policies governing how economies interact—in trade, finance, movement of workers, technology—

FIGURE 6-1 **Promoting Productive Equity: An Integrated Agenda**

National Reforms		International Reforms	
Address legacies of global financial crisis	**Step up longer-term, structural reforms**	**Make international system work better and for all**	**Improve global economic governance**
• Revive investment –Private investment –Public infrastructure investment • Deepen financial sector reform to bolster resilience and promote more productive and inclusive outcomes from growth and innovation in finance	• Revitalize competition policies for the digital age and spur business dynamism • Reform technology policies to boost innovation and its diffusion • Improve education and (re)training to broaden and upgrade skill base and adapt skills to shifts in demand • Reform labor market policies and revamp social protection to align with changing job dynamics • Reform tax systems to boost productivity and equity	• Pursue open markets for international trade and investment –Supported by domestic policies to facilitate adjustment and promote broad sharing of gains • Improve policies on international mobility of skilled labor • Promote international cooperation on competition policies, R&D/IPR regimes, taxes, and standards (labor, environmental)	• Promote a rules-based international system • Bring the institutions of global governance up to speed with globalization, technological change, and related economic transformations

are increasingly important. With the rising significance of international spillover effects, many policies in the national domain need to be designed with the global context in mind and are more effective if supported by international coordination. This applies not only to macroeconomic policies but also to structural reforms in areas such as competition and taxation. Ensuring that globalization works for all calls for an integrated approach to national and international reforms. It requires not only rules governing the global system that are fair and provide a level playing field for international engagement but also national policies that help firms and workers capture opportunities and adjust to change.

Within the integrated policy framework summarized in figure 6-1, this chapter focuses on national reforms. International reforms are taken up in the next chapter. Part of the national reform agenda involves addressing some of the legacies of the global financial crisis that slowed recovery from the crisis and continue to weigh down growth prospects. But many of the causes of the slowdown in productivity growth and the rise in income inequality run deeper, reflecting longer-term factors predating the crisis. Reversing these trends will call for a range of structural reforms.

Addressing Legacies of the Global Financial Crisis

Major financial crises typically cast a long shadow (Reinhart and Rogoff 2014), but one reason economies have taken so long to recover from the last global financial crisis is the inadequacy of policy response. The policy response was not so much wrong as insufficiently comprehensive. Macroeconomic policies responded, especially monetary policies, but not so much structural reforms, except actions in the financial sector where the crisis started. Policymakers initially tended to regard the financial crisis as a cyclical, albeit a major, shock. It was only later that it became clearer that broader, longer-term structural solutions were needed to restore stronger and more inclusive growth. The pre-crisis growth model was overly reliant on finance and leverage. More needed to be done to strengthen the underlying foundations of infrastructure and human capital, remove distortions that undermined the functioning of markets, and harness the benefits of new technologies while managing risks.[2]

So a two-pronged effort is needed on national reforms: more immediate actions to address the remaining legacies of the financial crisis and the ensuing deep recession and consolidate the recent acceleration of economic growth; and steady build-up of momentum on longer-term reforms to address deeper-rooted structural and institutional weaknesses and the secular forces at play. Two areas for attention in the former, shorter-term policy agenda are revival of investment and completion of reforms in the financial sector.

Reviving Investment

The decline in investment has been an important correlate of the slowdown in productivity growth. Private fixed investment rates fell sharply in advanced economies after the global financial crisis and remain well below pre-crisis trend despite some recovery. While private investment in these economies has started to recover, much of their recent growth acceleration has been due to rising private consumption. Investment in emerging markets also declined after the financial crisis, although more gradually. Falling investment rates contributed to slower productivity growth by limiting capital deepening and the adoption of capital-embodied new technologies. Weaker prospects for productivity growth, in turn, depressed investment, producing a negative feedback loop between investment and productivity (Adler and others 2017, Blanchard and others 2017).[3] Infrastructure investment declined as well, which hurt the productivity of other investments. Widening infrastructure gaps also hampered inclusive growth, since a strong infrastructure foundation is important for broad-based growth in economic opportunities.[4]

Private Investment

Weak aggregate demand in the aftermath of the global financial crisis was a key factor in the post-crisis decline in investment. In economies where aggregate demand remains relatively weak, as is the case in some economies in Europe, policymakers need to continue with policies supportive of a fuller recovery in demand. Macroeconomic policy space is constrained in many cases, which underscores the importance of policy mixes that exploit the synergies between monetary, fiscal, and structural policies (Gaspar and others 2016).

Protracted policy uncertainty in the wake of the financial crisis also discouraged investment and shifted its composition away from longer-term and higher-risk/higher-return projects that are important for innovation and productivity growth. Indicators of policy-related economic uncertainty have remained elevated in many European economies and have risen more recently in the United States (Bloom and others 2014, Baker and others 2016). Adoption of consistent dynamic macroeconomic policy frameworks to guide policy—including sound medium-term fiscal policy frameworks to manage public sector balance sheet risks—and clearer articulation of structural policies in key areas such as regulation and trade would help reduce policy uncertainty and improve investor confidence.

Further progress in restoring financial sector health and improving credit flows also would support the revival of investment (more on this later). Beyond demand-oriented macroeconomic policies and improved access to financing, reform of structural policies would be important to achieving a satisfactory and durable recovery of investment. Barriers to competition and regulatory complexity hurt both the quantity and quality of investment (Alesina and others 2005, OECD 2015a, Gutiérrez and Philippon 2017, Égert 2017). Structural reforms in these areas are taken up later in this chapter.

Infrastructure Investment

There is a strong case for a major boost in public infrastructure investment. Driven by fiscal constraints that intensified after the global financial crisis (as well as suboptimal policy choices), public infrastructure investment has been declining, exacerbating infrastructure gaps. While infrastructure backlogs increased, technological change has been transforming infrastructure needs, not just in digital infrastructure but also in sectors such as energy and transport. In the United States, net federal infrastructure investment recently has been close to zero. This trend must be reversed.[5] Larry Summers recently called for boosting infrastructure investment in the United States by 1 percent of GDP over ten years, totaling about $2.2 trillion, with half of that increase devoted to addressing backlogs in infrastructure maintenance (Summers 2016a).[6] Both in the United States and Europe, there are now efforts to boost infrastructure investment that, if designed and implemented well, could yield sizable growth benefits. An IMF study of seventeen advanced economies estimated (in what was termed a conservative estimate) that a 1 percent of GDP increase in public infrastructure investment could raise labor productivity by 0.5 percent over the medium term (Adler and others 2017). A recent McKinsey study estimated that returns on well-designed infrastructure projects could be as high as 20 percent (McKinsey Global Institute 2016).

With potentially high returns, and with borrowing costs currently at historic lows, well-designed infrastructure projects can, in fact, pay for themselves. User charges can be deployed more effectively to mobilize revenue to support investments—as well as promote efficient use of investments—while cushioning the impact on the poor. Governments can enhance fiscal space by better using their balance sheets, factoring into the fiscal calculus that borrowing to finance infrastructure creates a liability, but it also creates an asset with a stream of future returns (Derviş 2015, Fischer 2015). They should consider adopting capital budget conventions for infrastructure investments so that costs of projects are spread over time rather than all accrued during construction. An OECD study estimated that, on average, there is room to finance a productivity-enhancing multiyear fiscal initiative of at least 0.5 percent of GDP in OECD countries (OECD 2016a).

Boosting infrastructure investment at scale will also require an increase in private investment and public-private partnerships in infrastructure. There is substantial potential to increase private participation in infrastructure by improving regulatory and institutional frameworks, including adapting and clarifying frameworks as new technologies disrupt existing paradigms, and by mobilizing long-term private financing through innovations in financial instruments and risk mitigation. Assets under management by institutional investors globally amount to more than $120 trillion, but only about 5 percent of those are invested in infrastructure (Bielenberg and others 2016). With innovations and the right levers to develop infrastructure as an asset class, more financing can be mobilized from these sources.

Infrastructure investment needs, and potential returns on investment, are especially high in emerging economies. In these economies, infrastructure investment may need to double from current levels over the next fifteen years (from around $2 trillion to $4 trillion annually), owing to their growth needs, rapid urbanization, and already large infrastructure backlogs. Given concerns about "secular stagnation" in advanced economies, with an excess of desired savings over desired investment even at low rates of interest, channeling more of excess global savings to support infrastructure investment in emerging economies could be a win-win policy for both groups of economies (Bernanke 2015).[7] Removing barriers to capital flows and improving investment environments in host countries would spur such reallocation of global savings. Multilateral financial institutions can help by playing a stronger intermediation and leveraging role.

Besides contributing to stronger and more inclusive growth, sound infrastructure investments are key to combating climate change and, thus, to the sustainability of economic and social gains. Natural capital is a key input into production. Climate change disproportionately hurts the less well-off. Infrastructure currently contributes around 60 percent of global greenhouse gas emissions. It is important, therefore, to ensure that new infrastructure investments are designed to support environmental sustainability. The key action here is to institute carbon pricing, which can shift incentives toward sustainable forms of infrastructure while also generating substantial revenues. Shifting to sustainable infrastructure can open a new world of opportunities for innovation and investment, notably in energy-related sectors, that can boost productivity and growth (Bhattacharya and others 2016, Qureshi 2016).

Deepening Financial Sector Reform

Much progress has been made since the global financial crisis in restoring financial sector stability and normalizing credit conditions, but this remains a work in progress. Credit disruptions that followed the crisis particularly hurt firm investment in development and adoption of new technologies, exacerbating the slowdown in productivity growth (Anzoategui and others 2016, Adler and others 2017).[8] Small and medium-size firms were affected disproportionately. In the short term, completing corporate and bank balance sheet repair to normalize credit flows to support investment remains a priority, especially in euro-area economies. This includes reducing persistently large nonperforming loans—by improving insolvency regimes and removing legal impediments to corporate restructuring—and addressing capital deficiencies at banks that remain weak. Achieving an orderly corporate and financial system deleveraging is also important in several emerging economies, notably China (which also faces the challenge of continuing to move to a more market-based financial system).

A key plank of the post-crisis reform agenda has been phased-in implementation of the Basel III capital adequacy framework to bolster bank capital buffers. For systemically important banks, stronger regulatory frameworks are being put in place, including requiring higher capital requirements and credible plans for orderly resolution if needed ("living wills"). Addressing the "too big to fail" issue is important as explicit or implicit subsidies to large banks have been a factor in encouraging lax lending and also outsize remunerations within financial institutions. Ongoing reforms are also addressing prudential regulation issues in the "shadow banking" sector. International coordination of financial sector regulation has improved under the auspices of the Financial Stability Board.

Completion and consolidation of these reforms would help strengthen financial system stability and resilience (IMF 2016a). These reforms need to be complemented with deeper structural reforms to improve the functioning of the financial systems so they better support longer-term productivity growth and more inclusive outcomes. Current reforms have focused mainly on incumbents. Financial sector performance would benefit from encouraging entry and fostering more competition to address problems associated with size, interconnectedness, and oligopoly rents, and to better take advantage of new technologies to develop more efficient and inclusive systems. Concentration in the financial sector has increased. In the United States, for example, the top five banks' share of banking assets increased from about 25 percent in 2000 to 45 percent in 2014.[9] Removal of tax distortions that favor debt over equity and bias the allocation of finance toward households (particularly mortgage debt) and against business investment also would help. Such distortions are common across OECD countries (OECD 2015b).

Understandably, post-crisis financial sector reform has focused on the banking system. There is a need, however, to promote other forms of financing to increase the availability of risk capital, including by institutional investors. Seed and early-stage equity capital, such as venture capital, is especially important for innovative and growth-oriented small and medium-size businesses.

New technologies in finance so far have not delivered major, broad-based improvements in financial services, as they have been concentrated in activities such as trading and asset management tailored to the well-off—and largely by incumbent financial institutions. However, continuing advances in digital technology and technology-enabled business model innovations hold much promise to expand the range of financial services and reduce their cost, open new gateways to entrepreneurship, and democratize access to finance. Examples of such financial innovations are mobile financial services, digital platforms, real-time payments, peer-to-peer lending, equity crowdfunding, and blockchains. Young FinTech firms are in the vanguard in the application of these innovations. A challenge for policymakers is to foster the growth of these new entrants into the financial industry while managing associated risks. Some countries—Australia, Singapore, and the United Kingdom, for example—are using a "sandbox" approach that encourages innovation and generates learning to inform the development of appropriate regulatory policies to apply to the new entrants (Philippon 2016).

