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Make America Great Again

Investing in research, technology development, worker training, and modern technological infrastructure is the only prescription that will maintain the health of the US economy.

The United States emerged from World War II as the dominant technology-driven economy in the world. For decades, virtually every major technology was developed and initially commercialized within the US economy by a combination of government and industry investment in research and development (R&D) coupled with subsequent investment in technology-implementing hardware and software, skilled labor, and a world-leading technology-based infrastructure, including universities and government laboratories.

But today, technology is increasingly developed elsewhere in the world, creating severe pressure on domestic industries and supporting infrastructures. Domestic fixed private investment (FPI) in physical assets such as machinery, land, buildings, vehicles, and technology is too low, and survey after survey of industry managers shows that the supply of skilled labor is inadequate. Government research institutions and R&D budgets are still oriented largely toward a set of social objectives such as defense and public health that only indirectly leverage economic growth. The end result has been sluggish output and income growth.

For the first 30 years after World War II (1948-1978), when the United States was the dominant technology-driven and thus the highest productivity economy, the average annual real growth rate of gross domestic product (GDP), the total value of goods and services produced nationwide, was 3.9%. During the next 30 years, the growth rate dropped to 3%, as the effects of globalization began to be felt. Since the 2008 recession, real economic growth has averaged 2.1%, and the Federal Reserve forecasts the growth rate to remain at around 2% for the foreseeable future. Thus, the US economy is expanding at half its postwar pace.

One component of GDP that deserves special attention is household income. In 2016, US real median household income ($59,039) finally exceeded the level reached nine years earlier in 2007, just before the Great Recession. Many analysts have characterized this milestone as encouraging, but the reality is that in addition to taking too long to occur as a cyclical rebound, this important income measure has barely nudged above the 1999 peak of $58,665. In other words, in the past 17 years, real household income has been flat.

A key reason for the income stagnation has been the anemic growth in worker incomes. Real hourly compensation in the nonfarm business sector grew 2.8% annually from 1950 to 1980, then at a 1.3% rate from 1980 to 2005, and at a 0.6% rate from 2005 to 2016. Unfortunately, under current growth policies, the situation will not improve significantly. The projected continued 2% annual GDP growth will be insufficient to raise wages or the standard of living for most of the US population and will jeopardize meeting the government's rapidly rising obligations such as Social Security and Medicaid in the decades ahead.

The 1960s, when real GDP grew at an average annual rate of 4.5%, was the last decade of sustained superior economic performance. In that decade, increased spending on the space program, defense, and health care coupled with a surge of investment in automation and lower taxes fueled growth. The key here was the widespread automation of manufacturing, which raised productivity in the face of little foreign competition.

The acceleration of globalization in the 1970s and 1980s caused an increased rate of obsolescence of domestic economic capital. The rate of fixed private investment fell when the needed response was an increase. The result was that productivity growth fell as well.

The Reagan administration attempted to counter the economic slowdown by applying fiscal stimulation in the form of income tax cuts. But in the absence of adequate incentives for private-sector FPI to enable productivity growth, industrial output remained weak, and as a result wages and profits also were disappointing.

Moreover, this investment was now competing with growing investment across the global economy, including in emerging economies with lower labor costs. Advantages in productivity, cost, or both in these other economies significantly restrained the effectiveness of the US economy's modest response. The bottom-line economic impact was an offshoring of jobs and significant constraints on the wages of domestic workers.

In anticipation of the policy prescriptions to be discussed later, it is important to note that in the late 1990s the FPI growth rate briefly surged to an annual rate of 9.5% as companies invested heavily in computer/information technology. However, the rest of the world quickly matched such investment, so that without a broader follow-on investment strategy FPI virtually dried up in the 2000s, and income growth stagnated.

Disastrous policy response

The policy response to globalization has been a disaster. Instead of increasing productivity-enhancing investments in technology and innovation, policy-makers relied almost exclusively on a monetary policy of low interest rates and the demand-stimulation dimension of fiscal policy. Cheap credit led to more borrowing, real estate and stock market speculation, and eventually the worst recession since the Great Depression.

