CHAPTER 5: INNOVATION, TECHNOLOGICAL CHANGE, AND AUTOMATION

The *Report* highlights the concerning trends of less dynamism in the business sector, lower productivity growth, and subdued startup rates that pre-date the recent recession. These trends highlight a recurrent theme in this era of slower growth expectations: a divergent path that yet remains unclear for the future of America and worldwide. In the optimistic view, the *Report* suggests that investment will return to its historical trend after the capital overhang following the recent recession. In the pessimistic view, it is possible that the recent slowdown in investment may reflect lower capital intensity, slower labor force growth, or fewer startups going forward. Implementation of pro-growth policies remains important as ever in fostering a competitive business environment both here and abroad, as well as recognition of government's role in removing barriers to entry, protecting property rights and promoting the rule of law, thereby bolstering economic activity and entrepreneurship.

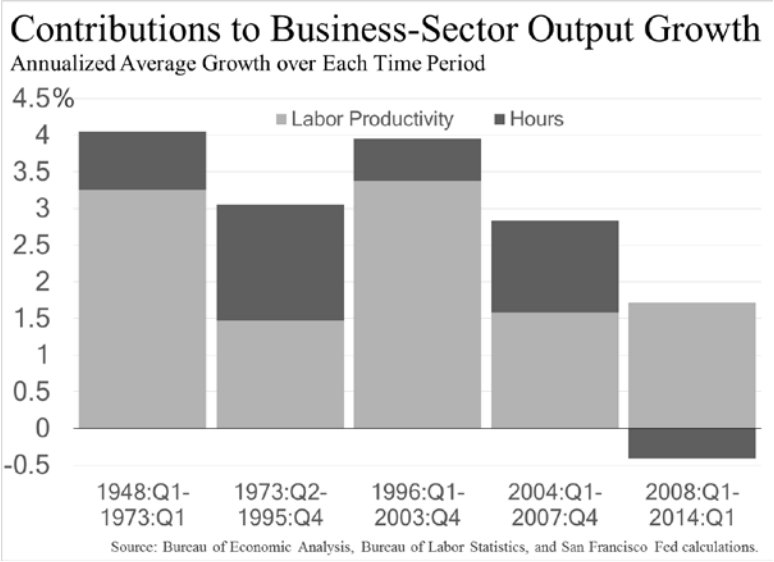
When the Administration talks of the middle class, it is usually in the context of insulating that demographic (however they define it) from disruptions in the economy. The Administration wants to ensure that the labor market is strong enough to encourage people to retrain to find work and reenter the labor force, yet participation remains at low levels not seen since the Carter administration. With these priorities in mind, it is curious that the Obama administration pursues, in the name of income security and redistribution, policies that would be counterproductive to reducing slack in the U.S. labor market. As Greg Ip notes in his book, *Foolproof*, "[S]ocieties and economies...are not inherently stable. They are constantly changing, evolving, and usually getting better in the process. Stability is blissful, but it may also be illusory, hiding the buildup of hidden risks or nurturing behavior that will bring the stability to an end."[1] In favor of increased stability, this Administration has sacrificed the entrepreneurial spirit that seeks to introduce new products, services and technologies. The policies proposed and passed into law may have simply redirected the underlying risks it seeks to mitigate into areas as yet unanticipated, which will likely result in the continuation of unfortunate, unintended consequences that have become a hallmark of the Administration.

Productivity Growth

Although productivity data is notoriously volatile, the Administration teases out three distinct 15-year periods of average annual growth: 1948-1973 averaging 2.9 percent annually; 1973-1995

averaging 1.5 percent annually; and 1995-2014 averaging 2.2 percent per year.[2] However, the San Francisco Fed sees a slightly altered version of these periods (Figure 5-1).

