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Annals of Science and Technology Policy

Published, sold and distributed by:
now Publishers Inc.
PO Box 1024
Hanover, MA 02339
United States
Tel. +1-781-985-4510
www.nowpublishers.com
sales@nowpublishers.com

Outside North America:
now Publishers Inc.
PO Box 179
2600 AD Delft
The Netherlands
Tel. +31-6-51115274

The preferred citation for this publication is

G. Tassey. *Globalization and the High-Tech Policy Response*. Annals of Science and Technology Policy, vol. 4, no. 3–4, pp. 211–376, 2020.

ISBN: 978-1-68083-691-2

Annals of Science and Technology Policy
Volume 4, Issue 3–4, 2020

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Annals of Science and Technology Policy, 2020, Volume 4, 4 issues. ISSN paper version 2475-1820. ISSN online version 2475-1812. Also available as a combined paper and online subscription.

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Globalization and the High-Tech Policy Response

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ABSTRACT

This monograph argues that (1) U.S. economic growth policy has not responded to the relentlessly growing competitive pressures from globalization, as evidenced by declining real GDP growth and (2) the policy solution is to create a more high-tech economy. This argument is dramatically supported by the fact that high-tech workers make almost twice as much as the average for all workers. However, they account for only 6 percent of the workforce. So, the promotion of high-tech investment and support for a high-tech labor force is imperative.

Specifically, investment is required in four major categories of assets: technology, "fixed" capital (hardware and software), highly skilled labor, and an intellectual, financial, and management infrastructure. All four assets must be integrated into functional ecosystems that, due to the complexity and variety of modern technologies, require technology specialization by state/regional "innovation clusters".

Among the current areas of underinvestment, the secular decline in federal R&D intensity is a particularly serious problem, given a national government's critical roles in funding scientific research *and* helping innovation clusters

Gregory Tassey (2020), "Globalization and the High-Tech Policy Response", Annals of Science and Technology Policy: Vol. 4, No. 3–4, pp 211–376. DOI: 10.1561/110.00000017.

develop new technology platforms. At the national level, this means pursuing an R&D intensity of 4 percent and dramatically expanding direct Federal support for state technology-based economic development.

Introduction

U.S. economic growth policy has not responded to the relentlessly growing competitive pressures from globalization. Specifically, the federal government has placed excessive reliance on business-cycle management (monetary and fiscal stimulus) and, more recently, on trade barriers in the form of tariffs to allegedly force access to foreign markets for U.S. firms and repress unfair trade practices by foreign governments.

These "growth" policies have not worked and will not work. A quintupling of the Fed's balance sheet and trillion-dollar budget deficits have done little to reverse two decades of declining per capita GDP growth and no increases in real incomes. The tariffs have raised costs of domestic industries that import materials and parts and reduced the growth of vulnerable export sectors such as agriculture, which are the targets of retaliation by other economies. The cheap credit is setting up inflation and another credit market crisis, as corporate balance sheets deteriorate.

The bottom-line reason these growth policies have not worked is that they do not address the *structural* problems resulting from globalization. This phenomenon began to be felt in the late 1970s and early 1980s, as one economy after another acquired a set of economic assets that allowed them to successfully compete in global markets.

Unrestrained by the narcotic of past success, these economies adopted technologies, invested in hardware and software, upskilled their labor

forces, and created technology-based infrastructures. In short, they raised productivity. The result has been a steady redistribution of national shares of world GDP.

The impact of poor policy responses by industrialized nations is exacerbated by the fact that, with lower birth rates, their economies are not growing domestic demand as fast as in the past. This trend places increasing importance on exports to achieve desirable rates of growth in incomes.

In this regard U.S. performance has been extremely weak, as evidenced by 44 consecutive years of trade deficits for the manufacturing sector. Moreover, in 2017, U.S. exports accounted for only 12 percent of GDP. While that is an increase from 9 percent in 1990, it is an extremely poor performance compared to total global trade, which accounts for 29 percent of the world's GDP. Thus, the need for improvement in U.S. trade strategies is evident.