The government responded to the recession with even more aggressive monetary policies that resulted in the Federal Reserve balance sheet growing from $800 billion to $4.5 trillion. The critical point is that these policies are business-cycle stabilization tools, which are useful only in addressing short-term disruptions along a long-term economic growth track. The prolonged cheap credit found its way into financial markets, which mostly benefited wealthy individuals while providing no incentives to companies to make long-term investments in research and innovation.

The bottom line is that the long-term structural policy problems caused by globalization remain unaddressed. Economic stagnation and increasing income inequality have had demonstrably negative political effects, not just in the United States, but across the industrialized world. The result has been the rise of populist political movements that clamor for trade and immigration restraints and cutbacks in government spending. The latter target is particularly destructive from a long-term growth perspective, as government spending (fiscal policy) has a critical investment component—including support for new technologies that drive sustained productivity growth and hence increased economic output over time.

The 2017 proposed Republican tax-reform bill is one consequence of this populist movement. However, its economic impact will be the opposite of what people in the lower half of the economy's income distribution expected when they swung their support to the Republican Party. The targeted corporate income tax cuts and a regressive personal income tax adjustment favoring higher income earners will not only not increase long-term growth, but by increasing budget deficits will result in pressure by conservatives to cut programs such as Social Security and Medicare.

History shows that income inequality and political discontent go hand in hand. Based on the universally accepted metric of income distribution, the Gini coefficient, the United States ranks number one among nations with respect to income inequality.

As demonstrated by sluggish growth and world-leading income inequality, the absence of investment incentives to drive productivity growth in the face of the relentless globalization of the technology-based economy is making the lack of a real growth policy an increasingly major economic policy blunder.

Globalization and its discontents

Failure to implement an investment strategy that will raise productivity at a faster rate than competing economies and thereby allow domestic incomes to rise in real terms is not a phenomenon unique to the current US economy. Rather, it is the result of an evolutionary process repeated throughout history in which emerging economies tend to grow faster and thereby catch up to the leaders as a group. As pointed out by economist and Nobel laureate Robert Lucas Jr., the only difference with this current episode is the much faster pace at which such "convergence" is occurring.

In such global economic cycles, emerging economies initially absorb existing technology from external sources and combine it with lower-cost labor to take growing shares of global markets. As this process unfolds, poorer nations eventually acquire the ability to develop new technologies domestically, and their evolving educational institutions turn out higher-skilled labor, further improving their competitive position. China is a prime example of an economy that has reached the second phase of technology-driven economic evolution.

This process is enabled in part by the fact that emerging economies, unencumbered by past practices, adopt the strategies of industrialized nations, but with greater vigor. The result is increased productivity relative to their labor costs and thus more rapid growth in income.

In addition to emerging economies' aggressive pursuit of greater productivity, their rates of growth are leveraged by the absence of two factors that plague established economies: the *installed base effect,* which reflects the difficulty of writing off existing assets that have become noncompetitive and replacing them with more productive ones, and the *installed wisdom effect,* which reflects the difficulty of adopting new strategies and management methods to replace those that worked well in the past but are now obsolete. Such forces of inertia help to explain why industrialized nations appear politically unable to fully grasp the effects of global convergence and enact needed reforms.

Investment-oriented growth policies that raise productivity at higher rates than competitors are necessary to solve the growth deficit problem. But in the United States, the ruling Republican Party has opted for reducing income taxes, cutting spending, and eliminating regulations, with the result of redistributing national income rather than increasing it.

The Democrats have supported several important parts of a legitimate growth strategy—education and improved digital infrastructure, and to a more limited degree, government funding for technology development—but the needed comprehensive investment-oriented growth strategy is still largely absent. Instead, Democrats have emphasized income redistribution policies, such as raising the minimum wage, which have some social justification but only a marginal effect on economic growth.