The potential for the combination of mobile telephony and digital financial innovations to improve and broaden access to financial services—for households and small and medium-size enterprises—is particularly large in emerging economies (World Bank 2106). Even in a more developed emerging economy, such as Mexico, roughly 60 percent of adults do not have a bank account. By some estimates, FinTech firms could take up to 30 percent of Mexico's banking market in the next decade and become the linchpin for financial inclusion.[10]

Stepping Up Longer-Term, Structural Reforms

The legacies of the global financial crisis have hurt productivity growth, but this has happened on the back of a secular slowdown in productivity that was already under way before the crisis. Similarly, the rise in income inequality in major economies started well before the crisis. Important factors underlying these trends have been building over a longer period and are structural in nature. Addressing these factors will require deeper reforms in product and factor markets and the policies and institutions that underpin them as well as innovative thinking on how forces such as technological change are reshaping the agenda.

Structural reforms in advanced and major emerging economies picked up in the aftermath of the financial crisis, spurred by the severe impacts of the crisis. More recently, however, the pace of reform has slackened in both groups of economies, especially in policy areas important for long-term growth in productivity (OECD 2017a). A stronger and more sustained reform effort is needed—supported by a change in the policy mind-set to approach growth and inclusion in an integrated manner and address today's economic transformations in a proactive way.

Revitalizing Competition

Competition is a strong spur to productivity growth; it works to improve the efficiency of resource allocation, and it stimulates new investment and innovation. Competitive markets also promote inclusive growth by providing a level playing field to businesses and greater opportunities for workers (Atkinson 2015, Furman and Orszag 2015). As we saw in previous chapters, there are several indicators that suggest that competition has been weakening in many major economies. These include declining business dynamism (entry and exit of firms); rising concentration of economic power in many industries; sharply higher firm markups; and increasingly skewed distribution of corporate profits, with supernormal profits earned by dominant firms suggesting a rise in economic rents. Weakening competition and growing monopoly power are also signaled by high corporate profits at a time of weak investment and productivity growth (Krugman 2016, Summers 2016b).

In industries less exposed to competitive pressures, technological diffusion is weaker; innovation-embodying new investment is lower; productivity gaps between firms are wider; and aggregate productivity growth is slower (Andrews and others 2016, Cette and others 2016, Égert 2016). Increased concentration of market power has reduced the share of corporate revenues going to labor (Autor and others 2017), while increased profitability gaps between dominant firms and most other firms have driven inequalities in worker earnings higher (Song and others 2015). Reducing barriers to competition, therefore, could carry the double dividend of boosting productivity growth and reducing inequality.

Regulatory reform needs to aim at both eliminating regulations that impede competition and ensuring that adequate rules and regulations are in place to prevent abuse of market power.[11] Product market reforms are an important part of this agenda, including actions to remove barriers to firm entry and exit and to check anti-competitive business practices such as anti-competitive mergers, collusive agreements, and exclusionary conduct. There is considerable scope for simplification and rationalization of domestic product market regulations in a number of advanced economies, especially in network and service industries (OECD 2017a). Preserving and enhancing exposure to international competition by reducing barriers to foreign trade and investment is important as well, especially in emerging economies. Strengthening of institutional frameworks for formulation and enforcement of competition policies would help combat rent-seeking by dominant firms. Also, when regulations are aimed at addressing genuine market failure, care should be taken to avoid unintended negative effects on small firms.[12]

The trend toward increased industry concentration has been boosted by a spike in mergers and acquisitions (Grullon and others 2017). The annual number of M&As recently has been more than twice what is was in the 1990s. Global activity in M&As exceeded $5 trillion in 2015, about half of which was in the United States, with the average size of the deal almost double the average for the previous five years (CEA 2016a). Antitrust enforcement has weakened (Kwoka 2017). In view of the rise in market concentration, the robustness and enforcement of antitrust regimes merit special attention. Guidelines for M&As—not only horizontal M&As but non-horizontal ones as well—need to be reviewed and updated in light of the new market realities (Galston and Hendrickson 2018).

In addition to competition policy failures, new technologies are contributing to increased market concentration by altering the structure of competition in ways that produce "winner-takes-most" outcomes. Digital technologies, in particular, offer scale economies and network effects that encourage the rise of dominant firms—and globalization reinforces the scale economies by facilitating access to markets worldwide.[13] The "winner-takes-most" dynamics are most marked in the high-tech sectors, as, for example, reflected in firms such as Facebook and Google, but could affect broader segments of the economy as digital technology applications penetrate business processes more widely, notably in sectors such as transportation, communications, finance, and parts of retail trade (Amazon, for example, has emerged as a giant in retail trade). Market concentration driven by technological change poses new challenges for competition policies.

Even when firms reach dominant positions on the merits of their innovations and superior efficiency, monopolies or quasi-monopolies can lead to abuse of market power—price manipulation, collusion, rent-seeking, and self-entrenchment by erecting barriers to entry—and discourage business dynamism and further innovation (Rajan and Zingales 2003, Autor and others 2017). The beneficiaries of an open, competitive system often work to close the system and stifle competition—hence the theme of saving capitalism from the capitalists that features in much recent research on rising market concentration (Krugman 2015, Reich 2015, Stiglitz 2016). Digital technologies are a major driver of today's economic advances, and a key question is how to ensure that markets continue to provide the competitive spark and a setting for fair play.

Scale economies and network effects give today's high-tech giants characteristics of natural monopolies. Should they be regulated like public utilities? How do today's digital platforms and networks differ from the network industries of the past? How should antitrust laws be adapted to the market power dynamics of the digital age? Some steps have been taken in the United States and Europe to address competition issues in the technology sectors, such as ensuring net neutrality, promoting competitive access to the wireless spectrum, and allowing unlocking of cell phones if consumers want to change providers.[14] Other areas under consideration by regulators include firms' use of big data, wider access to these data, protections for data privacy, ways of making digital data more portable by consumers, and improvement of price transparency amid opaque and changing pricing models, including algorithmic pricing (Furman 2016, Marcus 2016). In Europe, new rules on data access and protections drawn up by the European Union (known as the General Data Protection Regulation) came into force in May 2018. Revamping competition policies for the digital economy will require much learning by doing.

The combination of technology and globalization also means that competition policy needs to become more global. Today's superstar firms typically are multinationals operating and affecting concentration in markets in many countries. The OECD countries have already made progress in drawing up common rules to prevent companies from avoiding taxes through profit shifting and parking money in tax havens.[15] Similar cooperation is needed to develop a competition policy framework for the digital economy and address cross-border business practices that restrict competition.[16] One recent proposal is for the G20 to take the lead and set up a World Competition Network, building on the model of the European Union's European Competition Network (Marin 2017).

Reforming Technology Policies

Technology policies are an important complement to competition policies in spurring innovation and productivity growth. Productivity-enhancing innovation has weakened in major economies. It has slowed but remained relatively robust in firms at the technological frontier, but its diffusion across firms within economies has weakened greatly, which is reflected in widening gaps in productivity performance between small groups of industry leaders and the vast majority of other firms. There is a need both to spur innovation at the technological frontier and to facilitate its diffusion more broadly across economies.

One area for attention is policies regarding patents. Designed to provide incentives for investment in research, patents have come under increasing scrutiny amid concerns that overly broad and stringent intellectual property protection may, in fact, be hurting innovation and stifling competition. Recent empirical research on patents has been largely unsupportive of their role in promoting innovation (Moser 2013, Williams 2017).

Patent use is greater among big, established firms, which may use patent protections strategically to keep potential competitors at bay (and extract high prices for their products). There is sizable lobbying and rent-seeking activity around patents, in which the established players have a clear advantage. The result is discouragement of new entrants and new or follow-on innovations as well as prevention of a broader diffusion and adoption of innovations across firms. Industries that have seen larger increases in market concentration have also seen larger increases in patent-intensity and greater slowing of technological diffusion (Autor and others 2017).[17] Stronger patent protection may be associated with wider productivity gaps within industries (Andrews and others 2016). Patent trolls and patent litigation, booming by-products of the patent system as it has expanded, add to frictions that hold up innovation and its diffusion.[18] A majority of patents issued are not actually used in production but create legal thickets for potential competitors.

Problems with patents have led some to call for a complete abolition of the patent system (for example, Boldrin and Levine 2013).[19] This may be too radical an approach. However, a significant reform does seem to be in order to improve the patent system and give freer rein to competition that is the prime driver of innovation. Elements of patent system reform could include instituting stricter criteria and tighter approval processes for the award of patents (so as to reward only meaningful—“new, useful, and non-obvious”—inventions), shortening patent lives, streamlining processes around standard-essential patents, and ensuring that the litigation system is not unbalanced in favor of patent holders (Baily and Montalbano 2016, Furman 2016). One reform area to explore is to move away from a “one size fits all” patent regime and adopt a differentiated approach: across industries, such as pharmaceuticals where the gestation period and life of inventions tend to be longer than in other industries, notably digital technology and software (Roin 2014); and by firm size, as research suggests that patent protection supports innovation more in smaller firms (Galasso and Schankerman 2015).[20]

Besides patent reform, governments can make better use of fiscal incentives to promote innovation. The private sector is prone to underinvest in research and development because R&D investments have knowledge spillovers for the economy at large that firms do not take into account in their decisions.[21] Fiscal incentives such as R&D subsidies and tax benefits help correct this shortfall. Improvements in the design of these incentives can enhance their impact and cost-effectiveness. This includes targeting incentives to investments with potential for large economy-wide benefits and ensuring that young and small firms are not at a disadvantage in accessing the tax incentives. Best practices include payroll tax relief for researchers and refundable R&D tax credits (IMF 2016b). There is evidence that such well-designed incentives can raise R&D investment and boost productivity (Westmore 2014, Égert 2016).

There is also a need to bolster public investment in R&D, which weakened in many major economies as fiscal conditions tightened. In the United States, for example, government R&D spending fell from 1.2 percent of GDP in the early 1980s to 0.6 percent in 2015, and its share in total R&D spending fell from 45 percent to 22 percent (Shambaugh and others 2017). With its public good characteristics and focus on basic research that private firms are unlikely to undertake, public R&D investment complements applied private research.[22] Many breakthrough innovations that the private sector has developed commercially had their origins in public research at government research institutes, defense-related research programs, and publicly supported research programs at universities—including in medicine and biotechnology, information technology, nanotechnology, and aerospace (Moyer 2012, Mazzucato 2015).[23] Looking ahead, public research can play a similar seminal role in clean energy and other technologies to combat climate change.

Public research programs should pay particular attention to fostering broad access to the fruits of public R&D, reflecting this objective in the design and focus of these programs as well as how the resulting innovations are deployed (Cozzens and Thakur 2014, Chataway and others 2014, Breznitz and Zehavi 2017). Patent reform could reinforce this emphasis by requiring that government-supported research may not lead to patents but should be available to all market participants (Boldrin and Levine 2013). Support encouraging R&D collaboration between universities and firms can facilitate technological diffusion by providing smaller firms with access to sources of knowledge (OECD 2015c). A recent study of the United States finds that innovations are highly concentrated in high-income groups and that education and internship programs to increase exposure to innovation among disadvantaged groups (those disadvantaged by income class, gender, and race) can significantly boost overall innovation by helping the many "lost Einsteins" in these groups; indeed, such programs can have larger impacts on innovation than increasing the financial incentives to innovate by, for example, reducing tax rates (Bell and others 2017).

Complementary reforms can help raise resources for boosting public investment in R&D and related educational programs. For example, carbon pricing reform can help in scaling up support for research on clean technologies. Currently governments spend orders of magnitude more on harmful fossil-fuel subsidies than on clean energy research. Governments could also explore ways of better recouping some of their investment in research to help replenish their research budgets and sustain R&D programs—producing a better balance in sharing risks and rewards of public research investment compared to the current paradigm where risks are socialized but rewards are privatized. Ensuring that companies do not take advantage of loopholes in the tax system and pay adequate taxes on their profits is the obvious way. Other possibilities include requiring companies to repay research grants if their products succeed financially or acquiring equity stakes in the commercialization of successful technologies directly supported by public research funds (Lazonick and Mazzucato 2013, Rodrik 2015).[24]

While major emerging economies have boosted their R&D programs, most technology creation occurs in a small number of advanced economies: close to two-thirds of global R&D is undertaken in the G7 countries. International policies that promote technology transfers are, therefore, crucial to producing stronger and more inclusive impacts of technological progress on global productivity (Baker and others 2017).