Figure 5-1



Noting that output grows as a result of increased hours worked, productivity (output per hour), or both, the San Francisco Fed finds that labor productivity was relatively robust in the 1948-1973 and 1996-2003 periods, averaging nearly 3.5 percent annually. Growth in hours accounted for another approximate percentage point in contributions to output growth over those time periods. In contrast, the time periods including 1973-1995, 2004-2007, and 2008-2014 are characterized by relatively sluggish productivity growth, but with the exception of the 2008-2014 period, nonetheless exhibit stronger growth in hours worked. The 2008-2014 period saw a decline in hours worked on average of nearly 0.5 percent annually in combination with a sluggish 1.5 percent growth in productivity. The research further finds that capital per hour worked "has continued to grow modestly."[3]

Total factor productivity (TFP) represents another challenge, according to the *Report*. TFP is the productivity that results from employing both labor and capital. It grows when a fixed value of aggregate resources (i.e. labor and capital) produces more economic output. One of the downfalls of relying on TFP as an economic indicator is that it is subject to significant measurement error.[4] Yet the Administration relies heavily on TFP in economic forecasts for the President's ambitious fiscal year 2017 budget.

The *Report* points out that, compared to other G-7 nations, labor productivity growth in the United States is performing well. Further, the *Report* argues that the recent slowdown is mostly due to capital deepening (a.k.a. a declining pace of investment per worker).[5] Overall, the *Report* suggests that the recent weakness is due to cyclical, rather than structural factors. Hopefully this turns out to be the case. If not, however, the *Report* notes that, "…if sustained, slower productivity growth will mean…slower improvements in living standards."[6]

Declining Dynamism

The *Report* highlights that business dynamism, "the so-called churn or birth and death rate of firms" has been in decline since the 1970s, thereby increasing the age of existing firms.[7] New business creation fell by more than 30 percent during the recession and has been slow to recover.[8] A study by the Kauffman Foundation found that the rate of new entrepreneurial activity has fallen to new recovery lows for Americans age 20-34. In other words, millennials are not starting companies at the same pace as baby boomers did.[9] Furthermore, studies by economists at the Brookings Institution found that the share of start-ups (firms less than 1 year old) had fallen from 15 percent of all businesses in 1978 to 8 percent in 2011. By contrast, the share of older firms (older than 16 years) jumped from under a quarter to more than a third of all businesses.[10]

The *Report* argues that there are three puzzles relating to slower investment growth: (1) the effect of technology on investment, (2) rising returns to capital, and (3) potential mismeasurement. However, how these bode for long-term trends remains to be seen. The *Report* posits two contrasting views, one optimistic and one pessimistic. The optimistic perspective suggests that dissipating headwinds from the recent recession have left investment poised to return to its prior trend of stronger growth going forward. In the pessimistic view, however, "there are decades-long trends of less dynamism in the business sector which could suggest a shift in previous patterns of investment. The share of new firms among all firms—the startup rate—has trended down over the past decades."[11] The potential of a structural slowdown in the startup rate is concerning for a few reasons.

Many unintended consequences of the cumulative burden of regulation, redistribution efforts, and the current tax and welfare structures serve to negatively affect investment and entrepreneurialism. As noted in Chapter 1, the *Report* spends pages deriding rent-seeking behavior while at the same time defending the Administration's regulatory regime. However, it is this regulatory overreach that incites rent-seeking behavior and draws entrepreneurial activity away from more productive pursuits.

Administrative and bureaucratic compliance costs borne by firms have increased significantly. The annual costs of federally imposed rules is nearly $1.9 trillion in compliance according to the Competitive Enterprise Institute.[12] As measured by the Economic Freedom of the World Index, economic freedom in the United States has dramatically worsened since 2000, precipitating a decline within the overall Economic Freedom rankings from 2nd to 16th.[13]

It is difficult to overstate how harmful regulation can be to business investment, but the economic effects of deregulation in the United States and United Kingdom in the 1970s and 1980s were clear. As the utility, communications, and transportations were deregulated, investment in these sectors as a percentage of capital stock more than doubled. In stark contrast, European countries—such as Italy, France, and Germany—that did not undertake these large-scale reforms saw a five percent decline in investment.[14]

Entrepreneurship is the seed of creative destruction. In an effort to make themselves better off, entrepreneurs develop new products and services. Entire industries and the firms within them survive by improving the lives of their customers with better performance, lower prices, greater convenience, and new features.

