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## A Look Forward with a Policy Agenda

Increased productivity growth supports the “trifecta” of faster GDP growth, lower inflation, and higher-wage employment. Networked information technology fuels this productivity growth in two ways. First, innovations by IT firms in hardware, software, and services spearhead an acceleration of productivity growth. Second, IT products increasingly are purchased, networked via communications, and used by non-IT firms throughout the economy, thereby transforming business activities and workplace practices. Changes outside the IT-producing sectors are even more important than IT itself in generating sustained, widespread, and accelerated productivity. The globalization of IT and communications networks reduces the cost of investing in IT and raises the return to using it, thus playing a key role in the diffusion of IT throughout the economy.

Limiting or otherwise slowing technological change and its globalization forgoes real and large gains—productivity growth, job creation, and innovation. The economic pie is smaller without innovation and globalization of IT and, more importantly, the change they elicit. On the other hand, failure to address adjustment costs that can be a consequence of such globalized technological change also limits economic potential. If labor and capital are not well matched to changing economic needs, maximum economic potential will not be achieved because available resources will not be fully utilized. Labor and capital mismatches result in macroeconomic sluggishness as well as personal anxiety, both of which shrink the economic pie inside its potential frontier. Therefore, policy must both promote innovation and technological change and facilitate adjustment to change—not limit or avoid change or ignore redistribution—to ensure that all resources of the economy are used efficiently and effectively.

The fastest-growing international players, including India and China, change the landscape for innovation and globalized production in ways both positive and threatening to continued US productivity growth. As markets, US firms are attracted to the growth potential of these and other countries and see product differentiation to meet those market needs as new opportunities. As production platforms for the sale of products to the United States or to third markets, they are attractive for their geographical location and labor resources and skills. More generally, industrial policy, tax strategies, policy reforms, and economic openness have enhanced economic vibrancy in many key new markets and competitor countries.

Investment in and use of information technology in the US economy have had important effects that have been magnified by the globalization of the sector and the competitive pressures on the entire economy that come from global engagement. The transformations that yield these gains may also have yielded more rapid job churn in the economy, which some see as beneficial and others see as worrisome. Moreover, at the same time that these benefits have accrued to the American economy overall, IT investments have increased and changed the educational and skill requirements to perfect job matching and mobility, which may have increased the overall wage disparity in the United States. Since the pace and economy-wide scope of technological change and globalization are quickening and broadening, urgent attention to appropriate policies to improve job matching and mobility is crucial to maintain productivity growth and forestall widening income disparity so as to ensure that gains are widely shared.

There are, as well, policy imperatives outside the United States. In some countries, the domestic environment dampens the potential benefits of transformative technology. Some buyers do not benefit from falling global prices of IT products because of taxes and tariffs. Some companies cannot transform their business activities to reap the benefits of IT because of labor and product market rules and regulations. Some workers do not have the skills to use the equipment or services. Some sectors are not allowed to receive the technological benefits that come with foreign investments. Overall, to reap these benefits, to promote IT development tailored to local needs, and to encourage skill building requires complementary and enabling service sectors of telecommunications, financial services, and logistics.

The liberalization of trade in services can play a role in creating these complementary networked services that underpin greater use of IT. Increased cross-border trade in services can be positive for both industrial and developing countries. Industrial-country exporters of services, specifically the United States, gain from liberalized trade in services, since these are areas of comparative advantage. For many developing economies, increased trade flows and overall GDP come from improved domestic services. Extending the Information Technology Agreement and actively pursuing a more liberalized global environment for services through the

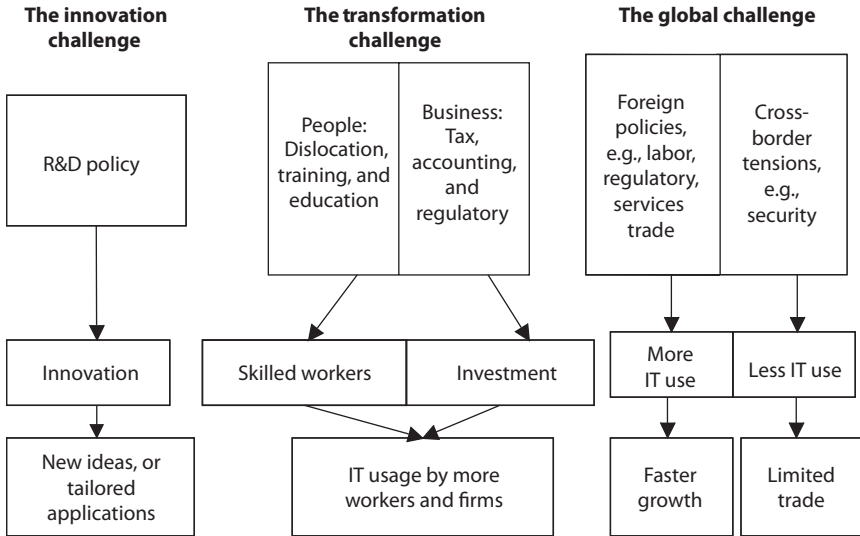
WTO Doha Development Round and other trade negotiations are part of the process of implementing domestic reforms that will have positive consequences for international competitiveness for both the United States and its trading partners.