The good news is that 95 percent of the world's consumers live outside the U.S. economy, and many of them are in emerging markets where consumption is accelerating. This provides a substantial economic growth opportunity. However, as with leaders in previous economic epochs, the United States has been slow to even admit to the "convergence" of the world's economies.

The policy mandate must be to significantly raise productivity. Industries that do so will both expand market share and achieve higher profits. They accomplish this by either (1) selling the same product at a lower price (process productivity) or (2) selling a new product with higher performance and hence a higher price (product productivity). In both cases, total profits, employment, and worker incomes increase.

Unfortunately, U.S. labor productivity growth, which averaged 4.1 percent from 1948 to 1978, shrank to a 1.4 percent annual rate in the most recent decade (2008–2018). This is not enough to raise worker incomes, and it cannot generate enough tax revenue to meet broad social needs. As a result of this decline, median real household income was only 2.4 percent higher in 2018 than in 2000. Such growth would be good for one year, but not for 18.

Decades of economic research have clearly shown that technology is the long-term driver of productivity growth. One would therefore think

that technology investment would be the highest priority among the elements of national economic growth strategies. Yet, its role is hardly mentioned in current policy debates.

Post-war U.S. technology leadership was maintained even though the country's economic growth model was inefficient in that most technologies were and continue to be developed to meet public objectives such as national defense, clean energy, health, space exploration, etc. Such objectives generate some growth, but it is the spinoffs into broader commercial applications that drive higher growth rates. However, this indirect route to commercial applications is slow in that the research infrastructure, although of general utility in the early phases of the R&D cycle, is not readily adapted to and connected with areas of the private sector capable of the further development required for commercial use.

This dysfunction is important because in the global technology-driven economy *comparative advantage* is no longer the result of *endowed* resources. Rather, it is *created* through (1) investment and (2) the resulting technologies' efficient application in a time frame necessary to attain "first mover" status in global markets. Unfortunately, without proper incentives and direct support, domestic rates of investment in new technologies that drive productivity growth and hence real incomes have become increasingly inadequate, leading to persistent trade deficits and slow growth.

A prominent example of growing global competition is China, which is now the second-largest performer of R&D, achieving an almost 30-fold increase in spending from 1991 to 2016. Estimates for 2019 put its total R&D expenditure at over $500 billion, which is closing in on the U.S. expenditure of $581 billion. Most important, from a competitive perspective, China is rapidly expanding R&D aimed at major new technologies, such as 5G, biopharmaceuticals, and artificial intelligence. Its target R&D intensity for 2020 is 2.5 percent. Its economy's focus on commercial applications and market development is driving a high rate of domestic growth.

In contrast, the 2019 R&D investment intensity of the U.S. economy was 2.75 percent. This is identical with its post-war peak 54 years earlier

in 1964.[1] At that time, the U.S. economy was the most R&D intensive in the world. Today it ranks ninth.

With respect to the federal government's critical role in funding emerging technology development, its spending on R&D exploded in the 1950s due to dramatic increases in the areas of defense and space exploration and a general realization that much more science was needed for the society of the future. But the federal government's R&D intensity then declined 64 percent between 1961 and 2017. Moreover, U.S. government R&D is still largely focused on defense and a few other "mission" areas, with only a few percent directly targeting economic growth.

The potential for positive economic impact from the right growth policies is dramatically evidenced by BLS studies, which show that high-tech workers make 70 to 92 percent more than the average for the overall workforce, depending on the particular definition of "high-tech". So, politicians should be falling over themselves to promote technology investment and a supporting labor force.

The good news is that the potential for growth in high-tech employment is substantial, due to a wide range of emerging technologies that are transforming the nature of the workplace. Examples are artificial intelligence, advanced robotics, automation, biopharmaceuticals, and 3-D printing. Industry analysts project these technologies will create more jobs than they replace, as has been the case in the previous three industrial revolutions. Current global shortages of highly skilled workers support this forecast.