Investing in Skills

The new technologies demand different, higher-level managerial and worker skills, and their success depends greatly on the availability of these complementary skills. In advanced economies, globalization also has shifted demand toward higher-level skills. An important part of the explanation of the paradox of slowing productivity in the midst of technological advances is skill shortages and mismatches that prevent broader diffusion of these advances throughout economies by limiting firm capacities to adopt and adapt.[25] These factors also contribute to increased income inequality as gaps in firm profitability widen and as wage differentials increase with higher premia on scarce skills. Investing in skills, thus, is a key part of the policy agenda, cutting across the productivity and equity domains.

There is active current debate on the implications of the new technologies—digitization, robotics, artificial intelligence—for the future of work and jobs. As described in the previous chapter, these technologies are having major impacts on labor markets, notably reducing the demand for labor for tasks involving routine and lower- to middle-level skills. This has led some commentators to draw up dire scenarios of massive job losses from automation—what Autor and Salomons (2017) call "robocalypse" scenarios. Some illustrative headline estimates of jobs at risk of automation are: 47 percent in the United States (Frey and Osborne 2013); 57 percent in the OECD countries (World Bank 2016); two-thirds in developing economies (Kim 2017); and half of the jobs globally—around 2 billion (Education Commission 2016). Such predictions have prompted calls for measures to slow the pace of automation, such as a robot tax (Gates 2017, Shiller 2017).

Technological innovation is a primary driver of long-term productivity growth and rise in living standards, and policies that undermine it would be counterproductive. Similarly, how many jobs will be killed by automation seems like the wrong question to focus on; it looks only at the destruction of existing jobs and ignores the creation of new jobs by the new technologies—as they generate new and different tasks and propel economic growth.[26] Similar predictions of large-scale job destruction and high technological unemployment were made in previous major episodes of automation, but they all failed to materialize.[27] As technological change made some old jobs redundant, it created new ones that were complementary with the new technologies.

The employment implications of technological change should be seen in terms of a process of dynamic adjustment of old jobs and tasks giving way to new ones (Autor 2015, Acemoglu and Restrepo 2018a, Autor and Salomons 2018).[28] Digital technologies will change the skill content of jobs. The composition of employment also will change, with more people working independently as digital platforms and the "sharing economy" expand opportunities for microentrepreneurs (Sundarajan 2016, Brynjolfsson and McAfee 2017). The main issue is that the nature of work is changing, and the main policy challenge is to equip workers with the skills demanded by the new technologies and support workers during the adjustment process.

The supply of skills has been slow to respond to the changing demand; education and training have been falling behind in the race with technology (Goldin and Katz 2008, Autor 2014). Policy reforms need to pick up pace to adapt education and training systems to the changing workplace. Upskilling and reskilling workers will require changes and innovations both in the content of education and training programs and how they are designed and delivered.

The new technologies reinforce the need to build science, technology, engineering, and mathematics (STEM) skills, but they also demand a foundation of broader skills, such as critical thinking, problem solving, adaptability, information literacy, and social/communications skills (Winthrop and McGivney 2016, World Economic Forum 2016, Gormley 2017). These skills complement digital technologies, are hard to codify and automate, and make workers more retrainable for midcareer transitions to other jobs or independent work as entrepreneurs. Training in specific occupational skills should be buttressed by these broader, portable skills. Relatedly, stronger models and a broader range of options need to be developed for lifelong learning, given the fast-changing skill needs but also the aging of workforces in many economies. The old cycle of "learn-work-retire" is changing toward one of continuous learning.

Across education systems, stronger commitment to investment needs to be underpinned by greater attention to quality and relevance. Budget constraints heighten the need for efficiency improvements to free up more resources for new investments in building skills. There is substantial scope for doing better on these dimensions in all countries, emerging and advanced (OECD 2016b, World Bank 2017).

Creative ways of co-opting nontraditional providers of education and training, such as employer training programs and apprenticeships, would not only augment skill-building efforts but also help better match those efforts with the actual skill needs of businesses. Skill mismatches will be an increasingly serious issue as automation and artificial intelligence continue to shift the demand for skills (Acemoglu and Restrepo 2018b). Across OECD countries, on average already around one-quarter of workers report a mismatch between their skills and those required by the job (Adalet McGowan and Andrews 2015); and, globally, some 40 percent of employers report that they are finding it difficult to recruit people with skills they need (ManpowerGroup 2015). Good models of apprenticeship, such as those in Germany, could be studied for wider adoption.

Well-designed tax incentives could encourage companies to invest more in human capital. Innovative financing mechanisms, such as "lifelong learning accounts,"[29] could help workers adapt to new technologies and learn new skills. Innovations in government aid (grants, tax incentives) and student loan programs could improve their effectiveness and flexibility in covering not just first-time college entrants but also older adults returning to school. Access to lifelong learning is typically more difficult for lower-skilled workers. Competency-based qualifications that recognize alternative credentials based on actual skill acquisition rather than only formal academic degrees could broaden opportunities for learning and skill certification and improve talent matching (OECD 2016c). Investment in education R&D should be increased to find innovations for skill development in the twenty-first century that work and can be scaled up (Turner 2017).

Technology is not only shaping which skills are in demand but also how skills may be acquired. Online courses and other technology-enabled solutions offer new opportunities for broadening access, tailoring content to needs, and improving delivery that education and training systems should exploit. Digital platforms can help improve matching between workers and jobs and enhance job and learning opportunities in the expanding gig economy. Investing in digital infrastructure and improving the digital ecosystem to promote digital access and literacy would help harness the potential of these opportunities. Despite progress, the digital divide remains wide: about half of the world's population is still offline, including 20 percent of the population in advanced economies and 60 percent in developing economies (ITU 2016).

Education is a powerful equalizer of economic opportunity. Improving access to quality education for all is key to addressing the inequalities of opportunity that have caused intergenerational income mobility to decline, as observed in the previous chapter. Reducing inequalities in educational attainment takes on added significance in a skills-based economy where their consequences are still greater, for both the individual worker and the economy at large. Lower-skill and lower-wage workers are disproportionately vulnerable to the disruptions of technology. Inequalities in educational attainment start at young ages and are magnified at higher levels of education. Large proportions of children do not receive pre-primary education, despite evidence that investment at this level offers high returns in terms of educational success and adult productivity.[30] Gaps in higher education attainment by family income level have widened rather than narrowed in many economies.[31] As policymakers seek to strengthen and adapt education and training systems, improving affordability and access to promote the inclusion of the economically disadvantaged should be an integral part of the agenda (Holzer and Baum 2017, Turner 2017, OECD 2017c). A strategy of "progressive universalism" would aim to improve education and training for all, while prioritizing the needs of the disadvantaged and areas of highest return (Education Commission 2016).

Revamping Labor Market Policies and Social Protection

Building the skills of workers and their adaptability to changing demand for skills needs to be complemented with improvements in labor markets and social protection arrangements that facilitate worker mobility between jobs. As discussed in the previous chapter, labor market dynamism has declined in many major economies. Barriers to worker mobility and inadequacies of social protection are contributing to outcomes that are both inefficient and unequal. Shifts in the nature of work and jobs caused by technological change reinforce the need for greater labor market flexibility and stronger supportive institutions.

The implied policy agenda has three interacting elements: employment protection laws that factor in the need for flexibility; social security arrangements that support workers in the transition between jobs; and active labor market policies that help retrain workers and match them with new jobs. These elements, which combine labor market flexibility and security for workers, are often referred to by the portmanteau term "flexicurity." The overarching principle of flexicurity—approaching these elements in an integrated manner and putting the focus on protecting workers rather than specific jobs—is increasingly being reflected in policy in a number of countries and has been adopted by the European Council for guidance to members (European Commission 2007). Perhaps the best-known, and widely admired, model of this approach is the Danish flexicurity system.[32] But no one size fits all, and countries can tailor reforms to their circumstances. A priority for policy should be to offer a better "springboard" to new jobs (Trebilcock 2014).

Labor market reforms should have a forward-looking orientation. Forward-looking policies, including supporting and reskilling workers, aim to help workers adjust to change and take advantage of new opportunities. In contrast, backward-looking policies, such as highly restrictive job protection laws, aim to preserve the status quo and, in particular, keep incumbent workers in existing jobs. Among advanced economies, doing more and better on forward-looking policies applies to all of them, including the United States; reforming backward-looking policies, such as the reform of stringent job protection laws currently under way in France, has particular relevance for the European economies (Bernanke 2017). Approaching these reforms as a package has the advantage that a reduction in rules on worker dismissals may need to be balanced with stronger social security and active labor market policies.

Social security systems will need a revamp as digital technologies continue to reshape work and the workforce, with higher rates of change between jobs, the need for continuous reskilling, and more people working on short-term contracts or independently in the gig economy. These new labor market dynamics driven by technological change add to the reform challenge social security systems already face in many economies to ensure their longer-term fiscal sustainability. The social contract, hitherto based largely on long-term formal employer-employee relationships, will need to be refashioned, with benefits such as health and retirement made more portable and adapted to accommodate different kinds of work arrangements (Sundarajan 2016). Similarly, unemployment insurance will need to be rethought to cover different types of jobs and incent workers to move to new jobs.

Several proposals have been put forward to revamp social security systems that are currently the subject of debate and experimentation. One such proposal is to provide a universal basic income (UBI) regardless of employment status. Economists' views differ on this, based on how it is structured, the extent to which it is an add-on to or a substitute for a variety of existing social programs, and the level of the benefit and its fiscal affordability.[33] Pilots of UBI are currently under way or planned in Finland and some subnational jurisdictions such as Ontario, Canada, and Oakland and Stockton, California.[34] A variant of UBI preferred by some is a negative income tax up to a certain income threshold.[35]

Another proposal is to set up individual "shared security accounts" that would pool all of workers' social benefits and would be fully portable across all jobs, supported by "shared security standards" (Hanauer and Rolf 2015). An innovation launched in France in January 2017 focused on support for training consists of a portable "personal activity account," where each worker accumulates training rights based on different kinds of work that can be drawn upon when needed.[36] Automatic enrollment in tax-preferred retirement accounts or other sensible default options are being considered for workers who do not have an employer-sponsored plan (Furman 2014a). Adaptations in unemployment benefits also are being explored, including, for example, making wage insurance more widely available (Litan 2016, Holzer 2017). Learning from this debate and experimentation should help inform and guide policy.

Proposals for a UBI are also being debated in emerging economies, such as India, where it could provide a more efficient alternative to an assortment of targeted social programs that are often ineffectively implemented (Bradhan 2016, Ministry of Finance, Government of India 2017). One major concern with UBI is that it may weaken incentives to work. However, evidence from well-designed cash transfer programs in emerging economies does not find any significant reduction in work by the recipients (Banerjee and others 2017). Reform of social protection is important in emerging economies also for reducing labor market segmentation; even in a more advanced emerging economy such as Mexico, nearly 60 percent of workers have informal jobs (Levy and Rodrik 2017). Another major reform objective is increasing the participation of women in the labor force, for which improved access to quality early childhood education and care programs and flexible work arrangements can be particularly effective. This is not exclusively an emerging economy issue, of course. In the United States, for example, despite progress, 26 percent of women age fifteen to fifty-four were out of the labor force in 2014 (Furman 2014b).

In many major economies, rising concentration of market power in industries coupled with declining unionization and a weakening role of minimum wages tilted the bargaining process in labor markets in favor of employers. Pro-competition reforms in product markets, as discussed earlier in this chapter, would, therefore, have the additional benefit of restoring a more competitive setting in labor markets for employer-employee negotiations.[37] Well-functioning labor market institutions, such as collective bargaining through unions and minimum wages, also help ensure that workers get a fair share in economic returns. Another reform that would add to competition in labor markets is to roll back the ever-increasing professional licensing requirements and non-compete restrictions; in the United States, almost one-third of workers require a government occupational license (CEA 2016b), and between one-fifth to one-quarter of workers are bound by non-compete restrictions (Shambaugh and Nunn 2018).