To further retard the needed policy response, politicians also bring up restricting trade, even though a viable economic future will require greater emphasis on exports, as 95% of the world's consumers live outside the United States. Blocking imports simply institutionalizes inefficiencies in the domestic economy, guaranteeing perpetually low growth in wages.

At the state level, Republican-controlled legislatures continue to implement policies that at best preserve the low-skilled jobs of low-paid workers. Doing so serves the last gasps of old, inefficient industries that will never again be sources of significant employment and certainly not of high-wage jobs. Kansas is a graphic example of using income tax reductions coupled with budget cuts in an attempt to spur growth, but the strategy failed miserably.

Liberal Democrats are complicit in support for older industries by arguing that a resuscitation of union bargaining power is a major need for raising worker incomes. But union power has declined largely because the homogeneous labor pools (and hence the preponderance of interchangeable workers) of the industrial revolution are being replaced by an increasing number of smaller groups with differentiated skills. Such heterogeneity does not lend itself to collective bargaining. Instead, the focus of unions should be on skill enhancement as the dominant means to long-term wage growth.

Meanwhile, China and other emerging economies are investing ever larger amounts in technology to increase the competitiveness of their domestic industries through sustained productivity growth. The world now spends $1.5 trillion per year on R&D, of which the United States accounts for 30%. This means that for every dollar the United States spends on R&D, the rest of the world is spending two dollars. Even more important is the fact that in the face of relentless growth in global R&D in the past 25 years, the R&D intensity of the US economy has increased by only 7%. Meanwhile, Germany's increase is 19%, but even this growth rate is dwarfed by South Korea's and China's increases of 135% and 184%, respectively.

Neither side gets it

US political leaders have not accepted the fact that the policies that led to world leadership are no longer adequate, and that these policies are powerfully influenced by a political system that is financed by groups that do not want to adapt. It is certainly easier to erect trade barriers than to invest in making domestic industries competitive in global markets. Corporations shy from adopting new technologies because of the initial costs and difficulties in learning and implementing new business models. Workers resist learning new skills because retraining is too expensive and stressful, is not rewarded, or is simply not available.

The right-wing populist groups and the more liberal wing of the Democratic Party, led by Senator

Bernie Sanders of Vermont, an Independent who normally caucuses with the Democrats, both favor protectionist philosophies, as evidenced by their opposition to the Trans-Pacific Partnership. Dumping it is basically ceding the huge Asian market to China, but President Trump agreed with these groups and terminated the agreement.

Neither political party has a firm grip on what needs to change. Both forget that the United States rose to the top position among the world's economies by out-investing everyone else from the late nineteenth century through most of the twentieth century in the four categories of economic assets that drive productivity and hence long-term growth in output and workers' incomes: technology, fixed capital, skilled labor, and infrastructure.

Fiscal policy should play a role in business-cycle stabilization (as through the Federal Reserve), but also in long-term investment support for economic growth. The latter "investment" role has been underfunded and poorly managed for decades, and in recent years it has come under attack from conservative Republicans determined to eliminate budget deficits. Over time, a balanced budget is a good objective, but running a deficit for a while if the extra funds are used for investments in support of greater productivity is often the right policy approach.

Indeed, the key Republican strategy (one that Democrats have previously supported) of reducing corporate income tax rates has justification in that nominal rates are too high relative to other industrialized nations. However, ignored is the fact that "effective" tax rates (after deductions) are much closer to those in competing industrialized economies.

Republicans argue that companies need the additional retained earnings for investment. But over the past decade US corporations have had more than enough cash to spend on increased investment, if they so desired—and apparently they do not. A study by the economist William Lazonick in *Harvard Business Review* calculated that over the period 2003-2012, the companies making up the S&P 500 Index used 54% of their earnings—a total of $2.4 trillion—to buy back their own stock. Dividends absorbed an additional 37% of these companies' earnings—a payoff to stock-market investors. This does not indicate a strong desire to increase investment in productivity-enhancing innovation. Absent appropriate incentives, corporate income tax reductions will do little to remedy insufficient investment. In fact, tax reform is actually an incentive to not do anything because companies will suddenly be reaping larger profits without having to change their behavior.