For example, technological advancements in telecommunications have enabled the industry to enable 96 billion more calls with 106,000 fewer operators today compared to three decades ago. One obvious benefit for consumers was that all of this efficiency was achieved while simultaneously costing consumers less to make long-distance calls.[15] However, it appears in recent years that all the "low-hanging fruit" in technological gains may have been plucked.[16] Technological innovation still occurs, but rather than making economic gains by leaps and bounds, improvements are incremental and less valuable. Just think of how much value harnessing electricity and inventing the telephone created, versus what the innovations of social media have done for society from an economic standpoint.

Economist Joseph Schumpeter originally coined the phrase "creative destruction" as a way to describe the dynamic evolution of the economy as markets change, industries rise and fall, businesses open and close, and workers gain and lose jobs. He argued that it is an essential fact of capitalism:

> *The opening up of new markets, foreign or domestic, and the organizational development from the craft shop to such concerns as U.S. Steel illustrate the same process of industrial mutation—if I may use that biological term—that incessantly revolutionizes the economic structure from within, incessantly destroying the old one, incessantly creating a new one. This process of Creative Destruction is the essential fact about capitalism.*[17]

Creative destruction makes scarce resources more productive by "shifting resources from declining sectors to more valuable ones as workers, inputs, and financial capital seek their highest returns."[18] By allowing creative destruction as a natural process of economic evolution, societies grow more productive and richer over time as they see the benefit of new and improved products, less dangerous jobs, and higher living standards.[19] In many ways, both measurable and immeasurable, Americans are better off than generations before them as their living standards have increased over time. Modern conveniences like the refrigerator, for example, now occupy space in approximately 99.2 percent of households, according to the Census Bureau.[20]

However, as economic growth slows, so too do gains in standard of living. Recent analysis finds that annual productivity increases of three percent double the U.S. standard of living every 24 years. Unfortunately, annual productivity increases have fallen by half of that figure to roughly 1.5 percent on average per year—which translates to a 23-year increase in the time it takes to double the standard of living (bringing the total time to 47 years).[21] The sluggish recovery has led many institutions, including CBO and BLS, to reduce projected estimates of potential GDP growth, labor force participation, productivity. As such, recent analysis finds that there is "little

room for gains in real incomes."[22] It is perhaps even more unsettling that it is unclear for how long these trends will continue.

One bright spot for the United States is that population and workforce projections point to positive growth over the next half-century, albeit significantly slower than the historical norm. Compared to other countries, however, the United States remains "demographically fortunate" over the long term given that its working-age population is expected to grow 10 percent by 2050. In contrast, other advanced economies will see their workforces shrink by at least one-quarter in many cases over the same period.[23]

Research and Development and the Role of Patents

Real private research and development (R&D) trends are a positive signal for future strength in U.S. productivity growth. Fortunately, the *Report* is quick to note that private R&D investment has grown by nearly five percent annually since the start of 2013 and that "2015 was the best year for private R&D growth since 2008."[24] The focus on the benefits of private spending, however, is fleeting. The *Report* then shifts its focus almost exclusively to the misguided notion that federally funded research is more important than that undertaken by the private sector. To make this argument, the *Report* points to the fact that "basic research" is primarily funded by the government. However, this obfuscates the overall picture showing that the private sector outspends the Federal Government on R&D by a ratio of greater than two to one.[25]

Other than direct spending, another means by which countries incentivize private R&D is preferential tax treatment. In the United States, some form of tax incentive supporting R&D has been in place since 1981 when President Reagan signed the *Economic Recovery Tax Act* into law.[26]