Innovation and its diffusion and application are the foundation for productivity growth, but they are also a source of disruptive change. The pipeline of innovation and the ability to use innovation to transform business activities to raise living standards may be at risk in the United States because researchers and workers are increasingly scarce or not up to the challenge of change. These supply-side forces, along with the shifting geography of demand for technology products toward rapidly growing economies abroad, propel businesses to move both research and production there. If the demand for products and the supply of researchers and qualified workers are growing fastest in emerging markets, that is where the companies will go. The financial resources to support innovation, as well as enhance the crucial resource of researchers and a literate, numerate workforce, are crucial to maintain US leadership and rising living standards.

A proactive US policy agenda will promote innovation here and encourage and enable US workers and businesses to embrace and use IT to make the most of global opportunities in production, sales, and trade in both the manufacturing and services arenas. To have no policy agenda or strategy has both short- and long-term consequences. In the short term, a slowdown in productivity growth or poor matching of labor skills to evolving labor demands implies lackluster job creation and a US economy operating below its potential. In the longer term, if innovation flags, skill building is inadequate, and customers complacent, the United States will relinquish its economic leadership in the global economy.

A proactive agenda must meet innovation, transformation, and global challenges. Innovation creates a technological frontier, which pushes out the potential of the economy. Innovation increasingly will be global, but will the United States continue to be a leader? Transformation means that businesses must be able to change products and production techniques, and workers must have the desire and skills to welcome new job opportunities. But transformation also means business turbulence and job restructurings and losses, even as there is greater growth overall. Global competition comes as more countries use IT domestically for growth, rather than only as a source of export revenues. This, in turn, means that more countries could be customers and partners, if markets are open. A proactive agenda by IT firms and IT-using firms, in conjunction with policymakers, centered around these themes can meet the specific challenges of new ideas, new jobs, and new competition so as to deepen the benefits of the globalization of IT for the overall US economy. Failing to meet these challenges puts US economic success and global technological leadership at risk (figure 7.1).

**Figure 7.1 The policy challenge**



## A Proactive Policy Agenda

### The Innovation Challenge

Innovation pushes out the technology frontier and creates the products and applications that raise productivity. IT products and applications create and expand opportunities to use information technology, which creates new business and jobs, raising income and wealth by applying IT innovations to customer demands.

Innovation and its application are the foundation for productivity growth and the fundamental source of change. Research is now more global, and there are important gains to this globalization—good ideas are not constrained by national boundaries, and tailored products and applications often address national preferences and regulations. US data emphasize the importance of people—researchers—in the innovation intensity of US IT firms, and they point to the importance of having educated workers who can respond to flexible workplace practices. Not only the pipeline of innovation, but the ability to use innovation to transform business activities to raise living standards, are at risk to the extent that the “people part” of both innovation and application is scarce or not up to the challenge of change. Additional key requirements to meet the innovation challenge follow.

## ***Keep the Innovation Pipeline Full with People and Funding***

Whereas productivity gains can come simply by diffusing existing technology to new sectors and new economies, some challenges to diffusion will be met only by innovation. Moreover, it takes time after innovations are presented for business applications to spring up to meet customer needs. These issues may be particularly germane for the sectors and countries that are not currently intensive users of IT. Therefore, it is crucial that the innovation pipeline be kept full, even if the value of innovations is not immediately apparent.

A first requirement is to nurture researchers. IT software and services, the locus for innovations and their applications for use by non-IT sectors in the US economy, are much more research worker-intensive than other sectors of the US economy, including IT hardware.

A second requirement is funding for research and development. Private funding of R&D through venture or internal funds plays a very important role in innovation. But the economy-wide spillovers to innovation imply that government funding should complement private R&D. Questions of who bears risk, reaps reward, and directs research strategies need to be addressed when public-private-academic partnerships are launched. Intellectual property considerations need to be factored into the equation to balance innovator rights against benefits of broader usage.