Most alarming for technology investment is that the Senate version of the Republican tax bill would eliminate the corporate research and experimentation tax credit, an extraordinary indication of the low priority that Republicans place on the nation's need for long-term innovation investment. The United States was the first economy to implement such an incentive, in the early 1980s, but it has been aggressively adopted and upgraded by competing economies. In fact, the Information Technology and Innovation Foundation calculates that the US R&D tax credit's relative strength has fallen from 10th among nations comprising the Organization for Economic Co-operation and Development in 2000 to a current 25th position.

The Democratic Party's preference for income redistribution through more progressive tax policies and higher minimum wages would provide some immediate social rewards. For example, the Economic Policy Institute points out that one in every five veterans would benefit from a hike in the minimum wage. However, marginal reallocation of a stagnant economic pie contributes relatively little to long-term growth. For example, although raising the minimum wage to the recent target of $15 per hour might help workers below the poverty line, it still generates an annual income of only $32,000. The Democrats' long-term economic growth strategy, titled A Better Deal, is similarly limited in scope, focusing mainly on raising the minimum wage, investing in economic infrastructure, and undertaking some efforts aimed at unfair trade practices.

It's the structure, stupid

The nation is facing a structural, as opposed to a business cycle, problem. The solution is investment in *productivity*. Productivity is another word for efficiency. Thus, when companies produce more output with less input, they can afford to pay higher salaries. In fact, they have to pay higher wages because increasing productivity entails more technology, which, in turn, requires higher-skilled workers. The Bureau of Labor Statistics notes that jobs requiring science, technology, engineering, and mathematics skills account for one out of 10 jobs in the US economy, and their average pay is 1.7 times the economy-wide average.

Ironically, the historically persistent argument against automation is that it creates unemployment. The scenario that a few highly paid skilled workers will replace many lower-skilled workers would be correct if market size remained constant, but producing goods at lower cost enables a company to expand market share and employ a larger workforce. The policy imperative is

to increase domestic worker skills to levels that are not easily accessible elsewhere in the global economy, thereby providing domestic investment incentives for the world's most productive companies.

But upskilling workers at the historical pace is not sufficient to guarantee US success in today's global economy. Real compensation closely tracked labor productivity during the three decades after World War II, as would be expected during a period when the US economy did not face significant foreign competition. But beginning in the 1970s and 1980s, as one economy after another acquired the ability to increase productivity while benefiting from lower labor costs, US workers were no longer able to command higher salaries commensurate with historical productivity gains. Global corporations benefited from labor arbitrage by moving operations to economies where a given level of productivity could be obtained for the lowest cost.

Glimpses of what types of policy initiatives are needed to grow productivity faster than competitors can be found in some earlier policy initiatives. In the 1980s and early 1990s, Congress created several mechanisms to help industry develop and commercialize breakthrough technologies. The first major pieces of legislation, the Bayh-Dole Act and the Stevenson-Wydler Technology Innovation Act, both enacted in 1980, facilitated the transfer and commercialization of federally developed technology to the private sector.

The Federal Technology Transfer Act of 1986 promoted technology transfer to small firms. It also created the mechanism for forming cooperative research and development agreements, or CRADAs, to manage intellectual property in projects conducted jointly by industry and the national laboratories. In the same vein, passage of the National Cooperative Research Act of 1984 removed concerns over antitrust restrictions related to private-sector cooperative research. Such cooperation is important in the early phases of modern technology development where long investment time horizons and high technical and market risk combine to reduce private investment in so-called proof-of-concept technology research.

At the innovation policy level, Stevenson-Wydler also established the Technology Administration, an agency within the Department of Commerce, to develop and coordinate technology-related economic growth policies, marking the first federal institutionalization of technology-based economic growth policy. However, it was disbanded by the America COMPETES Act of 2007.