With the rise in nonstandard types of work, the role and practices of collective bargaining will need to evolve as well. Some innovations are emerging already, such as nonstandard workers setting up new unions or associations,[38] traditional unions working to improve coverage of nonstandard forms of work,[39] and the use of social media for collective action (OECD 2017d). The changing workplace and distributional dynamics have also caused renewed interest in proposals for worker stock ownership, where workers have a chance to share profits and participate in corporate governance (Basu 2016, Summers 2017).

Reforming Tax Systems

Tax policy is often seen as presenting trade-offs between productivity and economic growth on the one hand and distributional equity on the other. Such trade-offs do exist, and a challenge for tax reforms is to design measures to mitigate them. However, there is substantial scope for reforms that offer win-win possibilities; these are reforms that improve the tax structure and, depending on the country's fiscal needs, enable the desired level of revenues to be raised efficiently and equitably. In relation to equity, taxes are often seen as a tool of redistribution. But they can also be a tool of predistribution; tax design can promote equity by creating incentives and influencing behaviors that improve the distribution of market incomes before taxes.[40] Policymakers should aim to take maximum advantage of reform opportunities to promote inclusive growth—reforms that boost growth but also improve equity.

In the area of labor income taxation, reducing the tax wedge for low-wage workers can help boost labor force participation—an increasingly important policy concern in aging economies—as well as improve distributional outcomes. Greater use could be made of options such as earned-income tax credits (EITC) at low-income levels, which have been found to be effective in bolstering incentives to work. In the United States, for example, which has seen the labor force participation rate for prime-age men (age twenty-five to fifty-four) decline by 9 percentage points over the past few decades, there have been proposals to expand the EITC that merit political support (Furman 2014b, Krueger 2017). Reducing the higher effective marginal tax rates that second earners in families often face could strengthen incentives to work for second earners, typically women. Countries could also consider lowering payroll taxes and social security contributions where they are excessively high, which could spur firms' demand for labor and (especially relevant for emerging economies) curb incentives for businesses to remain in the informal economy.

Countries may consider shifting part of the financing of social benefits to general tax revenue to avoid overburdening social security contributions and labor income taxation (and attendant labor market distortions) in funding the social security systems—particularly for benefits that are weakly linked to the contributions made, such as unemployment benefits (OECD 2017e).[41] Such a shift in financing may also be needed to extend social security coverage to an expanding part of the labor force that is working independently or in short-term or other atypical contracts. The changing nature of work driven by digital technologies will require more attention to horizontal equity in the tax treatment of workers in different work arrangements. Together with options such as raising the statutory retirement age, countries with aging workforces should correct provisions in the tax and benefit systems that generate incentives for early retirement.

Labor income is often taxed at much higher rates than capital income, which can distort investment and employment decisions and entail both efficiency and equity costs. For example, biases in tax systems that favor capital relative to labor may be creating incentives toward "excessive automation" (Acemoglu and Restrepo 2018b). Policy should seek to broadly harmonize personal income tax rates and the combined burden of corporate income tax and dividend/capital gains taxation. Taxation of capital can be administratively difficult because of its mobility, which can spark a race to the bottom across tax jurisdictions. Indeed, the corporate income tax rate has fallen sharply in many countries. Most recently, the corporate tax rate was substantially lowered in the United States as part of the 2017 Tax Cuts and Jobs Act. In a period when corporate profitability rates have been high, boosted by sizable rents associated with increased monopoly power in markets, the optimal policy may be to tax corporate profits at relatively high rather than low rates.

There is some encouraging recent progress under OECD/G20 processes on international cooperation to curb tax base erosion and profit shifting and improve information sharing between tax jurisdictions. This should strengthen the ability of national tax authorities to tax capital more effectively. In an increasingly networked global economy and fast-expanding digital commerce, international cooperation on tax matters will be even more important.

Policy should also seek to tax different types of capital income in a neutral way (Gordon 2016, IMF 2017b). Tax systems in many OECD economies are characterized by differential taxation of types of capital income, asset types, and sources of financing, which distort investment decisions and misallocate resources. Tax provisions that favor debt over equity particularly disadvantage small firms, start-ups, and R&D investment that tend to rely more on equity financing. Complexity of tax systems and associated compliance costs, and uneven enforcement (especially in emerging economies), can also put smaller firms and new entrants at a disadvantage.[42] Simplifying taxes and improving administration (where digitization can help) can, thus, improve both the efficiency and equity of the tax system.

Taxes on property, wealth, and inheritance are equitable and also less distortionary than taxes on income but are underutilized in most economies. Wealth inequality is typically much higher than income inequality and has risen more sharply in many countries. High wealth inequality is a significant factor contributing to the increase in intergenerational persistence of income inequality. Taxation of wealth has not kept pace with the surge in wealth; the effective tax rate on different types of wealth collectively fell from an average of around 0.9 percent in 1970 to 0.5 percent in the early 2010s (Clements and others 2015).[43] Making better use of property and wealth taxation can improve the tax structure from the standpoint of both economic efficiency and equality (of outcomes as well as opportunity).[44]

While the primary contribution of taxation to the pursuit of equity objectives is through financing spending (such as on education and social programs discussed in the previous sections), taxes themselves can contribute to those objectives through their progressivity. The progressivity of taxes in major economies has declined sharply, which, together with cuts in transfers, has contributed to a reduced redistributive role of the state, as discussed in the previous chapter. Well-designed redistribution through taxes and transfers may not be inimical to growth and can even be pro-growth (Ostry and others 2014).

There is scope for recovering some of the lost tax progressivity without hurting economic growth (IMF 2017a). A mix of tax measures could be considered, including rewinding some of the large reductions in the top income tax rates—which could be particularly challenging politically. The most efficient way to improve the progressivity of the tax system is to reform the assortment of tax expenditures that characterize most tax systems, such as favorable treatment of mortgages, capital gains, dividends, pension contributions, carried interest and stock options, and different types of expenses. These tax expenditures typically are regressive, cause economic distortions, and entail sizable revenue losses. Removing or limiting these tax breaks can broaden the tax base and raise average tax rates without having to raise marginal rates. Similarly, greater horizontal equity in the tax treatment of different tax bases—labor income, capital income, wealth—can enhance vertical equity. Even proportional taxation of capital income and wealth can increase the overall progressivity of the tax system. Depending on their circumstances, countries may also consider progressivity in taxing capital income and wealth, which could relieve the burden of progressivity carried by the personal income tax (Brys and others 2016). Curbing tax avoidance and evasion also helps raise effective progressivity of tax systems.

Reforms should be guided by overall progressivity of the tax and transfer system. For example, a shift in the balance of taxation from income to consumption that improves the efficiency of the tax system from a growth perspective may be accompanied by adjustments in taxes and transfers to compensate lower-income households who may be hit harder by the shift.

Not all tax expenditures cause distortions and waste. They can be used to produce better economic and social outcomes by aligning private and social costs and returns. Tax incentives can correct disincentives from knowledge spillovers and worker mobility that lead private firms to underinvest in R&D and underprovide skills training. Such tax incentives for investment in R&D and human capital need to be designed well to be cost-effective and accessible to potential users on a level footing.[45,46]

Carbon taxes can raise revenue efficiently by helping to overcome a major market failure—the climate externality. The revenue can be used to support investment and innovation to foster stronger and inclusive growth in a sustainable way. Depending on country circumstances, it can also be used as part of a plan to pay down national debt and improve longer-term fiscal sustainability. Carbon taxes can be implemented in a revenue-neutral way as well. One way is to reduce other, less efficient taxes. Another is to distribute the revenue to households equitably via transfers—carbon dividends (Commission on Carbon Prices 2017, Shultz and Summers 2017). A carbon tax will reduce the need for an extensive apparatus of environmental regulations and subsidies.

Conclusion

Much of the attention of policymakers in major economies in recent years has been focused on the more immediate agenda of responding to the global financial crisis and the ensuing recession. Important legacies of the crisis remain, but as economies recover, attention must shift to addressing deeper structural reforms that will drive longer-term economic prospects. Slowing productivity growth and rising inequality are the two defining challenges that policymakers need to confront through deeper reforms of markets, policies, and institutions as they steer economies toward stronger, sustained, and more inclusive growth.

The drivers of slowing productivity and rising inequality are closely interconnected, creating scope for win-win policies. The agenda is not one of productivity versus equity, but rather one of productive equity. It is best approached through integrated policy packages that exploit the synergies between productivity and inclusiveness—and allow potential trade-offs to be mitigated.

The policy agenda is broad, cutting across policy domains. Countries will need to define and sequence policy actions depending on their specific circumstances. Given the agenda's scope and interconnectedness, it would pay to underpin policy formulation with a strategic overview of the objectives, policy priorities, and linkages and a whole-of-government approach.

Technology is changing competition in markets, the nature of work, and demand for skills in major ways. These changes have profound implications for policy. They call for new thinking and innovations to revitalize competition for the digital age and promote broad diffusion of the benefits of new technologies across firms. Training and social protection need to be rethought to upskill and reskill workers and support their transition between jobs in a dynamic job market and to adapt systems to new work arrangements. Tax and transfer policies need to adjust as well. The agenda ahead will demand greater policy responsiveness to change and more experimentation and learning.

The effectiveness of policies at the national level is increasingly intertwined with cooperation at the international level, given global interdependence and spillover effects. How international trade and investment and flows of skills and technology are managed and complemented with national policies have important effects on productivity and income distribution. Globalization has been a positive force for productivity and growth but some of its distributional consequences have recently triggered a populist backlash. How can globalization work better and in more inclusive ways? What improvements in international cooperation and global governance can support national efforts to achieve stronger and more inclusive growth? We turn to these questions in the next chapter.

Notes

1. The 2017 *Going for Growth* report finds that around one-half of the policy reforms proposed in the report for individual member countries to boost growth would also reduce income inequality, close to one-tenth could increase income inequality, and the remainder would have neutral or uncertain effects on inequality. It argues that, compared to piecemeal reforms, implementing reforms in packages helps maximize reform synergies through complementary policies and allows reform conflicts to be addressed through offsetting actions.

2. See, for example, El-Erian (2017), who argues that policymakers missed the central lessons of the global financial crisis and notes that the crisis called for significant reforms to the underlying growth model.

3. Falling investment may have lowered TFP growth in advanced economies by around 0.2 percent per year over the post-crisis period (Adler and others 2017).

4. There is much recent evidence that efficient infrastructure spending not only boosts productivity and economic growth but can also help reduce inequality. On the productivity/growth and distributional effects of infrastructure investment, see, for example, IMF 2014, Calderón and Sérven 2014, Gibson and Rioja 2015, and Hooper and others 2017.

5. In advanced economies as a group, real public capital stock declined from around 70 percent of GDP in the early 1980s to around 60 percent in 2013 (Adler and others 2017).

6. Poor maintenance hurts productivity in two ways: by reducing the productivity of the infrastructure asset itself and by reducing the productivity of activities dependent on it.

7. A simulation of such redirection of savings from advanced economies to infrastructure investment in emerging economies (excluding China) shows that global growth could rise by 7 percent over a ten-year period (McKibbin and others 2014).

8. A recent IMF study estimates that in those advanced economies where credit conditions tightened more severely, the post-crisis productivity decline in annual TFP growth was 1.31 percentage points greater on average in the more credit-constrained firms compared to less credit-constrained firms. The former group of firms reduced their investment rate in R&D and other intangible capital by 0.81 percentage point more than the latter group of firms (Adler and others 2017).

9. "A Giant Problem," *The Economist,* September 17, 2016.

10. Estimates developed by Finnovista, a Mexican FinTech start-up accelerator, as reported in *Financial Times,* June 21, 2017.

11. A recent study of U.S. firms finds regulatory policies a significant factor in driving the rise in industrial concentration (Gutiérrez and Philippon 2017).

12. Regulatory compliance typically entails fixed costs that do not vary with firm size. So regulatory economies of scale can give a competitive advantage to bigger, older firms. In the United States, for example, small firms may be penalized more by laws such as Sarbanes-Oxley and Dodd-Frank—and by the tax code.

