Cornell University
ILR School

Cornell University ILR School
DigitalCommons@ILR

Briggs Volume III

Briggs Papers and Speeches

April 1986

Science, Technology and U.S. Economic Policy

Vernon M. Briggs Jr.
vmb2@cornell.edu

Follow this and additional works at: http://digitalcommons.ilr.cornell.edu/briggsIII

This Article is brought to you for free and open access by the Briggs Papers and Speeches at DigitalCommons@ILR. It has been accepted for inclusion in Briggs Volume III by an authorized administrator of DigitalCommons@ILR. For more information, please contact hlmdigital@cornell.edu.

Science, Technology and U.S. Economic Policy

Keywords
Science, technology, economic, industrial, government, policy, development, public

Comments
Volume 3 - Paper #44

This article is available at DigitalCommons@ILR: http://digitalcommons.ilr.cornell.edu/briggsIII/3

44

Keynote Address
Phi Kappa Phi Banquet
New Mexico State University
Las Cruces, N.M.
April 9, 1986

Science, Technology and U.S. Economic Policy

Vernon M. Briggs, Jr.
Cornell University

As the result of the confluence of an unlikely combination of technical, intellectual, and political forces, the United States was "born running" with the Industrial Revolution. In the eventful year of 1776, James Watt finally perfected an efficient and workable steam engine that would revolutionize the means of production; Adam Smith published his famous treatise on The Nature and Causes of the Wealth of Nations that outlined the incentives for production and the potential for economic growth that a competitive and unrestricted market system could provide; and the Declaration of Independence was signed and implemented in Philadelphia which spawned a new nation that would soon link its future course of economic development to the evolution of technology and the practice of domestic (but not international) competition. Other nations, of course, were also affected by these happenings. Britain in particular jumped off to a faster start down the path of industrialization but it has been the United States that has emerged over the long run to date as the quintessential "industrial state." Other industrial leaders of today took a longer time to shed their pre-industrial traditions. Japan is only now making a mighty challenge for preeminence in this race after centuries of delay.

It is of interest to note, however, that the momentum of the Industrial

Revolution of the late-18th Century drew very little of its strength from science. As has been frequently noted, science was far more indebted to the perfection of the steam engine than the steam engine was to science. Moreover, it is also likely that the interest that British scientists quickly took in industrial questions during this formative period was more a "result" of British industrial prominence than a "cause" of that leadership.

As for economics, it is essential to see that Smith was writing before the Industrial Revolution had taken hold. It was an era in which science had no particular contribution to make to economic development or growth. Science required little of society's inputs and contributed little to its output. It is in this context that Smith's advocacy of laissez faire economic policies must be evaluated. Smith's view that each individual should be free to pursue his economic self-interest in a purely competitive market environment that is guided by an "invisible hand" was a pre-industrial concept. The same can be said for his policy conclusion that inefficiency and distortions were caused entirely by governmental interference with the natural workings of economic laws. Smith never envisioned the rise of the private corporation or the coming of trade unions or the emergence of economies that would be highly capitalized and dependent upon science-based technologies. In a real sense, his writings were obsolete at the time they were written. As I will discuss later, Smithian economics has enjoyed great popularity in U.S. economics'academy but his ideas were not the economic principles that were actually practiced during the formative years of the nation's economic development. With regard to its economic policy legacy, the nation owes a great intellectual debt

to Alexander Hamilton and Henry Clay for setting the governmental interventionist course early in the nation's history that has subsequently been followed.

To return to the major theme, it is important to note that science and technology in Western Societies in general and the United States in particular developed along entirely separate streams. At times their evolutionary paths crossed and at times they received support from each other. But it was not until the last quarter of the Nineteenth Century that the development of science and technology became intermeshed. It was also during the last quarter of the 19th Century that the link of both science and technology to economics was established. It was Thomas A. Edison who first put together a team of researchers to study what was needed to produce an electric light and power system. When he opened the first electric power station in the world in New York City in 1882, he and his associates had developed every aspect of the necessary system -- from the generators, the cables, plugs, safety fuses to the incandescent lamp bulb. Edison was an inventor -- a technologist with little formal training in science. But through extensive self-study of the scientific literature, he was able to exploit discoveries that others had made in pure science for practical and commercial applications on a scale never before known in the annals of technology. He set the research pattern of teamwork that has now become common in the last half of the 20th Century.