In 1988 Congress passed the Omnibus Foreign Trade and Competitiveness Act, which established two institutional mechanisms to implement federal support for technology development in support of economic growth: the Advanced Technology Program, which was conceived as a civilian analog to the Defense Advanced Research Projects Agency (DARPA) and thus funded early-phase technology research, and the Manufacturing Extension Partnership (MEP), which establishes centers across the country to provide local technology support to small firms for acquiring technical knowledge and related management expertise aimed at improving productivity and competitiveness.

Unfortunately, the policy initiatives that required direct funding, with the possible exception of MEP, were not only underfunded but were relentlessly attacked by conservative Republicans. They maintained that basic scientific research is a public good that should be funded by government, but that technology development is a completely private good and therefore should be supported by the private sector only.

In reality, technology is developed through a complex sequence of phases, becoming progressively more applied until it is ready for the market. The early phases, usually centered on proving a concept or developing a technology platform, are quite different from the final more applied phase targeting actual product development. The chances of success are smaller, progress is slow, and the results rather easily spill over to companies not investing in the research.

Because it is difficult to capture all the value of the early phases, companies are hesitant to support this work, with the result that there is considerable private-sector underinvestment. This is an example of what economists label a "market failure." Technology policy experts call this early-phase barrier to technology development the "valley of death." The Advanced Technology Program was designed to address this problem. However, Republican members of Congress denied the existence of a market failure by not recognizing the difference in investment characteristics between the early and late phases of technology development.

The next significant phase of government action came after the economic collapse in 2008. In the face of the most serious global recession since the Great Depression, Congress made a modest and short-lived attempt to use fiscal policy as a true economic growth instrument. The centerpiece was the American Recovery and Reinvestment Act of 2009, funded at $787 billion, with significant portions allocated to economic infrastructure and science and technology research. It was the beginning of a needed upgrade, but there has been no follow through.

A comprehensive strategy

A successful innovation and economic growth strategy requires coordinated action on four fronts:

- **Technology**: the core driver of long-term productivity growth;
- **Private fixed capital**: hardware and software that embody most new technology and thereby enable its productive use;
- **Human capital**: skilled labor capable of using the new hardware and software and associated techniques; and
- **Technical and institutional infrastructure**: public-private infrastructure to enable the development and effective use of modern complex technology systems.

The first three categories are understood at least at a general level by policy analysts and stakeholders, even though substantial increases in all three are required. The fourth, however, is less familiar, more complex, and continuously evolving. It includes infrastructures such as digital communications networks and data storage, and research-oriented institutional arrangements such as research consortia, innovation clusters, incubators, accelerators, research data base standards, and "infratechnologies" such as science and engineering data, measurement/testing methods and calibration tools, and product-acceptance testing standards.

Continual advances in technical infrastructure and its broad implementation will be required to maintain competitive positions in the forthcoming Industrial Internet of Things. The supporting information technology (IT) infrastructure will require huge investments in information and communications technologies to integrate not only manufacturing supply chains but after-sales service and software updates for product and service systems. Such a dynamic extension of current product-service supply chains will give new meaning to the concept of technology life cycles and will require a significant upgrade in supply-chain management techniques.

In contrast, the obsessive overemphasis on monetary policy, which is not even a growth policy tool, and the misguided assertion that demand stimulation through income tax reductions will create significant and sustained investment incentives for industry, need to be discarded. They are short-term actions capable of adjusting only fluctuations of the business cycle but fail to address the heart of the growth problem.

The development and commercialization of radically new technologies can take decades—well beyond the investment time horizons and, in fact, the R&D capabilities of industry acting alone. Government support of basic scientific research is part of a long-term vision, but government must also take additional actions to enable the nation to respond to the changing global competitive environment characterized by ever more complex technologies and shorter windows of opportunity for achieving competitive positions in global markets.