13. "In normal markets you can have Pepsi and Coke and a bunch of others. In technology markets in the long run you tend to have only one. . . . Generally, number one is going to get like 90 percent of the profits. Number two is going to get like 10 percent of the profits, and number three through 10 are going to get nothing" (venture capitalist Marc Andreessen as quoted in *Bloomberg View,* March 17, 2016).

14. U.S. net neutrality policy is currently in flux following repeal under the Trump administration of the net neutrality rules put in place under the Obama administration.

15. About 30 percent of global foreign direct investment flows through tax havens, and big companies routinely use transfer pricing to shift profits to no- or low-tax locations (*The Economist,* September 17, 2016).

16. The EU recently took antitrust action against Google for abusing its dominance in search and unfairly privileging its own services on the platform it controls.

17. Similar concerns are expressed about copyrights, whose long terms (life plus seventy years in the United States) are considered to have contributed to high concentration in the entertainment industry. Four record labels account for roughly 85 percent of U.S. recorded music sales and 70 percent of the global market, while five movie studios have captured around 80 percent of the U.S. market and 75 percent globally (Lindsey and Teles 2017). In publishing, a field once populated with independent publishers, just five conglomerates now account for two-thirds of all books published in the United States (Galston and Hendrickson 2018).

18. Patent trolling cost the U.S. economy an estimated $500 billion between 1990 and 2010 (Bessen and others 2011).

19. "Both theory and evidence suggest that while patents can have a partial equilibrium effect of improving incentives to invent, the general equilibrium effect on innovation can be negative. . . . Our preferred policy solution is to abolish patents entirely" (Boldrin and Levine 2013).

20. Care needs to be exercised to avoid creating undue complexity in the patent regimes. Development of an administrable system of tailoring patent rights is an important direction for future research.

21. An IMF study estimates that private R&D investment would be higher by 40 percent if private investment decisions took into account the broad knowledge spillovers. It estimates that such an increase in R&D investment could lift GDP in advanced economies by 5 percent in the long term—and globally by 8 percent due to international spillovers. The associated fiscal cost is 0.4 percent of GDP per year (IMF 2016b).

22. Research covering the period since 1980 shows that large U.S. firms have shifted away from basic scientific research and toward more applied R&D (Arora and others 2015). In the United States, the government now funds about a quarter of all R&D but 60 percent of basic scientific research. The corresponding figures for OECD as a whole are about 30 percent and three-quarters, respectively (OECD R&D Statistics Database: www.oecd.org/sti/rds).

23. Three often-mentioned examples are the Internet, Google's basic search algorithm, and several key features of Apple smartphones (such as the GPS positioning,

touchscreen, the HTML language, and voice-activated virtual assistant), which had their roots in U.S. government-supported research and defense-related research projects.

24. Ideas such as government acquiring equity stakes are not without controversy. Government stakes could be "passive" and temporary, with the research investments focused in priority areas that entail high risks that private investors would not take on their own, and managed by independent entities shielded from day-to-day political pressures.

25. The pace of improvement of educational attainment slowed across advanced and emerging economies during the 2000s, and an IMF study estimates that this weakening of human capital accumulation lowered labor productivity growth in these economies on average by 0.3 percentage points per year during that period (Adler and others 2017). An OECD study documents rising skill mismatches in OECD economies and estimates that reducing skill mismatches can lift labor productivity on the order of 10 percent in economies where the mismatches are particularly high (Adalet McGowan and Andrews 2015).

26. Besides, some other studies come up with much lower estimates of the proportion of jobs that may actually be automated. For example, based on an analysis covering forty-six countries representing 80 percent of global workforce, McKinsey Global Institute (2017a) estimates that the proportion of occupations that can be automated entirely by currently demonstrated technology is less than 5 percent. It estimates that partial automation can affect more jobs: about 60 percent of all occupations have at least 30 percent of activities that are technically automatable. McKinsey Global Institute (2017b) develops various scenarios up to 2030 that yield a midpoint estimate of about 15 percent for work activities that could be displaced.

27. Including, for example, by such illustrious economists as Keynes (1930) and Leontief (1952).

28. In a study of twenty-eight industries for eighteen OECD countries between 1970 and 2007, Autor and Salomons (2018) find that the net effect of technological change on employment was, in fact, marginally positive rather than substantially negative. Job losses in individual industries implementing labor-displacing but productivity-enhancing technologies were more than offset by positive spillover effects of higher productivity on jobs elsewhere in the economy through inter-industry input-output effects (what they call "Costco effects") and demand effects (what they call "Walmart effects"). They find, however, that technological change did contribute to the observed decline in labor income shares. Acemoglu and Restrepo (2018a) estimate that about half of the total employment growth in the United States between 1980 and 2007 is explained by additional employment growth in occupations with new job titles, relative to a benchmark category with no new job titles (using new job titles as a proxy for new jobs). McKinsey Global Institute (2017a) estimates that one-third of new jobs created in the United States

in the past twenty-five years were types that did not exist, or barely existed, before—in areas including IT development, hardware manufacturing, app creation, and IT systems management.

29. In these accounts, workers can save some tax-deferred income annually that employers can match (Holzer 2017).

30. This is the case even in many advanced economies. In the United States, for example, the enrollment rate of four-year-olds in early childhood education is only around 70 percent (OECD 2016b). A high-quality early education program in the United States returns $7 to $12 in benefits to the individual and society for each $1 invested (Heckman and others 2010). For a broader review of evidence documenting high payoff to early childhood interventions, see OECD (2017b).

31. In the United States, college enrollment and completion gaps by income level have increased over the past few decades (Turner 2017).

32. See, for example, Aghion (2016) for a supportive commentary. For the United States, specifically, Baily and Montalbano (2016) write: "For the United States . . . there is the potential to combine Silicon Valley innovations with Danish training programs and that could be a winning combination."

33. For a supportive account, see Tyson (2014) and the debate among Nobel laureates Heckman, McFadden, and Pissarides at www.mediatheque.lindau-nobel.org/videos/37268/closing-panel-inequality. For a largely critical account, see Holzer (2017) and a survey of top economists at www.igmchicago.org/surveys/universal-basic-income. Derviş (2017) proposes a mixed system with a universal benefit combined with social policy guidance on its use. The universal business income idea has received support from some major business leaders as well, including Mark Zuckerberg (2017) and Elon Musk, see www.businessinsider.com/elon-musk-universal-basic-income-2017-2. For an overview of the issues, see IMF 2017a.

34. The Finnish pilot will end in 2018, and its results will become available in late 2019.

35. See, for example, Feldstein (2016). The basic idea of a negative income tax has been around for a while; its intellectual genesis can be traced back to Milton Friedman and James Tobin.

36. For a brief description, see https://ec.europa.eu/epale/en/content/personal-activity-account-comes-force-france.

37. Recent research finds evidence of synergies between product and labor market reforms (IMF 2016c, Andrews and Saia 2017).

38. For example, the Freelancers Union in the United States and platform workers groups emerging in Europe.

39. Such as the German IG Metall with the FairCrowdWork or the German independent service union *ver.di*.

40. "Predistribution," a term coined by Jacob Hacker (2011), embodies the idea that the state should try to prevent inequalities occurring in the first place rather

than ameliorating inequalities through the tax and transfer system once they have occurred as happens under redistribution. Ricardo Hausmann (2015) draws a similar distinction between policies for redistribution and inclusion (in the growth process).

41. This could take the form of levying contributions through a progressive income tax or using taxes that bear not only on labor income but possibly also on capital income and property. France, for example, levies social security contributions on personal capital income.

42. For a sample of advanced and emerging economies, an IMF study estimated that reforms that removed tax-induced distortions in business decisions and strengthened tax administration could add up to one quarter of a percentage point to the GDP growth rate by improving resource allocation and boosting productivity (IMF 2017b).

43. For economies with available data (mostly advanced economies and major emerging economies).

44. While Thomas Piketty's work on inequality (Piketty 2014) has attracted much controversy, one key proposal—to find a better way to tax wealth—has merit.

45. In OECD countries, governments support 10 percent to 20 percent of business R&D through tax incentives and direct support such as grants and public procurement. At present, such R&D support tends to favor incumbents and inadequately benefits small and young innovative firms. R&D investment is highly concentrated in large firms (ranging from 65 percent in Canada to 85 percent in the United States and 95 percent in Japan) and these firms also receive the lion's share (more than 75 percent) of government R&D support (OECD R&D Statistics Database, www.oecd.org/sti/rds).

46. With technology causing more frequent shifts between jobs (and the associated increased need for reskilling) and giving rise to more independent work arrangements, targeting re(training) incentives directly to workers may be more effective than targeting incentives to firms (OECD 2017f).

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SEVEN

International Cooperation and Global Governance

KEMAL DERVIŞ

The major responsibility in the agenda to boost productivity and reduce income inequality and, thereby, achieve more robust and inclusive economic growth rests with national policies. As Dani Rodrik argues, for most issues, national policies are much more important than what happens beyond borders (Rodrik 2017). Overall, that is still true. But international interdependence has increased and international cooperation has an important role as well. Global interdependence and spillover effects increasingly require national policies to be framed in a global context—intensifying the need for, and increasing potential rewards from, international cooperation. In a globalized world economy, rules of engagement at the international level, such as those governing international trade and investment and flows of skills and technology, matter more. So do arrangements for global economic governance.

In the agenda ahead, reforms at national and international levels must play complementary, mutually supportive roles. The need for complementarity between these reforms has been brought into sharper focus by the recent rise in populist political sentiment and a backlash against forces, notably globalization and technological change, that are seen to be associated

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with job losses and increased income inequality. Attempting to inhibit globalization or technological change would be the wrong response to the rising popular discontent with some of their impacts, as they are key forces that drive productivity and economic growth. Instead, policies must work with these forces and channel them to promote outcomes that are better for both growth and its inclusiveness.

This includes rules of engagement at the international level that are adequate to the task of governing a more deeply interlinked world economy and are fair, complemented by policies at the national level that help firms and workers adjust to the challenges and opportunities that come with international integration and technological change. In the area of international trade, for example, the agenda includes ensuring an international trade system that provides a level playing field and reforming national policies to foster competition in domestic markets and support workers through retraining programs and social protection mechanisms to adapt to shifts in the demand for skills (IMF and others 2017).

Policy reforms at the national level were addressed in the previous chapter. This chapter focuses on reforms at the international level. It considers areas for attention in improving policies and rules at the international level that govern engagement between countries in trade, investment, competition, transfer of technology, migration, and tax policies. It also looks at the institutions of global economic governance and how they can be more effective in supporting better global economic and social outcomes.

A recurring theme in the chapter is that global policymaking and institutional frameworks have not kept pace with reality. While much has been built in the past few decades, global disciplines have been slow to respond to a changing agenda driven by advancing globalization, rapid technological change, and major structural transformations in the global economy (OECD 2017a). There has been an erosion of trust in policies and institutions. The perception is one of elite-driven institutions, with the elites often unable to explain in simple terms how these institutions function and why certain policies are being pursued. Against this background and the risks associated with an ascendant national populism fed by growing societal discontent with outcomes, the reform agenda and related debate acquire increased significance.

Making the International System Work Better and for All

Over the last decade, international trade and investment have been growing more slowly, weighing down global productivity and growth. Policy failures associated with official tolerance of creeping protectionism, neglect of fresh liberalization, and barriers to investment have contributed to these trends. The World Trade Organization (WTO) has been unable to keep the international trade agenda under its global multilateral umbrella, resulting in fragmented processes. Weaknesses in international frameworks to ensure fair competition and promote flow of knowledge have intensified inequalities in the sharing of benefits from globalization and technological advancement. The digital revolution is posing new challenges for international cooperation in trade, investment, and competition policies. While shifts in labor supply and demand caused by demographic and technological change have brought migration issues more to the fore, policy responses and coordination mechanisms have been lagging. With increased capital mobility, international tax competition risks a race to the bottom in tax policies across countries.

These developments call for increased cooperation among nations on reforms that are responsive to the new challenges and make the international system work better and for all. Without attempting to be comprehensive, this chapter focuses on some areas where international cooperation is particularly important.

