

IS INDUSTRIAL INNOVATION DESTROYING JOBS?

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One of the principal motivations for the establishment of an industrial policy in the United States is to counteract or facilitate structural change in the economy, especially in labor markets. It is alleged that our basic manufacturing sector is in a state of semipermanent decline.¹ It is further alleged that the number of high-technology jobs is not growing fast enough to absorb those being laid off in the heavy manufacturing sector.² The result, therefore, will be rising unemployment and declining standards of living for many Americans.³

This is a pretty dismal scenario and, if it were true, might provide some rationale for the establishment of an industrial policy or some other government economic planning mechanism. I believe, however, that such fears about the future can be dispelled on both theoretical and empirical grounds. The first part of this paper will examine the theory of technological unemployment and survey the literature on this subject. The second part will look at some of the data.

The Theory of Technological Unemployment

Technological unemployment has been discussed by economists and feared by workers ever since the beginning of the Industrial Revolution in the 18th century. The issue is broader, however, than just the question of whether men are going to be replaced by machines. It really has to do with the question of what will result from any

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¹See, for example, Eckstein et al. (1984), Bluestone and Harrison (1982), and many other current studies favoring industrial policy.

²See Schwartz and Neikirk (1983), Appelbaum (1983), Serrin (1983), Riche et al. (1983), McGahey (1983), and U.S. General Accounting Office (1982).

³In addition to the above, see Kuttner (1983), Thurow (1984), AFL-CIO (1984), and Harrington (1984).

factor which increases output per unit of labor. Structural unemployment could result not only from automation or robotics but also from the introduction of any sort of machinery or fixed capital in the manufacturing process, or even from managerial innovation.

Although he was talking about the division of labor rather than the effects of machinery, Adam Smith made the essential point in his famous discussion of the pinmakers. In Smith's anecdote, a group of pinmakers, working separately, were barely able to manufacture one pin per day per man. However, when a group of ten got together and began to specialize—one drawing out the wire, another straightening it, a third cutting it, a fourth sharpening it, and so on—they were able to increase their collective output some 4,800 times. Instead of producing 10 pins per day between them, they could now, through the division of labor, produce 48,000 (Smith 1937, pp. 4–5). The question that immediately arises, of course, is whether this vast increase in pinmaking productivity then led to permanent unemployment in the pinmaking industry. After all, these ten pinmakers working together could now probably satisfy most of the existing world demand for pins by themselves!

Smith does not tell us what happened, but we can surmise that given the previous low productivity of pinmaking, pins must have been extraordinarily expensive, costing the equivalent of one day's wages per pin. Under the circumstances, obviously, uses for pins must have been quite limited, a luxury only for the very wealthy. However, after a 4,800-fold increase in productivity, the cost of pins would now, presumably, be just 1/48,000th of their previous cost. If the price of pins were to fall accordingly, there would, no doubt, be many new customers. New demand for pins may, indeed, rise more than 4,800 times, creating new jobs in the pinmaking industry rather than unemployment.

But what if this did not occur, and the pinmakers chose to lower prices just enough to put all the other pinmakers out of business but not enough to stimulate demand for pins substantially, thus creating unemployment and pocketing monopoly profits? Might society not be worse off somehow? Smith did not think so. He believed that the increased profits would have to be spent on something and would simply create new employment in other industries (p. 272). He also thought that competition would inevitably force prices down (p. 706). Thus he concluded that any measure which raises output per unit of input invariably makes society better off.

David Ricardo muddled the water when, in the third edition of his *Principles of Political Economy and Taxation*, he added a chapter on the effects of machinery on workers (See Hollander 1971). In this

chapter he argued, contrary to Smith, that workers are not always better off as a group from rising productivity:

Ever since I first turned my attention to questions of political economy, I have been of the opinion that such an application of machinery to any branch of production as should have the effect of saving labour was a general good, accompanied only with that portion of inconvenience which in most cases attends the removal of capital and labour from one employment to another.

[Ricardo 1911, p. 263]

Ricardo originally felt that lower prices would free income for expenditure on other commodities, increasing demand for them, while benefiting workers who could now buy more with the same wages. Thus, after some temporary transition, all classes would benefit equally from rising productivity.