The R&D staple in the tax code is formally known as the Research and Experimentation (R&E) Tax Credit. The R&E credit is equal to a certain percentage of a business' qualified research expenses in excess of a base amount. The credit can be claimed by corporations or by shareholders in S-corporations or other types of pass-through entities, in which case business income is taxed at the individual level. However, only recently did the R&E tax credit become permanent. Until December 2015, it was one of many "tax extenders," a set of Federal tax provisions that expire every one or two years and are sometimes renewed retroactively after their expiration.[27] However, the R&E credit finally gained "permanent" status when the *Protecting Americans from Tax Hikes* (PATH) *Act* was signed into law late last year.[28]

In addition to the R&E credit, tax code section 174 allows businesses to fully deduct R&D expenses in the year they are incurred (known as "expensing") rather than amortizing and deducting them over a number of years like other capital expenditures. Since expensing and the R&E tax credit are applied when a firm invests in research and development, they are referred to as "front-end" tax incentives.

The past 15 years, however, have seen growth of "back-end" tax incentives in countries around the world, especially in Europe. As opposed to front-end incentives which allow R&D credits or

deductions when the expense is incurred, these incentives tax the income derived from the development of intellectual property (IP) at rates much lower than the country's corporate tax rate. Tax systems that treat IP income preferentially in this way are referred to as "patent boxes" (a.k.a. innovation boxes or license boxes). Their proliferation among the tax codes of America's competitors (see Figure 5-2) has brought the debate to Washington. In fact, members of Congress have already begun to explore, in a bipartisan fashion, how such a regime would work in the United States.

Figure 5-2

R&D Tax Incentives by Country		
Country	**R&D Credit**	**Patent Box**
Austria	X	
Belgium	X	X
Canada	X	
France	X	X
Hungary	X	X
Ireland	X	
Italy	X	X
Netherlands	X	X
Portugal	X	
Spain	X	X
Switzerland		X
United Kingdom	X	X
United States	X	
Source: PricewaterhouseCoopers, 2015		

The preferential tax treatment of both R&D expenses as well as IP income is common throughout the developed world and beyond. Countries seem to be intent on fostering innovation and keeping the resulting IP—as well as the income derived from it—within their borders since many economists note that the creation of IP in the United States generally leads to innovators developing and expanding their businesses domestically rather than headquartering in another country solely for tax reasons.[29] Put simply, the more innovation-driving entrepreneurs in one economy, the better. These persons and the companies they create are part of an integral process known as "creative destruction"—the abrupt disruption of an industry, typically creating positive externalities and making the economic pie bigger for everyone.[30]

Technological Advancement and the Sharing Economy

The *Report* notes that the sharing economy, or "on-demand" economy, disrupts incumbent businesses. The on-demand economy is not new, but it is changing. Temporary-hire workers, from writers and artists to home health professionals and computer technicians, have a storied experience in earning their income as freelancers, and a third of the workforce earns some temporary income.[31] Computers and smartphones expand the possibilities of finding freelance "gigs" through an "on-demand platform" that facilitates communication between providers and users. Younger generations most readily adopt this new technology; workers between the ages of 25 and 34 make up more than a quarter of today's on-demand workforce.[32] Aided by technology, the number of on-demand workers grew at a faster rate from 2002 to 2014 than the overall job market.[33] In innovative services like drive-sharing, companies like Uber and Lyft, which began business is 2009 and 2012 respectively, have created 22,000 jobs in just a few years.

Like many emerging technologies, existing regulations can serve as a barrier to entry that protects incumbents.[34] Due to their contractual nature and low barrier to entry, gig work is readily available and very flexible, allowing gig workers to set their own hours. By the same token, gig work lacks the usual protections and benefits associated with a traditional employer-employee relationship.[35] However, the *Report* also notes that consumers appear to benefit from the on-demand economy because of lower prices and greater choice.[36] Gigs offered by on-demand platforms are growing because consumers who use them find them affordable and convenient,[37] and the services offered expand continuously. New platforms help consumers shop, sell goods they no longer want, park their cars, and walk their dogs.[38]

Economist Dwight Lee takes a long view on the potential of this on-demand or "sharing economy": "What is now seen as the sharing economy is really a continuation of a long history of sharing through markets that enriches all our lives."[39] Technology may give entrepreneurs a marketing reach that only established businesses had in the past, and may broaden consumer options. Appropriate regulations will provide consumer assurances while protecting on-demand innovation.[40] The challenge of meeting this balance is a key factor in determining its growth and appeal to consumers.