Promoting an Open and Fair Trade System

International trade is a key driver of productivity growth. Export penetration makes firms more productive through exposure to competition and learning from foreign markets. Import penetration sharpens incentives for firms to become more efficient and improves access to quality intermediate goods. There are valid "learning by doing" type arguments to shield "infant" activities that have the potential to become competitive. The challenge is to avoid such rationale being used as a cover for pure protectionism. Many high-performing countries have grown with some degree of protection from imports, but in many others protectionism contributed to stagnation. It is also important that trade agreements ensure real competition and not become instruments for the expansion of global monopolies.

Trade inevitably creates winners and losers. This distributional dimension of trade has tended to be minimized by most economists under the correct premise that, on the aggregate, trade enhances welfare. But the distributional impacts are important and need addressing. Public debate, now perhaps more than ever, has shifted to revisiting the negative effects that trade can have in labor markets. For instance, Shushanik Hakobyan and John McLaren (2016) find that even if the North American Free Trade Agreement (NAFTA) was welfare enhancing on the aggregate, wage growth for U.S. blue-collar workers in industries that experienced increased competition because of NAFTA slowed down considerably. David Autor and others (2013) find that import competition from China resulted in higher unemployment, lower wages, and lower labor participation in U.S. locations that were more exposed to it.

Even though trade can explain only a relatively small part of the wage and job losses for low-skilled workers (capital- and skill-biased technological change having been a much more important factor), there has been a sharp rise in political forces using trade as a lightning rod to fuel an anti-globalization agenda. Developments such as Brexit, the outcome of the 2016 U.S. presidential election, and the escalation of trade tensions between the United States and China are dramatic recent examples of the rise in nationalist political forces. But an anti-trade sentiment has been building for some time, reflected in rising protectionism. Between the onset of the global financial crisis and 2017, there were more than 9,000 policy interventions implemented worldwide that are considered harmful to trade, compared with around 3,500 liberalizing interventions.[1] These harmful policies mostly consist of non-tariff barriers (NTBs) of an increasingly murky nature, such as nontransparent subsidies, domestic content requirements, and public procurement discrimination (Hufbauer and Jung 2016).

The political climate has become quite difficult for deepening the process of freeing global trade that started with the post-war Bretton Woods accord. The last major multilateral trade agreement, the Uruguay Round, dates back to 1994. The period since then has been marked mostly by regional trade agreements, the momentum of which also appears to have stalled recently.

The challenge ahead is to find a balanced approach that resists protectionism and pragmatically seeks opportunities for further opening up of trade, ensuring that trade rules are fair and promote true competition. There is much "traditional" trade agenda that remains, particularly in agriculture and services, and there are new issues relating to regulatory harmonization and the fast-expanding digital trade. At the same time, policies at the national level need to address the distributional impacts of trade much more seriously than they have in the past, including through retraining and social protection policies for workers negatively affected by trade. Such policies are needed not only to make openness work for all but to ensure the very sustainability of the progress on openness.

While the world has taken major strides toward trade liberalization in terms of lowering tariffs since the inception of the GATT and the WTO, particularly in manufacturing, there is still a long road ahead in addressing NTBs. Often NTBs take opaque, behind-the-border forms and are used to continue to protect industries that have experienced tariff reduction (WTO 2012). In the absence of adequate multilateral frameworks, countries have attempted to address such barriers in bilateral and regional trade negotiations through provisions covering relevant domestic regulations. Here, policymakers face the challenge of balancing efforts to counter protectionist use of domestic regulations with allowance of adequate policy space at the national level for regulatory structures to reflect legitimate differences in country circumstances and preferences.

Two regulatory areas receiving increased attention in trade negotiations are labor and environmental standards, which aim to enforce basic rules to prevent unfair advantages in trade. Between 1994 and 2016, there were seventy-seven trade agreements, involving 136 countries, that included some labor provisions (ILO 2016). Agreeing on a minimum set of core labor standards is challenging, but this will be an important issue in the global trade agenda going forward. The same can be said about the challenge of agreeing on a set of core environmental standards.

Digital trade is now the most dynamic component of international commerce, and appropriate disciplines covering this trade are crucial to the broad diffusion of today's cutting-edge digital technologies. These technologies matter increasingly for productivity and economic growth. Internationally agreed rules are needed to ensure free flow of data across borders, support digital intellectual property rights that reward innovation but prevent monopolies, address cybersecurity issues, and provide for dispute settlement. One way forward is for such rules to be negotiated in a plurilateral digital trade agreement among a critical mass of WTO members that would be open on a most-favored-nation basis to all countries (Meltzer 2016). A promising recent step in that direction was the setting up of a working group of about seventy WTO members at the WTO Ministerial Conference in Buenos Aires in December 2017 to initiate exploratory work on future negotiations on trade-related aspects of electronic commerce.

All in all, despite the recent surge in anti-globalization political sentiment, it is important to recognize how crucial international trade has been in fostering productivity and growth across all nations while also acknowledging trade's distributional consequences within countries that policies must be responsive to. In the current political environment, it is difficult to envisage new comprehensive global trade agreements backed by all 160-plus WTO members. Yet, if we care about growth, more, not less, trade is the answer. Each country will decide whether it wishes to engage in bilateral, regional, or global efforts. While agreements among a subset of countries can enhance trade, it is desirable that they remain within the multilateral rules framework of the WTO and are open to others. Plurilateral agreements should be seen as "moving ahead while others catch up," not as a patchwork of trade blocks.

Improving the Framework for Cross-Border Investment Flows

Together with trade, cross-border investment flows can boost productivity and growth by promoting technological diffusion, augmenting competition, and improving the allocation of global savings. International trade and investment have become increasingly intertwined. In the new world of global value chains (GVCs), multinational corporations, the parents of foreign direct investment (FDI), account for around 80 percent of world exports. Yet despite this ever-tighter linkage between trade and investment, an adequate multilateral framework of rules governing international investment is lacking.

Unlike the WTO-led global framework of rules governing trade, foreign investment is guided mainly by piecemeal international investment agreements negotiated by individual countries or country groups. These agreements, which vary in content and are mostly bilateral, now number more than 3,300. At the multilateral level, there is only a partial patchwork of investment rules within the WTO, which date back to the Uruguay Round.[2] This creates a regime that is fragmentary and lacks coherence, which can impede and distort investment flows.

Across countries, openness to foreign investment is uneven between sectors, with some sectors, such as services and network industries, typically less open. Within countries, behind-the-border impediments to foreign investment remain large. These factors keep foreign investment from realizing its full potential contribution to global productivity and growth. FDI flows in recent years have been running between 2 percent to 2.5 percent of world GDP, well below their peak prior to the global financial crisis. Given a more conducive environment, FDI could possibly double from its current level (World Economic Forum 2013, UNCTAD 2017a). At the same time, foreign investment by global quasi-monopolies can frustrate entry by national newcomers, so it is important that investment agreements are designed well and are not used as vehicles that facilitate the maintenance of monopoly positions by the giants of the digital age.

Efforts were made in the early 2000s to develop multilateral rules on foreign investment and a WTO Working Group on the Relationship between Trade and Investment was established. However, these efforts were soon abandoned for lack of progress. Despite the current challenging environment for international policymaking, conditions may be more favorable now for the development of a multilateral framework for investment. The growth of GVCs and the tighter trade-investment nexus sharpens the need for more integrated trade and investment disciplines governing international supply chains. Besides the monopoly potentials mentioned, increased FDI flows by state-owned enterprises and sovereign wealth funds present new challenges. The North-South divide that bedeviled previous efforts at developing a multilateral framework for investment is disappearing. Emerging economies are now playing a much bigger role in FDI as both host and home countries, accounting for around half of all FDI inflows and 30 percent of outflows. A set of Guiding Principles for Global Investment Policymaking was endorsed by the G20 group of major advanced and emerging economies at their summit in Hangzhou in 2016, with the objective of fostering an open, transparent, and conducive global policy environment for investment (G20 2016). Even though the principles are broad and nonbinding, this is an encouraging development that can pave the way for further progress at the multilateral level.

Consideration should be given to reviving the WTO Working Group on investment. A multilateral agreement on investment open to all WTO members could initially start with a group of countries that are willing to go ahead. Besides provisions on issues such as investor protection, access, national treatment, and dispute settlement, a multilateral framework could incorporate provisions on corporate-social responsibility and sustainability drawing on useful recent work on these issues—such as UNCTAD's Investment Policy Framework for Sustainable Development (UNCTAD 2015, Sauvant 2016).

International cooperation on an investment framework needs to extend beyond regulation to facilitation to remove obstacles to investment at the domestic level, through more transparent and predictable investment governance regimes, modernized investment information systems and administrative processes, and assistance to countries in these areas. As discussed in the previous chapter, boosting sound investment is a key part of the agenda to revive productivity and foster more robust economic growth, and global investment needs are large for infrastructure development and the attainment of the Sustainable Development Goals more broadly. Multilateral investment facilitation efforts acquire increased significance in this context. In the trade area, the 2013 WTO Trade Facilitation Agreement was an important step forward. A multilateral agreement on investment facilitation would complement and enhance the trade facilitation agreement. There are some promising recent steps to build on, including the Global Action Menu for Investment Facilitation launched by the UNCTAD in 2016 and the Informal Dialogue on Investment Facilitation initiated by the WTO in 2017 (UNCTAD 2017b, WTO 2017).

Promoting Fair Competition and Improving Policies on Intellectual Property Rights

As in the case of investment, development of a multilateral framework on competition policies has been a challenge. In a landmark study of global competition policy, Edward Graham and David Richardson (1997) wrote that, because of increasing integration of economies and business organizations across national boundaries, ”there is growing consensus among international trade negotiators and policymakers that a prime area for future multilateral discussion is competition policy.” Yet, two decades later, agreement on multilateral rules on competition has remained elusive.

In the interim, not only has globalization advanced much further, but digital technologies have given rise to a new class of superstar multinational firms that are causing market concentration to rise across many economies in technology-related industries. Digital platforms and digital activity today are the fastest growing element of global flows (McKinsey Global Institute 2016a). Cross-border M&As have multiplied, as have cases of cross-border cartel-like practices.[3] Concerns about the lack of a level playing field in international competition are adding to the backlash against trade and the rise in protectionist sentiment. If global competition issues were considered important two decades ago, they are even more so now. International competition policy has increasingly lagged behind the challenges associated with a more globalized and networked economy.

The fundamental synergy between trade and competition policies and the importance of fair competition to inclusive trade liberalization are generally recognized. Foreign investment and competition policies also are closely linked. There is a strong conceptual argument for an integrated, holistic multilateral framework for international trade, foreign investment, and competition policies that have international effects (Baldwin 2016). Views differ widely, however, on the precise approaches and modalities for incorporating competition issues in multilateral rules. A broad international agreement on competition policy also faces the challenge of continuing significant divergences in competition policies and processes across economies despite progress on convergence over the years, especially across economies at different levels of development.

In the absence of tangible progress toward an agreement within the multilateral framework of the WTO, international competition policy issues have been addressed mainly through bilateral and regional trade agreements that have included clauses dealing with harmonization of competition policies and establishment of consultative mechanisms. The European Union has made the most progress toward developing a common international competition policy regime covering its members. International competition disciplines also form part of the two major cross-regional trade negotiations where progress has recently stalled, namely the Trans-Pacific

Partnership (TPP) and the Trans-Atlantic Trade and Investment Partnership (TTIP).

A multilateral agreement on competition policy would be highly desirable. However, given divergent country views, the prospect for a WTO agreement covering all members is currently remote. In the meantime, further progress through plurilateral agreements among subsets of WTO members and through informal networks of national competition authorities (notably the International Competition Network) offers the best prospect for progressive advancement toward an eventual global framework. Key issues concern cross-border M&As and cartels, national treatment of foreign enterprises, competitive neutrality between state-owned and private enterprises, new competition policy challenges in digital trade, and international consultation and dispute settlement mechanisms (Hufbauer and Kim 2008, Bergsten and others 2014, Pérez-Motta 2016, Marin 2017). There is also a need for capacity-building assistance to countries with less developed competition institutions. The G20 group of major economies can provide political leadership on the international competition policy agenda, as it is beginning to do on international investment policy, supported by the technical work of organizations such as the OECD and the UNCTAD.