But then he changed his mind and came to believe that "the substitution of machinery for human labour is often very injurious to the interests of the class of labourers" (p. 264). He based this on a belief that the introduction of machinery (or fixed capital) would reduce labor's share of total income while raising the share going to capital. If this argument is carried to its logical extreme, workers could become poorer and poorer even as output continually increased.

The first to respond to Ricardo's argument was the French economist Jean Baptiste Say, who argued that machinery does not compete with labor at all. In Say's view, machinery merely augments the productivity of labor. To the extent that more output is created with fewer inputs, society is necessarily better off:

A new machine supplants a portion of human labour, but does not diminish the amount of product; if it did, it would be absurd to adopt it. When water-carriers are relieved in the supply of a city by any kind of hydraulic engine, the inhabitants are equally well supplied with water. The revenue of the district is at least as great, but it takes a different direction. That of the water-carriers is reduced, while that of the mechanists and capitalists, who furnish the funds, is increased. But, if the inferior charges of its production lower its exchange-value, the revenue of the consumers is benefited; for to them every saving of expenditure is so much gain.

[Say 1834, pp. 90-91]

Say recognized that there was still the problem of what to do with the unemployed water carriers. But he believed that three factors would substantially mitigate the harmful effects of such unemployment:

1. New machines are slowly constructed and still more slowly brought into use, giving those who are affected time to adjust.

2. Machines cannot be constructed without the input of considerable labor, which can create employment for some workers even as machines may put others out of work.
3. The condition of consumers, including workers affected by the machinery, is improved by the lower prices of consumer goods.

Marx (1977, p. 568n) referred to Say's argument as "insipid nonsense," and went on basically to repeat Ricardo's argument—Marx merely added details in the form of historical data and refutations of the views of other economists, such as McCulloch, who endorsed Say's position (Schumpeter 1954, p. 685; Tucker 1961, pp. 252–69).

The vast majority of economists, however, tended to be optimistic rather than pessimistic about the effects of machinery on labor. Alfred Marshall's view may be taken as representative when he said that an increase in capital

may occasionally diminish the field of employment for manual labor in a few trades, yet on the whole it will very much increase the demand for manual labor and all other agents of production. For it will much increase the national dividend, which is the common source of the demand for all; and since by its increased competition for employment it will have forced down the rate of interest, therefore the joint product of a dose of capital and labor will now be divided more in favor of labor than before. This new demand for labor will partly take the form of the opening-out of new undertakings which hitherto could not have paid their way; while a new demand will come from the makers of new and more expensive machinery.

[Marshall 1920, pp. 553–54]

The Great Depression

The onset of the Great Depression in 1929 reopened the whole debate on structural unemployment. With the exception of Alvin Hansen (1931; 1932), most economists tended to dismiss the idea that vast amounts of unemployment were the result of technological change.⁴ They tended to concentrate, correctly, on the relation of aggregate demand to the government's monetary and fiscal policies. Perhaps typical was the view of Professor Willford King, who said in 1933 (p. 390):

There is nothing in the statistical evidence now available to indicate that new inventions are not still continuing to benefit labor. It is absurd to blame technological improvements in methods of production for the evils resulting from our antiquated and unsound monetary system. Because of imperfections in this system, the prices of most products of industry have been allowed to decline sharply.

⁴See Gregory (1930), Haberler (1932), Kahler (1935), Fisher (1937), and Dankert (1940).

The obvious result is that employers can no longer hire the total labor force of the nation at the old wage rates. To adjust wage rates to lower levels is, however, a slow and difficult process. Unless the prices of the products of industry rise, unemployment is likely to continue until wages are adjusted downward to an extent approximately equal to the fall in the price level. . . . The present situation may be summed up by saying that no facts or figures thus far discovered cast any doubt upon the approximate validity of the orthodox economic theory that the forces giving rise to technological unemployment tend, at the same time, to create a demand for new goods, and that the production of these new goods normally calls for a volume of labor roughly equalling the quantity displaced.

John Maynard Keynes himself accepted the view that technological unemployment was temporary and that technological innovation was good for society (1963, pp. 358–73). Nevertheless people remained concerned about the issue of technological unemployment—politicians in particular. The Works Progress Administration, for example, commissioned economist Alexander Gourvitch (1966) to thoroughly survey all existing literature on the subject of technological change and employment. The literature was generally sympathetic to the Ricardo-Marx view. The Temporary National Economic Committee (1940) also delved into the issue thoroughly, holding many days of hearings on the relationship between technology and the economy, and it commissioned a lengthy study on the subject in 1941. Again the thrust of this work tended to support a pessimistic view of the impact of technology on unemployment.