The combination of automation and digitalization will require that these investments be integrated and managed by an advanced infrastructure that spans product systems and post-sale updating of system components. The forthcoming "Industrial Internet of Things (IIoT)" and the broader "Industry 4.0" are the core of the Fourth Industrial Revolution and will drive private investment in new technologies. However, implementation will require huge and multi-faceted private *and public* investments.

[1] See https://www.nsf.gov/statistics/2018/nsb20181/report/sections/research-and-development-u-s-trends-and-international-comparisons/recent-trends-in-u-s-r-d-performance.

To be competitive going forward, growth policy will have to address the fact that the amount and type of labor skills needed and hence the content of the educational infrastructure will have to change dramatically. Sixty-five percent of children entering primary school right now are destined to work in jobs that do not exist today. Today's workers also need retraining, as automation will largely replace lower-skilled jobs.

However, U.S. policymakers are not responding. The resulting frustration among the majority of workers, whose standard of living has been stuck in neutral for not just years but decades, led to the embracing of Donald Trump, who parlayed the angst of the lower half of the middle class into political victory.

This phenomenon is being repeated across western economies. The British Labor Party's recent drubbing was driven by the loss of its traditional support from blue-collar workers whose real incomes are not rising. The election results have ensured the consummation of Brexit as a weak and destructive response to globalization.

U.S. politicians need to stop acting as "apostles of denial" and ask themselves what will happen to the Nation's standard of living if underinvesting in being competitive continues to be largely ignored and growth policy instead relies on demand stimulation and protectionist measures. Such actions allow low-productivity and hence low-wage jobs to be preserved, but the long-term cost is lower profits for domestic companies and lower incomes for workers.

Another policy mistake is reducing corporate *income* taxes allegedly to stimulate private investment, as was the case with the 2017 Republican tax legislation. An economy needs competitive corporate tax rates but excessively lowering them reduces incentives for investment in productivity, as instantly expanded profit margins take the pressure off companies already reluctant to invest in future competitiveness.

However, the most significant policy error has been to rely largely on business-cycle stabilization tools—monetary credit enhancement and demand-stimulating fiscal policies. They have not worked as a long-term growth strategy, nor will they, as they do not emphasize productivity growth. Record demand stimulation by the Fed's massive credit creation

over the past decade, leveraged by growing federal budget deficits, have lowered unemployment but have done little for income growth.

Another area of policy initiative is targeted income enhancements such as raising the minimum wage. While justified on social grounds, such efforts have limited impact on aggregate economic growth. For example, increasing the minimum wage to the Democrats' proposed $15 per hour generates an annual income of only $31,000. This is hardly prosperity.

In summary, the successful technology-based economy requires a number of assets and the ability to integrate them into an efficiently functioning product or service producing system. These assets include intellectual, physical and human capital, better channels for technical and business knowledge diffusion to firms of all sizes, capital formation to enable high-tech production, and finally an intellectual, financial, and management infrastructure.

Thus, the correct policy response requires an investment-oriented approach that targets the four major categories of assets that drive productivity growth and hence incomes: (1) technology, (2) physical and intellectual capital (basically hardware and software), (3) skilled labor, and (4) a high-tech infrastructure to support the first three asset categories.

The focus of this monograph is the characterization of these four asset categories and the economic rationales for emphasizing investment in them, recognizing that change is difficult. It consequently meets resistance from companies and workers who must make significant adjustments to their investments and skills to implement a new growth strategy.

A major barrier to these needed investments is the fact that companies apply significant discount factors when considering R&D spending opportunities. Specifically, underinvestment can result from (1) a high degree of technical and market risk that characterize most early-phase technology platform research, (2) the propensity of technical knowledge to leak, and (3) the long time typically needed to reach the point of commercialization. These factors explain why industrialized nations promote various forms of cooperative research to pool risk, capture economies of scope, and reduce the average time to completion of the

R&D stage, thereby enabling faster scale-up to commercial production levels and subsequent market penetration.