## ***Embrace the Benefits of the Globalization of Innovation***

A globalized update to the adage “necessity is the mother of innovation” is that innovation will be promoted by the idiosyncratic needs of certain sectors, the unpredictable situations in some countries, and the concentration of intellectual resources in certain places. Since the geographical scope for innovation already extends beyond the United States, making sure that US firms can access these global technologies as well as sell their products abroad is important for continued productivity growth both here and in other countries. In addition, innovation as an activity, particularly applied innovation, can be fragmented, with some of the components of the activity done more cheaply abroad. Globalization of innovation reduces its price, leading to more widespread use of the new application and associated economic gains.

Also, vibrant consumers demanding new products at home are key to keeping innovation percolating at home. A complacent market is a poor environment for new ideas.

## **The Transformation Challenge**

Achieving broad-based productivity growth demands more transformation in the domestic economy as well as greater engagement by US com-

panies abroad and by foreign economies in global trade. What with the increased tradability of services, pressures for transformation will extend to more sectors of the US economy, to more countries, and to more workers. On top of that, continued innovation implies an ongoing and rapid pace of change.

The very rapid pace of technological change that opens new global production possibilities to firms highlights the issues of labor market dislocation and change. Overall, technological change and globalization put an even higher premium on more education and higher skills (measured by formal schooling, trade apprenticeships, or other metrics). Policies are particularly needed to address two types of job losses in the technologically volatile marketplace: permanent job loss and the depreciation of skills. Some of the key requirements to meet the transformation challenge follow.

### ***Deepen Economic Transformation via More Widespread Use of IT***

Global integration of the production of IT hardware significantly reduced prices and improved performance, which supported the first wave of productivity growth. IT services and software are a rising share of the computer “package” and key to making it “work” for the customer. Nascent global integration and standardization of elements of services and software production portend a rapid reduction in these prices along with improved operability and better tailoring to diverse needs.

Productivity gains from intensive use of IT are clear. But large segments of the US economy, particularly smaller firms, and much of the rest of the world have not yet integrated IT fully into their business operations and economies. The cheaper, improved, and tailored IT package of hardware, software, and services has the potential to extend the use of information technology to the sectors and businesses that have lagged in terms of productivity growth. This, in turn, has the potential to initiate a second wave of transformation and overall productivity growth. Reducing the price and improving the functionality of the productivity tools of IT services and software will support a deepening and more pervasive use of IT in the United States.

### ***Institute New Policies for Permanent Job Loss***

Successful transformation by businesses implies some permanent job loss. Whether dislocated by technology or trade, workers need to get back to work quickly to avoid a loss of specific job skills and familiarity with job requirements. Extended unemployment benefits (which provide more time for adjustment), training assistance, wage insurance, and portable and available social insurance (such as health and pensions) are all strategies to ease and promote the transition to a new job and career.

In particular, policies that create positive incentives to move to a new job increase the likelihood that the worker will learn the skills on the job

that move wages upward on a new career path. For a period of time, wage insurance (Kletzer 2001, Kletzer and Rosen 2005) replaces a portion of the difference between the old wage at the lost job and the new wage at the new job. This policy acknowledges that a low rung on a new job ladder probably does not pay as much as the previous tenured job, which is now gone. But it creates the incentives, nonetheless, to move to the new job. Facilitating the redeployment of labor resources makes both the individual and the economy better off.

### ***Institute New Policies to Address Skill Depreciation***

For some skilled workers, particularly in science and technology, globalization and technology do not eliminate their job category altogether, but they may alter the career path by speeding skill depreciation and by removing certain “rungs” of the career ladder. Classic “market imperfections” argue for a “human capital” investment tax credit to promote skill upgrading within an organization and career path.

A human capital investment tax credit recognizes that technological skills take a long time to develop, yet depreciate quickly, and may be made uncompetitive by competition from other countries. A tax credit recognizes three realities of the marketplace for skills: free riders, incomplete information, and spillovers. First, firms that engage in substantial training of their own workers to move their skills up the ladder beyond the threat of international competition and to keep abreast of technological change face the disincentive of “free riding” by other firms that do not train. Second, “incomplete information” about the whole career ladder may dissuade students from getting into the career pipeline, as some first-rung jobs may no longer be available in the United States. Third, such a tax credit recognizes the “spillover” benefits to the economy as a whole of having a technologically trained workforce that diffuses to all sectors of the economy.