The onset of World War II ultimately solved the unemployment problem, and concern about technological unemployment quickly faded away. The slow growth of the mid-1950s, however, combined with what seemed to be a quickening pace of technological innovation—especially the development of the computer—again gave rise to concerns that permanent unemployment may result from what came to be called automation.

The Automation Scare

The automation scare of the late 1950s appears to have started from a series of hearings held in 1955 by the Joint Economic Committee of Congress, which issued a report on *Automation and Technological Change* in January 1956. The committee concluded that “no specific broad-gage economic legislation appears to be called for” since the Employment Act of 1946 was already on the books (U.S. Congress 1956b, p. 13). Nevertheless it suggested that the federal government more closely monitor the effects of advancing technology and productivity on employment.

However, rising unemployment continued to fuel interest in the automation issue. Although low by today's standards, unemployment more than doubled between 1953 and 1958, rising from 1.8 million to more than 4.6 million unemployed. By 1961 the unemployment rate had reached 6.5 percent (which was to remain the highest post-war level until 1975). The result was continuing congressional interest and concern about automation.⁵

A 1961 staff report from the Joint Economic Committee argued that structural unemployment could not be shown to have risen. It said that the rise in unemployment resulted from inadequate aggregate demand—a typically Keynesian argument. This study had considerable influence on President Kennedy and had much to do with his decision to push for an across-the-board tax cut, the plans for which were announced in late 1962 (Heller 1967, pp. 63ff).

Walter Heller, chairman of the Council of Economic Advisors under Kennedy, strongly held the view that technological innovation was necessary and desirable. Permanent technological unemployment was not a problem for two reasons:

1. The existence of poverty and many other pressing economic problems demanded that productivity be increased. They made it highly unlikely that society might become too productive and not provide sufficient meaningful work. "Clearly," he said, "we need not fear that the increasing productivity associated with even a speeded up rate of technological progress will founder upon a contradiction between our needs and our ability to satisfy them. As people continue to receive the extra incomes which our enlarging production can generate, they will also continue to use those extra incomes to buy the enlarged output—for private and public consumption and for investment."
2. Automation was unlikely to cause any major shift in the general skill requirements of the labor force. There was no reason to believe, for example, that unskilled labor would completely disappear, since automation simplified some jobs just as others became more complex. In any case, sensible government policies to encourage education, worker retraining, and labor mobility could mitigate whatever temporary dislocations may result.⁶

⁵See U.S. Congress, House, Committee on Education and Labor (1961), and U.S. Congress, Joint Economic Committee (1957 and 1960).

⁶U.S. Congress, Senate, Committee on Labor and Public Welfare, Subcommittee on Employment and Manpower (1963, pp. 1751–69). See also *Economic Report of the President, 1964*, pp. 85–111.

The majority of economists continued to believe that automation was not a serious problem.⁷ But there were a few voices of doom and despair. Principal among these was Charles Killingsworth, a professor at Michigan State. Killingsworth consistently questioned assumptions about the employment and societal effects of automation, generally taking a highly skeptical view.⁸

The issue was more or less settled by two factors. First was the sharp decline in the unemployment rate, which fell from a postwar high of 6.5 percent in 1961 to 3.4 percent by 1969. Second was the report of the National Commission on Technology, Automation, and Economic Progress, established in 1964 by Public Law 88-444, which was set up to make some final determination of the automation issue. The commission concluded that automation was not a major factor in unemployment:

We believe that the general level of unemployment must be distinguished from the displacement of particular workers at particular times and places if the relation between technological change and unemployment is to be clearly understood. The persistence of a high general level of unemployment in the years following the Korean War was not the result of accelerated technological progress. Its cause was interaction between rising productivity, labor force growth, and an inadequate growth of aggregate demand. This is firmly supported by the response of the economy to the expansionary fiscal policy of the last five years. Technological change, on the other hand, has been a major factor in the displacement and temporary unemployment of particular workers. Thus, technological change, along with other forms of economic change, is an important determinant of the precise places, industries, and people affected by unemployment. But the general level of demand for goods and services is by far the most important factor determining how many are affected, how long they stay unemployed, and how hard it is for new entrants to the labor market to find jobs.