With respect to the underlying political economy, the public's frustration over prolonged low rates of economic growth is shown clearly by the fact that President Trump's share of a state's vote in 2016 was *inversely* correlated with that state's per capita GDP, reflecting voters frustration over stagnant incomes. The message is that a real growth policy is needed, based on investment in productivity, in order to raise incomes broadly over time.

Extremely important is the fact that a successful economic growth policy must be geographically focused. The reason is that a central requirement for technology-based economic development (TBED) is an elaborate technical and economic infrastructure, including research consortia based around major universities, technology incubators and accelerators to support startups and entrepreneurs, community college curricula focused on training laboratory and manufacturing technicians, and ample supplies of risk capital at each phase of a technology's development and commercialization.

Investment in regional ecosystems has been shown to produce significant economies of scale and scope, risk pooling, and access to large high-skilled labor pools. Such ecosystems yield economic benefits in the form of higher profits and substantially higher worker incomes. Most states now have nascent TBED ecosystems, but most are young and quite small.

To significantly raise the standard of living, the U.S. needs to average about 4 percent annual growth in real GDP. This was last achieved in the 1960s—before globalization got underway in earnest. The post-recession average annual growth rate has been half that, in spite of unprecedented monetary stimulus by the Fed and large budget deficits.

Clearly, if the U.S. economy is to resurrect acceptable rates of income growth, R&D investment must increase faster. In this context, the steady decline in federal R&D intensity is a disaster from a long-term investment perspective, given government's increasingly critical roles in funding scientific research *and* helping develop new technology platforms and technical infrastructure.

Politicians need to ask themselves what will happen to the standard of living if jobs in export industries continue to shrink? Current protectionist measures will allow low-productivity and hence low-wage jobs to be preserved. But, the long-term price is higher inflation, lower profits for domestic companies, and lower incomes for workers.

Unfortunately, managing a modern economy is only getting more difficult. The complexity of new technologies is forcing nations to (1) address an increasing scale and especially scope of the research and development required to create new products and services, (2) capture the co-location synergies inherent in multidisciplinary and capital-intensive research processes, and (3) provide greater support for production scale-up and other commercialization investments needed to penetrate global markets.

The emerging innovation ecosystem described in this monograph is therefore a far more complex and integrated set of industries, universities, and government institutions than what characterized previous industrial revolutions. The policy imperatives are investments in technology, hardware and software, labor skills, and supporting technical infrastructures, which can achieve the economies of scale and scope needed to compete with increasingly aggressive national programs across the industrialized world.

In summary, it is hard to imagine politicians ignoring the opportunity to get credit for raising the incomes of their constituents by almost a factor of two. To this end, the failure to respond to the imperative of greater investments in technology and its complementary assets to accelerate productivity growth is becoming increasingly costly and is resulting in little or no growth in the standard of living.

This monograph systematically documents and analyzes the set of policies and investment trends and resulting impacts on rates of growth over the post World War II era. These trends highlight a very inadequate growth policy, which is the result of failing to admit that America's dominant post-war position in the global economy has been steadily eroded by aggressive growth strategies in other economies.

State governments have begun to understand this policy imperative and are therefore acting on the realization that new investment-oriented

growth strategies emphasizing technology-driven productivity growth are needed.

The bottom line from a policy perspective is that productivity growth is affected by a number of factors, but the most important one for long run growth is improvements in technology. However, technology by itself cannot create advances in productivity. It must be embedded in capital, labor, and infrastructure, and all four assets must be integrated into a fully functional ecosystem that enables them to work together synergistically. This is the core economic growth policy challenge.

To this end, regional growth strategies with a productivity focus are being implemented around the world, but in these cases, the national governments are driving the policy process through provision of resources and expertise. It is time for U.S. policymakers to realize that governments compete against each other as much as companies do.

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