Alongside competition policies, there is the need to improve international cooperation on intellectual property in a world where ideas, knowledge, and information are increasingly important drivers of economic activity. As discussed in the previous chapter, there are growing concerns that overly broad and stringent national patent systems are impeding innovation and its diffusion and hurting competition. Similar concerns arise at the international level. National intellectual property regimes and related international frameworks may, therefore, need a significant recalibration (Baker and others 2017). They also need to adapt to the new innovation dynamics of digital technologies (Curtis 2016).

Unlike competition policies, a formal multilateral framework does exist for intellectual property rights, centered around the Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS) administered by the WTO. This could provide a foundation for further international cooperative action, based on an approach that provides more open access and more room for new entry and less protection for the big, entrenched players. Related to this, there are proposals to include research services in GATS and establish an Agreement on Access to Basic Science and Technology aimed at strengthening the global commons in science and technology without unduly restricting private rights in commercial technologies (Doherty and others 2016).

Developing Sensible Policies on Migration

Policies relating to international mobility of labor also play an important role in the diffusion of know-how and technology. For example, cross-border patent citations are more likely to occur when inventors across borders are ethnically related (Kerr 2008). A study of India finds that teams managed by returning migrants file disproportionately more patents than teams with local managers (Choudhury 2016). Migration can also strengthen trade networks; one study finds that migrants contribute to the emergence of new exports in receiving countries that are competitively marketed to sending countries (Bahar and Rapoport 2018). Firms do not adopt new technologies and organizational knowledge simply by acquiring a blueprint or buying new machinery; often the process involves bringing in new skills and know-how in the form of new workers. A lot of knowledge is tacit, and its transmission requires human interactions. International migration can be an important part of this transmission, or "brain turnover," across borders.

Migration policies are a matter of much public debate. Some would argue in favor of full cross-border labor mobility, like the kind that exists within the European Union. In theory, free movement of people should be welfare enhancing, similar to free movement of goods and capital. Several recent studies document the sizable potential economic benefits of migration from spurring technology diffusion and innovation and alleviating imbalances in labor/skill supply and demand (IMF 2016, McKinsey Global Institute 2016b). Yet, as with other cross-border flows, there are concerns about winners and losers and distributional impacts. Moreover, cultural issues arise, especially when migration involves large flows of relatively unskilled people. Balancing these considerations makes migration a particularly challenging area for policymaking.

One area is policies regarding temporary migration, which may be politically less contentious than permanent migration. A global framework to incentivize migration could start by facilitating temporary work visas between countries. Work visas, even if temporary, can encounter political opposition, requiring numbers to be regulated. For example, countries could bilaterally negotiate the scope of a program of reciprocal work visas for skilled workers. A more ambitious approach could involve negotiating temporary work visa quotas among countries at the plurilateral or global level. Under Mode 4 of the GATS, the WTO already provides some multilateral framework that deals with cross-border movement of natural persons. As it stands, this framework is limited in scope, but it can underpin the development of more ambitious approaches.

One interesting approach is a tradable quota system of the kind suggested by Jesús Fernandez-Huertas Moraga and Hillel Rapoport (2014) to deal with the refugee crisis. Countries would agree on a quota allocation system to accept refugees based on certain parameters, and they would subsequently be able to trade the quotas in a manner similar to the carbon emission quotas under the Kyoto Protocol. Such tradability would make the quota system more flexible and accommodative of national preferences. While conceived initially in the context of the refugee issues in Europe, the basic model could be applied to the design of temporary work visas for certain categories of workers at a more global level among interested countries. Another proposal is for interested countries, working through the GATS, to establish a plurilateral but open "innovation zone" within which technical personnel would be able to move freely over agreed multiyear periods (Doherty and others 2016).

Through knowledge transfers, entrepreneurship, and other benefits, countries typically gain from having their skilled migrants return home. Migrants are more likely to become entrepreneurs. While migrants account for about 15 percent of the U.S. population, they account for more than 25 percent of entrepreneurs in the country (Kerr and others 2016). Policies to incentivize citizens to return are, naturally, at the discretion of each country. These could include, for example, fiscal benefits such as temporary tax exemptions or access to risk capital for new ventures. These policies could be targeted to particular occupations that are in high demand by growing sectors. Fiscal resources used for this purpose are likely to be recovered through fiscal contributions from the returnees later on.[4]

As the aging of populations in advanced economies continues and the skilled workforce—with a digital-age education—grows in many emerging economies, the forces of income convergence will strengthen and the terms of the debate on migration are likely to shift (Ahmed and others 2017). In the near term, however, the pressure from low-income, low-skill potential migrants will continue to rise. Alongside other policies, there is an important role here for policies that encourage investment in source countries that improves prospects for gainful employment there. Returns on such projects can be high, but so can the variance of these returns given associated risks. Risk-pooling and de-risking instruments can be particularly helpful in catalyzing more such investment.

Enhancing Cooperation on Tax Policies

Globalization has enhanced the need for international cooperation in tax matters, as it makes it easier to shift income and assets offshore and increases the cross-border spillover effects of tax policy actions of national tax jurisdictions. Attention has recently focused, in particular, on the shifting of profits by multinational corporations away from countries where they are generated to tax havens with lower or no taxes. In recent years, such profit shifting by U.S. multinational groups has been estimated in the range of 25 percent to 30 percent of gross corporate profits (Cobham and Janský 2015). Globally, tax revenue losses from profit shifting and related tax base erosion were conservatively estimated at around $600 billion in 2013 (Crivelli and others 2015). This consisted of around $400 billion in loss for OECD countries and $200 billion for non-OECD countries.[5] In addition to corporate tax base erosion, international tax competition to attract more mobile corporate income and investment has contributed to a very pronounced decline in corporate tax rates; the mean statutory corporate income tax rate in OECD countries has fallen by almost one-half over the past three decades. Revenue losses and distortions resulting from these effects entail negative implications for both longer-term growth and equity.

International cooperation in combating cross-border tax avoidance and evasion has been a brighter spot in the recent record of global economic governance. Led by the G20 and supported by the OECD, two important initiatives have been launched. First, in 2014 at the G20 summit in Brisbane, the Automatic Exchange of Information (AEOI) reporting standard was established to improve transparency and exchange of information for tax purposes. The AEOI standard requires automatic exchange of information on financial accounts between participating tax jurisdictions. It upgrades the earlier standard of exchange of information on request (EOIR) that had been instituted soon after the global financial crisis. Second, in 2015 at the G20 summit in Antalya, an initiative was launched to combat base erosion and profit shifting (BEPS), which aims to improve and standardize tax codes, treaties, and data sharing to ensure that profits are taxed where economic activities generating the profits are performed and value is created. Since the launch of these initiatives, notable progress has been made in setting up implementation arrangements. More than one hundred countries and jurisdictions so far have committed to the AEOI and BEPS initiatives (OECD 2017c, Global Forum 2017).

Looking ahead, strong implementation will be crucial, including putting in place national and international legal and regulatory frameworks required to deliver on the commitments made. Capacity-building support to emerging economies will be particularly important to enable their effective participation in these international initiatives. This should form part of broader efforts to build these countries' tax capacities, with support from institutions such as the IMF, the OECD, and the World Bank. Within the BEPS framework, further work is needed to develop some key elements, including those relating to transfer pricing and taxation of the digital economy. Moreover, dispute prevention and resolution mechanisms need to be further developed (IMF and OECD 2017).

Another area where stronger international cooperation will be needed is carbon taxation. Taxing carbon emissions is a vital reform for climate sustainability, which can also boost productivity and longer-term growth by spurring innovation and investment in new technologies. It can generate sizable revenues, as well, that can be put to good uses. Coordinated international action on pricing carbon emissions can boost collective progress by alleviating individual country concerns about potential negative implications for their competitiveness of unilateral action.[6] Some countries may consider imposing border tax adjustments on imports from trading partners with no or weaker carbon pricing regimes, though these adjustments can raise complex issues. Clearer guidance on such border tax adjustments will need to be developed within the WTO framework. There is an important role here also for support to poorer countries as they develop their climate policies, which can promote consistency of actions across countries and expedite progress toward convergence of carbon prices (Commission on Carbon Prices 2017).

A Medium-Term Vision for Global Economic Governance

The concrete reforms outlined here could go a long way in improving how the global "system" works. It must be acknowledged, however, that the adoption of many such reforms faces major obstacles in today's political climate. Beyond technical proposals there is the broader issue of what is perceived as legitimate, how citizens around the world relate to international institutions and to the nature of global markets. If global markets and players are not embedded in institutions that have the support of citizens, a retreat to old-style nationalism may seem to be the only alternative.

The coming decades will be a period of huge technological changes impacting all societies and markets. Legitimacy will take on new dimensions. What will be the legal framework for markets being transformed by digital trade, for access to and use of big data, and for cybersecurity? Scientific advances are not limited to digital technologies, of course. Bio/genetic-engineering, for example, is another potentially big area of change. Another phenomenon is the rise of global business giants in a world of global value chains and digital globalization. As noted, around 80 percent of world trade now takes place in value chains linked to transnational corporations. Eight technology giants account for about a third of the market capitalization of the world's one hundred most valuable companies (Wolf 2017). What are the implications of this world of change for global governance? What will be considered "legitimate" in this new world?

Answers to these questions have great importance for growth and equity. There are no ready answers to these big questions. They will have to evolve gradually from scientific and economic realities and politics. Here, we give a brief overview of what kind of global governance has taken shape and how it can be improved, especially from the perspective of legitimacy. National and international markets need to be embedded in institutions that help them work efficiently and fairly (Ruggie 2008). It took centuries to embed national markets in national institutions. It will take time before the new types of markets that are developing on a global scale become embedded in global institutions that reflect the twenty-first century.

There has long been tension between individual citizens and nation-states in the visions about global governance and international cooperation. After the disastrous three decades from 1914 to 1945 when extreme nationalism led the world to experience the biggest catastrophes of modern history, there was a desire to construct an international system that could prevent similar disasters. There was also a certain willingness to look beyond the nation-state when discussing what democracy was all about. The San Francisco Declaration leading to the creation of the United Nations contained the words "we the peoples," although it was a declaration by nation-states (United Nations 1945). The European Union of today was built with a vision that went beyond the nation-state.

Thus the vision of post–World War II global governance included two "constituent units" of governance: "nation-states" and "peoples." Granted, nobody was seriously thinking of setting up a world government, nor should we be thinking of it now. Governance is a much "softer" concept and harder to define than government. It leaves open the question of how much actual decisionmaking is implied in governance.

Governance is defined as "all of the processes of governing, whether undertaken by a government, market or network, whether over a family, tribe, formal or informal organization or territory and whether through the laws, norms, power or language of an organized society" (Bevir 2013). This definition captures well the multi-actor nature of governance. But by referring explicitly to the processes of governing, it can exaggerate the implementation ability of governance. Instead, it would be more accurate to refer to the "processes of governing, proposing or influencing." What concept of "governance" will be relevant in the twenty-first century?

The closer global governance comes to an actual decisionmaking and implementation concept, the greater is the dilemma of the "constituent unit." One extreme view is to stick to the nation-state as the sole constituent unit. When that view is combined with commitment to equality among constituent units, we get the one-nation one-vote principle, as embodied in the General Assembly of the United Nations (UNGA). Malta, Russia, and the United States each have one vote in the UNGA, irrespective of the number of their citizens, the size of their territory, their GDP, and so on. Each one is a nation-state and, therefore, a constituent unit of the "democratic" international system.

This is problematic, not least from the point of view of democracy. The one-person one-vote principle is a bedrock of democracy. So how can Malta with its population of 440,000 have the same weight as the United States with a population of more than 320 million? There is another issue that reflects the tension between democracy and the one-nation one-vote rule. If one is committed to democracy, one could argue that the nation-states' decision power can only have legitimacy if the nation-state in question is a democracy. This issue is not clear-cut, however, as there are many forms of "democracy," including constitutional monarchies, some of which are, in effect, more democratic than many democracies in name only.

Going to the other extreme would bring us to a system of one-person one-vote at the global level—in fact, to a global democracy. While conceptually easy to understand and reflecting at the global level the one-person one-vote principle at the national level, such a system would be as infeasible in the 2020s as it was in 1945. Perhaps even more so, because in 1945 the ravages of nationalism were fresh in everyone's mind, while today nationalism is making a comeback. All international institutions face these tensions related to legitimacy.