But it was in the natural sciences where the importance and relevance of science to daily life was most clearly demonstrated and where economics and science first became intertwined. The circumstances were provided by the publication of Charles Darwin's Origin of Species (1859) and, later,

The Decent of Man (1871). Darwin attributed his reading for "amusement" of the classic study by the economist Thomas Malthus of the constant struggle of society to feed a growing population for cystalizing his thoughts. The result was his theory of natural selection as the creative force of evolution. The reaction to Darwin triggered an unprecedented debate in the 1880s and 1890 over the relationship of science and economics to each other and to public policy formulation. So pervasive was the dialogue that the historian Henry Bamford Parkes has called it "the most intellectually fruitful period in the whole of American history."

Darwinism teaches that evolution has no particular purpose. Evolution means only that organisms struggle to pass on their genes to future generations. There is no harmony or order implied by the process. It is, as the biologist Stephen Jay Gould of Harvard has recently written, "the economy of Adam Smith transferred to nature." Evolution is not the process of executing the unfit nor does it necessarily mean that there is any higher or better results that spring from the adaptation process. Surviving organisms in science are simply those that are better able to adapt to their local environment.

Social scientists, however, picked up Darwin's teaching and applied them to the economic world in a context that was completely counter to Darwin's message. It was the English sociologist Herbert Spencer who coined the phrase "survival of the fittest" -- not Darwin. It was Spencer and his American disciple, the political scientist William Graham Sumner, who applied Darwin's principles to an understanding of the social and economic order of society. They equated progress with struggle as a way to interpret human history. Competition between individuals and business enterprises

could provide economic advancement for society. Any interference by government, they argued, would hinder this natural process. This interpretation of the economic world also had a dire political implication as well. It meant, if true, that all men were not created equal despite what the Declaration of Independence proclaimed. Sumner, in fact, once called democracy "the pet superstition of the age." The conclusion that they drew was that any effort by the government to interfere in the economy by trying to regulate business practices or to help the poor to improve health and safety for workers was positively harmful. Sumner went so far as to complain that such reform policies would result only in the "survival of the unfit." Hence, Darwinism was used as a means of support for laissez faire economic principles. Business and conservative political groups revered these views and their proponents because they glorified their personal conduct and pursuit of self-interest. But when Sumner later extended his views to their logical conclusion to include international competition by actively promoting free trade, many of these same conservative interest groups tried to have him fired from the Yale faculty. The U.S. economy since its founding had been built behind the protective walls of high tariffs and it continued to adhere to such policies until well into the 1960s.

The point is that the concept of evolution in science does not mean progress. For if "survival of the fittest" actually meant that only the fittest survive, it would be a tautology. A statement that survivors are the fittest because only the fittest survive does not say anything. But this is not what Darwin said. His theory of natural selection is simply a statement of local adaptation to a changing environment. There is

absolutely no perfecting principle involved or any implication that nature provides a mechanism for natural progress if left alone. Evolution only means that those organisms which can adapt to changing environmental conditions are the ones that survive. Those that cannot adapt, perish. It does not mean that those that survive are in any way qualitatively better. In fact, biologists in Darwin's time and today have shown repeatedly that artificial interventions by man into the developmental processes of organisms can frequently produce better results than if left to natural development alone. In the world of science, there is no belief in any automatic benefits that can be derived from laissez faire principles.

Unfortunately, the damage to economic thinking had already been done. Adam Smith's pre-industrial concepts of the alleged benefits of a competitive world with its laissez faire and free trade policy conclusions had been wedded intellectually to a misinterpretation of Darwin's teachings. An unregulated economy guided by the "invisible hand" of the market place was linked to a notion that adherence to such policies would assure economic progress. Any interventions by government to regulate business practices, or to protect workers, or to assure a more equitable distribution of income were alleged to be not only counterproductive but actually harmful to progress.

Yet it is exactly this false notion that continues to be perpetuated in the way in which economics is taught and public policy options are discussed in the United States. Its lasting effects are simply devastating to any quest for actual understanding of the domestic and international economy in which we currently live in the last years of the 20th Century. As the social critic Robert Kuttner recently wrote:

> The modern economics profession is surprisingly aloof from the institutions of economic life. As their methods have become more abstract, economists have disdained study of the gritty details of production, the organization of markets and the march of technology. Rather it is simply assumed that Henry Ford's assembly line of the 1920 or the rise of computerized production in the 1980s are natural processes that reflect the changing tastes of the sovereign consumer and the survival of the fittest entrepreneur.