These rather familiar market imperfections are the rationale for the R&D tax credit and the investment tax credit for IT capital. Given the importance of innovation and skills in the competitive and globalized environment of the 21st century, a human capital investment tax credit offered to individuals, through firms, and implemented by educational institutions has even greater merit. Of course, workers must acknowledge the demands being put on them and rise to the challenge.

Retaining high-wage jobs in the United States held by the prime-aged, educated workforce, in part through the mechanism of the human capital investment tax credit, is not just altruism but is also in society’s interest. This group of workers is key to intergenerational prosperity—they support fiscal transfers to the currently old and finance the education of the currently young. Keeping them employed at the frontier of their capabilities, as defined by the frontier of the economy, warrants society’s and the government’s support.

## The Global Challenge

Meeting the US productivity challenge demands not only deeper global engagement by US IT firms but also commitment by foreign countries to open markets and create an environment favorable to more extensive use of IT by firms throughout their economies. Because China and India are both major IT producers and users, their policy choices are particularly important in this regard.

However, there are growing challenges to deepening and extending the successful global business model. That is, incorporating that model in more countries and extending it to include more information-intensive services sometimes collides with other issues important to policymakers, ranging from taxes to information privacy, digital rights management, and national security. Managing the tension between the global nature of the business model and the often domestic concerns of policymakers is key. Some of the steps needed to meet the global challenge follow.

### ***Promote Globalization of IT Abroad to Extend Productivity Gains There and Here***

The productivity experience of the United States has not been widely shared. Extending the productivity gains to the rest of the world is critical for the United States to enjoy continued productivity gains itself. Differences in patterns of investment and flexibility of domestic markets are important factors holding back the effective use of IT in many countries, industrial and developing alike. Rapid innovation and falling prices for information technology products make imported IT cheaper, but many countries still impose tariffs on these products. Tariffs on imported IT disproportionately reduce its use inside an economy, thus holding back productivity. In addition, tariffs on imported IT bias investment, and generally inhibit the development of the high-tech export sector that many countries desire. All told, market access for IT products and services, and an enabling environment abroad facilitated by liberalization of the services sector, are important for US firms and foreign countries alike.

### ***Work Toward Interoperable Strategies that Reduce the Tension Between Countries' Domestic Policy Objectives***

There is no one right approach to the role that a government will play in the increasingly interrelated world of fragmented and globalized production of services. Approaches to taxation, treatment of data, and information-based national security will not converge to one homogeneous approach because resources as well as societal values and priorities

differ. However, if the domestic-focused policies ignore the impact on the global marketplace and business incentives, a country will forgo some of the gains of the next wave of globalization based on IT services and software.

## **A Plea for Data**

This book presents a vast array of data from statistical agencies, international institutions, consultancies, and private firms to support analysis and policy discussion. However, available data have not kept pace with the rapid pace of change in the IT sector, its globalization, its adoption by businesses, and its impact on workers. Particular weakness in the data involve the more dramatic areas of change: the shift toward IT services and software in both production and demand, the globalization of R&D, the rise of the global company, and changing skills in occupations and industries.

A funded program is needed that focuses on collecting disaggregate data by product, industry, country, and occupation and that, importantly, provides the data in a more time fashion. Data cannot, in raw form, directly answer the most pressing questions and concerns about US businesses in the global economy or the impact of technological change and globalization on US workers. But analysis of more pertinent and timely data would significantly improve the understanding of the forces of globalization and technological change and thereby aid policy design.

## **Final Word**

Investment in and use of information technology in the US economy have had important effects that have been magnified by the globalization of the sector and the competitive pressures on the entire economy that come from global engagement. The ensuing enhanced diffusion of IT has had the positive effects of increased productivity and GDP growth and reduced inflation.

Innovation lies at the heart of investment in and use of information technology. Some innovations are novel, some more applied. Some are supported by research funded publicly, some privately. Some are initiated here, and some abroad. All are complemented with professionals trained in technology, analysis, implementation, and communications and come ultimately from a population that demands “new and better.”

The transformations that boost these gains also yield more rapid job churn in the economy and demand different job skills. Some workers respond easily to the educational and job challenges; others less so. Globalization-powered technological change may well have increased overall wage disparity in the United States.

Maximizing the benefits of the technological innovations and transformations that go hand-in-hand with deeper globalization is key to ensuring the continued positive impact of IT on the US economy. But so too is ensuring that the benefits of those innovations are more widely obtainable and completely shared across society. Failing to engage all resources implies forgoing some of the potential of the economy. The pace and economywide scope of technological change and globalization are quickening and broadening across business and society. Urgent attention to appropriate policies is crucial.