While the UNGA is governed by the one-nation one-vote rule, the UN Security Council (UNSC) is governed by a much smaller group of fifteen nations, with ten rotating elected members and five permanent members—the P-5 consisting of the key victors of World War II, including China, France, Russia, the United Kingdom, and the United States. Each of the P-5 nations was granted a veto right. Except for some intra-UN administrative and budgetary matters, all important political and economic decisions (for example, sanctions) could be taken only by the UNSC. Thus, a compromise was struck between the one-nation one-vote principle, or democracy with nations as constituent units, and "real politik" reflecting real military and economic power.

The compromise struck was far less than perfect. To give any one power an absolute veto right later led to a great deal of dysfunctionality of the United Nations. Moreover, because any one of the P-5 has a veto power, it has been difficult to reform the system from within.

The GATT, which later metamorphosed into the WTO, followed the one-nation one-vote rule but with the added understanding that decisions were to be made by consensus, in theory allowing any one member to derail an agreement. In practice, there were escape clauses such as the differentiated treatment of developing countries, but the fundamental consensus-oriented governance of the GATT/WTO did not change. As discussed, moving forward on today's dynamic trade agenda will require more flexible approaches, including seeking eventual multilateral outcomes initially through pragmatic plurilateral agreements. The rules-based trading system underpinned by the WTO is a key strength of the global economy. The WTO's trade-focused mandate now needs to be broadened to reflect the much more strongly interwoven nature of trade, investment, competition policies, and intellectual property rights. Instead, today's political dynamics threaten to weaken the WTO.

The Bretton Woods Institutions—the International Monetary Fund and the World Bank—were set up quite differently although they were and remain specialized agencies of the United Nations. The governance of these institutions tried to reconcile nation-states as constituent units of the international system with the inequality of nation-states' economic power through a weighted-voting governance system. Given the economic focus of these institutions, the weights in their governance reflected economic and financial variables such as GDP and trade. As time passed, the weights became outdated and unfair, failing to reflect the changing economic size of countries, and the institutions have been in the process of adjusting the weights. But the fundamental nature of the system of weighting nation-states has not been questioned. Regional development banks, which complement the global World Bank and play a similar role at the regional level, also have weighted-voting governance structures.

The question is often raised whether, given the increased size of private capital flows, the "official" development banks (the World Bank and its sister regional banks) are still needed. Their size relative to total capital flows has shrunk quite dramatically. The IMF, too, is now much smaller in relative terms. The answer to this question is that there remains a large need for risk pooling and maturity lengthening for investments in many parts of the world (Bhattacharya and others 2016). Individual projects in climate-friendly infrastructure, in particular, often appear very risky because of regulatory and political problems and their long-term nature. Development banks can help leverage financing through risk pooling and mitigation. Their role is particularly important in supporting investments in global public goods, such as combating climate change and pandemics.

The IMF has a different role, but that role also is linked to risk pooling. It is costly for countries to self-insure by accumulating large amounts of foreign exchange reserves. Access to IMF finance can reduce that cost. There has been much debate on the modalities of such access, but the basic principle remains. Another important role for the IMF in the absence of a formal sovereign debt restructuring process has been to provide some of the coordination among creditors that formal or informal debt restructuring requires. A critique of the IMF's macro-model over decades has been that it took supply as largely given, so deficit reduction and debt sustainability depended mainly on fiscal tightening. This has changed, and the IMF's macroeconomic approach has become more sophisticated, with supply and demand seen as interdependent. Nonetheless, as was shown again in the case of Greece, the IMF tends to underestimate the contractionary multipliers of fiscal tightening. This in no small measure reflects the reflexes of the past and the still-disproportionate weight of big creditor countries on the IMF's board.

With the economic crisis of 2008 came the creation, at the level of heads of government, of the G20, a self-selected group of nineteen large economies and the European Union. The group is not a formal organization; there is no voting and no secretariat, but a rotating presidency. It functions as a plurilateral convening forum and platform of major economies that provides political impetus to work on particular economic issues, such as securing financial stability or tackling tax base erosion, to be implemented at the nation-state level or through international organizations. It was instrumental in the establishment of the Financial Stability Board to improve and coordinate global financial sector policies. The G20 has also sought to steer thinking and action on broader issues of global reform, such as convening an Eminent Persons Group in 2017 to advise on reform of global financial governance.

The international governance architecture also includes many regional political organizations, with the European Union standing out as the one having attempted the most daring steps toward governance beyond the nation-state. With respect to the EU, it is interesting to note that for decisions that do not require unanimity, a double majority of 55 percent of member nation-states representing at least 65 percent of EU's population is required.

In broad brushstrokes, such is today's "official" system of global governance. It is the one in place that will have to deal with the big challenges, such as the digital revolution and digital globalization, the rise of a knowledge-driven intangible economy, cybersecurity, masses of data including false data ("information apocalypse"), climate change, and more. Technological change and globalized markets offer tremendous opportunities but are likely to amplify today's already large economic and social disparities without a rules-based system where one objective of the rules is to deliver greater inclusiveness. Superpowers are likely to have massive destructive power, enough to annihilate humanity many times over, but often limited power in imposing their will on the ground. In 2025 China and the United States are going to be the two juggernauts, unless the European Union finds a way to move toward much greater integration. One can reasonably expect that the superpowers will cooperate on many issues, but can an open clash resulting from a miscalculation or megalomania be altogether excluded?

To strengthen and reform the global governance system, the "big actors," such as the United States, China, and Europe, will have to be supportive. Whatever their pronouncements are today, all three have, in fact, an interest in an inclusive and legitimate system because all three benefit from an open and reasonably harmonious system and would suffer if global governance became fragmented and unable to function under a broadly unified set of rules. This may not have been the case for China in the past, but with its current size and the stakes it has in the global economy, it is not surprising that China has become a vocal supporter of globalization. China will insist, however, on having its weight correctly reflected in the weighted voting schemes of international institutions. The same will be the case with other emerging "big actors," such as India. This does not mean that all will necessarily be operating under identical rules. Different countries and regions of the world may have different preferences about how they organize and manage aspects of their economies, and the international system will need to accommodate that in a way that different regimes can coexist without harming one another.

Finally, alongside the "official" system, there are many non-state actors, including private and nongovernmental organizations. They have no formal political power but a lot of political influence and are an increasingly important component of governance. Among these non-state actors, today's mega-corporations are a dominant force.

The challenges ahead are huge. A natural reaction to such thoughts is to think of other, more manageable problems. Paul Krugman once observed that the three biggest issues in one's life are long-term career choices, lifestyles impacting health, and one's love life (Krugman 1997). People may wake up on a Sunday morning thinking of these but quickly decide to fix some minor problem in their basement. Yet the big problems will not go away.

Multi-Level and Multi-Channel Governance

It would be presumptuous to attempt to describe in any detail at the end of this report a blueprint for future global governance that would foster productive equity (the report's theme) and relative peace. We can, however, put forward some broad principles that may be helpful.

First, governance will have to be seen and analyzed as a multi-level and multi-channel phenomenon; multi-level in the sense that there are and will be many levels of governance: communes, cities, metropolitan areas, regions, nation-states, multi-state regions such as the EU, and the world. Recognition of the multi-level nature of governance often leads to greater empowerment of the local level—the subsidiarity principle as applied to the global stage. Because many citizens feel lost in the vast ocean of globalization, they need a greater feeling of local ownership and control, where feasible.

Governance will be multi-channel in the sense that many of the "official" levels interact with "nonofficial" or private organizations, ranging from private business groups to various NGOs—not in government but in governance. Some of these nonofficial groups will dwarf many nation-states in resources and reach. The nation-state will remain a predominant player but cede some of its functions wholly or partially to the other levels and channels.

This multi-level and multi-channel form of governance will take many different forms in different places. What is important is that it be recognized and discussed as such. It would be pointless to discuss global governance without reference to and analysis of the role of the private sector. But this implies that the governance of the nonofficial sector itself should be part of the debate. What should shareholder rights be? Should workers be represented in private firms' ownership and governance? Given the global nature of large firms, should there be global rules for their governance and how they compete? Answers to these questions will have important implications for the distribution of power and income.

In the "official" sphere, it should be acknowledged more broadly that weighted voting is the way to bridge the gap between one-state one-vote democracy and one-person one-vote democracy. This principle needs to be applied more widely to help international and regional organizations acquire greater legitimacy. A big step forward would be to have the United Nations accept the weighted-voting principle in the Security Council. This could be achieved in steps. As is the case in the IMF and the World Bank, one or more countries could retain *de facto* veto power by requiring certain decisions to be taken with a large percentage of the weighted vote. But once the weighting is accepted, there would at last be a way for the system to move forward, either by an explicit decision to change the weights or by the historical evolution of the weights. There is no reason the same principle should not apply to the WTO, although the weights could be quite different. What goes into particular weights would, of course, be subject to much debate. But as the European Union and the Bretton Woods institutions have shown, agreement is possible.

The role of a grouping such as the G20 in all this would be that of a facilitator, as it has been so far in areas such as finance and cross-border tax cooperation. The G20 has no explicit political legitimacy of its own, but given its membership it can lead and achieve reforms supported by the technical work of various international organizations. Given the arbitrary composition of the G20, one could well ask whether it should continue in its present form. If it had formal or legal decisionmaking power, the answer should be in the negative. But precisely because it does not, it is probably not worth trying to change its composition.

In many areas, the official and nonofficial spheres explicitly debate and sometimes even decide in mixed forums. Just as the private sector should accept representation in its governance of stakeholders other than capital owners, the public sector should accept private sector participation in some of its governance processes. An example is the proposal put forward by Manfred Elsig, on behalf of the WEF-ICTSD expert group on the functioning of the WTO, to establish a formal Business Advisory Council at the WTO (Elsig 2016). The private sector is already involved in many of the official processes, so this is not a radical or new proposal, but it is important to recognize and broaden this involvement; it reflects reality on the ground.

This does not mean, however, that we should forget that government, as opposed to governance, is "official" by the very nature of democracy. The

Enlightenment and the French and American revolutions brought us democracy based on the one-person one-vote principle, although at the beginning who was a person entitled to vote was restricted (by gender, race, property). Not without reason, citizens around the world wonder whether globalization is not fundamentally undermining democracy. That is what Dani Rodrik captured in his "political trilemma of the world economy"—the difficulty of reconciling national sovereignty, democracy, and global economic integration (Rodrik 2011). The discussion here has tried to show that there is, in fact, quite a bit of global governance, albeit in need of improvement.

The new big issues ahead will test the global governance system and require reforms, but it would be folly to argue for tossing it out. There does not appear to be a radically different architecture that would be clearly superior. What is needed is to put in place improvements and empower citizens around the world to participate in the debate. An improved system building on what we have will be sorely needed in the years ahead as science opens up new opportunities but also carries new risks for humanity.

Notes

1. Data drawn from www.globaltradealert.org/global_dynamics.

2. This includes the Agreement on Trade-Related Investment Measures (TRIMs) and the "commercial presence" mode in the General Agreement on Trade in Services (GATS). These rules are limited in scope and do not provide a comprehensive regulatory framework for foreign investment at the multilateral level.

3. Between 1990 and 2015, 240 cross-border cartels were detected and fined, affecting $7.5 trillion in sales (OECD 2017b).

4. A recent report by the National Academies of Sciences, Engineering, and Medicine (2017) discusses this at length for the U.S. case. It finds that the net fiscal impact of skilled immigrants is positive. Low-skilled immigrants entail a fiscal cost, but that is offset later by fiscal contributions of the next-generation immigrants.

5. In relative terms, the estimated loss is larger in non-OECD economies (about 1.3 percent of GDP) than in OECD economies (about 1 percent of GDP). Since tax/GDP ratios typically are much lower in non-OECD economies (emerging and developing economies), the revenue loss relative to total tax revenue is particularly significant for them.

6. Most studies find only small effects of carbon taxes on competitiveness at the macroeconomic level and little evidence of emissions leakage from shift of production offshore to countries with laxer policies (see, for example, McKibbin and

others 2017). However, the competiveness effects can be more significant in particular industries, notably energy intensive, trade-exposed industries.

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Index