Such notions as to how technology and science have reshaped the economy of our nation are, of course, patently false. From the construction of the original vacuum tube computer; to the creation of the transistor; to the perfection of silicon logic; to the current experimentation with gallium arsenide as the next step in electronic revolution, the development of the computer has been financed by massive governmental research support at every step. As matters now stand, more than one out of every two dollars spent on research and development in the United States are provided by the federal government. The recognition of the essential role of research and development to economic development along with the corollary that the federal government must underwrite most of these costs was first recognized during World War I. Support for this view accelerated during World War II and, since that time, it has become one of the principle driving forces of the economy. It is the key to understanding the economic transformation that is occurring within our life time. Science has become <u>the</u> principle source of invention. Its imprint is to be found in virtually every aspect of our lives -- whether it be in food and fiber production, computerized manufacturing, nuclear power generation, laser based defense systems, space exploration, information processing, toxic waste management, the content of educational instruction, or genetic engineering to mention only a few of its contemporary ramifications. The United States has become a science-

based, technologically-oriented society. Many other nations -- both our friends and adversaries -- in the world community have put their economies on the same track. The industrial and occupational structures which constitute the substance of our economy are being rapidly transformed and the ensuing alterations are not the product of responses to changing consumer tastes or entrepreneurial competition between little business enterprises. In today's economic environment, inventions and discoveries come largely from the scientific laboratories of our universities, corporations, and governmental institutions. In these laboratories, research is organized and systematized by scientists who usually have pre-determined objectives in mind. Most of the work is subsidized by the highly "visible hand" of public funds although the support provided by private sources is also significant. As a consequence, we have had a veritable explosion of knowledge that has triggered a race between business firms both within our country and those of other nations to apply this knowledge. The scale of the enterprises and the degree of governmental involvement in the economy of today are such that Adam Smith must be having fits of convulsions in his grave. The world of Adam Smith is not descriptive of the economy of today nor is it a vision of an economy that many of us would long to be a part of.

The issue is not really whether or not the nation adheres to laissez faire principles. Obviously it does not. Each daily session of Congress since the nation was founded has amply proven that the fully free market economy is an illusion. Subsidies, tariff protections, bailouts, and tax loopholes to various business enterprises are the essence of the political process. As Michael Reich of Berkeley has succinctly pointed-out, "because

neither government nor business can admit the intimacy of the relationship, both sides treat it as an illicit affair, hiding it from public view and thereby thwarting any attempt to give institutional legitimacy to those aspects of the relationship that promote adjustment."

Nonetheless, by going through the motions that somehow the Smithian competitive world is an ideal world, it was possible to continue to teach economic principles that treat science and technology as exogenous variables that do not impinge upon the way the economy functions. This is decidedly not a depiction of reality today. As Nathan Rosenberg of Stanford has pointedly observed, "far from being exogenous forces to the economic arena, the content and direction of the scientific enterprise are heavily shaped by technological considerations that are, in turn, deeply embedded in the structure of industrial societies." Far too much attention is paid in the economics profession to the consequences of economic change and far too little to understanding the determining forces. It is time for a change in perspective. The formation of contemporary economic policy is too important to be based on reminiscences of a past that probably never was.

Likewise, the principles of laissez faire are still spouted by opportunistic politicians who believe they can be elected by mouthing such cliches to an uninformed public. As a result, the ability to discuss and to implement the measures that are urgently needed to facilitate the structural adjustments of the economy and its labor force to rapid technological change are seriously hampered. The economic policy agenda should be focussed upon the formulation of a national industrial policy with its commitment to national economic planning; increasing public support for research and development expenditures; establishing a tax system that

rewards saving for investment and not borrowing for consumption; providing quality education for our future workers and citizens; establishing a national system of re-training for workers who are the accidental victims of rapidly changing technology; the adoption of a national relocation policy to facilitate the movement of workers from surplus to shortage regions; and a commitment to the creation of public service jobs for those workers who, for whatever reason, cannot be retrained, reeducated, or relocated to find employment in these changing times.

Here in the 1980s and 1990s it is essential that there be another intellectual debate as there was a century ago on the subject of economics and science. In the process, it can be hoped that this time the rhetoric of *laissez faire* can be abandoned and that economic policy making can be brought into step with the dynamic forces of science and technology that are shaping our economic destiny.