Education for the 21st Century

As economist Alex Tabarrok argues in *The Chronicle of Higher Education*, while there appears to be a need for a greater focus of funding toward science, technology, engineering, and mathematics (STEM) education—which have the potential to confer greater benefits to society through technological innovations—there remains a pressing need to focus more on students that have fallen behind, including millions of college and high school dropouts. Tabarrok points out that the "obsessive focus" on attaining a college degree has not served taxpayers or students well. Given that the United States has the highest college dropout rate in the developed world, it is perhaps problematic that the U.S. education system has developed only one path to knowledge, when there are "many roads to education."[41]

In the United States, vocational high school programs frequently receive a bad reputation as only for struggling and "at risk" students, and in many cases, lack a connection to real jobs. In contrast, many OECD countries boast high school graduation rates that exceed 90 percent. Instead of college, high school students in Germany often start apprenticeship programs in high school, and go on to graduate with the equivalent of a technical degree, better equipped than most American students for the workforce.[42] In fact, 40 to 70 percent of students in Austria, Denmark, Finland, Netherlands, Norway, and Switzerland will opt for a high school education that combines classwork with learning in the workplace. These programs allow students to be paid while receiving high-skill technical training in apprenticeship programs that acclimate them to success-yielding attitudes and practices. As Tabarrok concludes, "We need to provide opportunities for all types of learners, not just classroom learners. Going to college is neither necessary nor sufficient to be well educated."[43]

The President's budget has called for nearly $6 billion in funding for employment training, apprenticeship programs, and partnerships with private companies. Approximately $2 billion would be dedicated over five years to a mandatory Apprenticeship Training Fund to assist employers and states in creating apprenticeship programs.[44] Such funding is duplicative of money currently spent on the Registered Apprenticeship (RA) program administered by the Department of Labor in conjunction with State Apprenticeship Agencies. The Federal Government already registers programs and apprentices in 25 states, while programs are run at the state level in the other 25 states and the District of Columbia.[45] More mandatory spending will simply add to the future debt burden of the potential apprentices the Fund would be meant to help.

The high variance of the quality of education students receive across America is also worrisome. Many students find themselves unprepared for even the most basic post-secondary courses. While the President's call for K-12's "new basic" skill of computer science is a laudable goal, it seems unwise to totally refocus education policy when American students' aptitude for truly fundamental skills—such as arithmetic—lags behind that of their international peers. The recently enacted *Every Student Succeeds Act* places quality improvements to K-12 education systems under state purview, enabling them to determine how best to equip students with fundamental skills.[46]

The existing deficiencies in education quality have compounded over time and resulted in the unfortunate skills gap that has partly driven unemployment and lower labor force participation. As was mentioned in last year's *Response*, part of making participation in the labor force more attractive involves strengthening the connection between workers and employers, empowering workers with the skills they need to fill the jobs that employers offer. Government can encourage thriving employer-employee relationships through smart regulatory reform that accomplishes two goals: 1) a reduction the cost of hiring workers, and 2) a relinquishment of business resources otherwise spent on compliance.

As emphasized above, the traditionally healthy increase in living standards is slowing. Many are still struggling in the aftermath of the recession. Most alarming is the possibility that—unlike their

parents and grandparents—today's youngest generations may not be able to attain the standards enjoyed by the generations that came before them. If they are left burdened with legacy debt caused by excessive Federal spending, there promises to be a dearth of socioeconomic mobility and a flagging economy. The Administration is right that a number of long-term issues remain to be tackled but, sadly, fiscal sustainability—and its importance for American entrepreneurship, innovation, and well-being—was not listed among them.

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