Competitive success at the national level—and also the regional level in larger economies such as the United States—is determined to a significant extent by the effectiveness of the collective productivity that comes from geographic concentrations of small and large firms and a technical infrastructure capable of leveraging technology development and commercialization. These "innovation clusters" are appearing in all technology-based economies.

US support for such clusters has lagged behind many competing nations. Congress did take a useful step in the Revitalize American Manufacturing and Innovation Act of 2014, which authorized a National Network for Manufacturing Innovation. Now called Manufacturing USA, the network's major purpose is to co-fund with industry a series of Manufacturing Innovation Institutes (MIIs). Most of the MIIs were created by the Obama administration under an ad hoc program using funds from the major R&D agencies, primarily the Department of Defense and the Department of Energy.

But the legislation failed to provide direct funding for the network, so it will be up to the mission R&D agencies to fund and manage future MIIs. As of the end of 2017, 14 MIIs have been established, but 40 to 50 of them should be the target to have significant and broad long-term national economic impact. Furthermore, only two MIIs are located in the western half of the country, leaving a large swath of the nation without this important resource for regional economic growth. Further, funding these MIIs through the defense and energy departments means that the portfolios of research projects will reflect those agencies' needs and therefore may be suboptimal for stimulating overall economic growth.

Promoting regional and sectoral clusters of firms in high-tech supply chains addresses the reality that modern technologies are complex systems. Such systems require research in a variety of technical disciplines, which mandates coordination and efficient interfaces among a large number of companies making up the evolving new supply chains. The inherent complexity means that co-location synergies among component suppliers and system integrators

are significant for both conducting research and integrating the results into the evolving technology system.

Regional innovation clusters also boost overall economic efficiency by offering large and diversified pools of skilled labor. Workers can move among companies much more efficiently as labor needs shift. Toyota recently announced that it would invest $1 billion over the next five years in the development of artificial intelligence and robotics. The company chose the mother of innovation clusters, Silicon Valley, as the location for this research because of the unparalleled availability of the needed research talent.

The message for policy-makers is that investment creates productive assets, which in turn enable sustained growth. Unfortunately, neither political party fully appreciates the investment requirements required to create advanced technologies and develop them into forms that enable market applications.

The Democrats at least partially recognize the strong public-private good character and the complexity of the early phases of R&D, as evidenced by President Obama's support for innovation clusters. They also have introduced legislation to provide infrastructure support for small businesses and entrepreneurs. Unfortunately, these efforts are largely ad hoc and incomplete.

The Republicans are further off course, implicitly claiming that government should support development of only those technologies useful to a government mission such as defense. They see no need to nurture the development of technologies that will contribute directly to economic growth.

The final critical policy point is that technologies evolve in cycles. Information technology moved from mainframe computers to personal computers to smartphones. The generic technology platform remained the same, but each of these IT applications differed in hardware, software, and markets. The challenge for policy-makers is to understand how each of these developments differs and to adapt federal supportive activities accordingly.

And as described above, even within specific technology life cycles there are stages of development that require different types of assistance. Investing in the assets necessary to develop and commercialize new technologies that drive productivity growth requires policies that accelerate the replacement of existing capital stocks with new intellectual, physical, and infrastructure assets. The most important policy tools are funding for early-phase technology research, education and training, technical infrastructure, and tax incentives for applied R&D and capital investment.

This policy mix stands in direct contrast to fiscal stimulus through corporate income tax cuts emphasized in the current tax reform effort. The nation's focus should be on productivity-enhancing investments, not a company's bottom line—the latter will be improved only over time by the former. The most urgent need is increased investment in infrastructure, particularly the high-tech infrastructure necessary for a modern economy. The cost will be high, but failure to make the needed investments is a recipe for a future of continued economic decline and falling incomes. US policy-makers need to understand that with respect to efficiency, governments compete against each other as much as do their domestic industries.

Gregory Tassey is a research fellow at the University of Washington's Economic Policy Research Center.

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