[Bowen and Mangum 1966, p. 10]

The commission added, "The basic fact is that technology eliminates jobs, not work." Thus it firmly opposed the old "lump of labor" fallacy, which holds that there is only so much useful work to do in the economy and no more. Total employment, in short, is a function of macroeconomic policy. Technology is microeconomic and only affects the composition of jobs within this macroeconomic framework.

⁷Buckingham (1962), Dale (1964), Dankert (1959 and 1960), Fuchs (1963), Hazlitt (1962), Kendrick (1966, pp. 773-7), and Terborgh (1965).

⁸In addition to Killingsworth (1960 and 1965), see U.S. Congress, Senate, Committee on Labor and Public Welfare, Subcommittee on Employment and Manpower (1963, pp. 1461-99).

The Current Debate

As in the past the current discussion of structural unemployment, technology, and industrial policy is largely a function of abnormally high unemployment rates. Since 1975 the national unemployment rate has averaged more than 7.5 percent, in contrast to an average of 4.6 percent in the 1960s. The average of 9.5 percent between 1982 and 1983 has made concerns about high-tech, robotics, and automation even more frenetic.

Everywhere, one seems to read about how dismal the future will be—with robots doing all the work, the disappearance of our basic industries, and declining standards of living for many Americans. Unfortunately very little analysis underlies most of these books and articles, since most economists continue to believe that our economic problems remain largely macroeconomic. If we could just get monetary and fiscal policy right, they believe, we could get unemployment down to its “natural rate.” Of course no one agrees on what the “right” monetary and fiscal policy is, or what rate is “natural,” but that is another issue.

The only economist who is seriously working on the problem of technological unemployment is Professor Wassily Leontief. He has largely been skeptical about the effects of automation on work and income (1952; 1982). As I read his work, it follows closely Ricardo's views that by affecting the distribution of income, mechanization may have negative effects on employment. Professor Leontief virtually echoes Ricardo when he says:

One way of meeting the threat of potential technological unemployment is the creation of new and the maintenance of old jobs through increased investment, i.e., economic growth. But this possibility has definite limits. How fast would the economy, and with it the volume of investment, have to grow in order to keep the number of long-distance telephone operators from decreasing in face of the fact that each of them will soon be able to handle 10 million instead of 1,000 telephone calls? The rate of investment required to accomplish this end might turn out to be so high that very little would be left over for current consumption.

In the pursuit of full employment through a greater and greater volume of productive investment, the society ultimately would find itself in the position of the proverbial miser who deprives himself of the bare necessities of life while depositing more and more into an already swelling savings account, and this despite his steadily increasing annual income. This is exactly what might happen in the long run under the relentless pressure of technological advance, if the forces of unrestricted cutthroat competition were permitted

... to govern the operation of the labour markets and conditions of employment. [Leontief 1978, p. 452]

I have little doubt that one can construct a theoretical model which would produce such an outcome. One could simply respond that under present conditions it would take so long for such a situation to develop, it would be like worrying about when the sun will burn out, as it inevitably will one day. Or one might use the Keynesian response, that the correct sorts of fiscal policies—for example, redistributing income from investment to consumption—would prevent the development of this situation even if it were theoretically possible.

I would prefer to argue, as Schumpeter did, that Leontief's scenario misses the essential point about the impact of machinery on employment. In responding to Ricardo's argument, Schumpeter (1954, p. 684) said:

He never clearly realized that the *essential* fact about capitalist "machinery" is that it does what, quantitatively and qualitatively, could not be done at all without it or, to put it differently, that it "replaces" workmen who have never been born.

In addition Ricardo failed to recognize that total output in terms of goods must increase, under conditions of perfect competition (which he assumed) as a consequence of mechanization.

Sir John Hicks (1963, pp. 115–17) has also argued against the Ricardian proposition that progress may so adversely affect the distribution of income that society would be worse off. He did so in the form of three counter-propositions:

1. An increase in the supply of any factor of production will increase the absolute share (that is, the real income) accruing to that factor if the elasticity of demand for that factor is greater than unity.
2. An increase in the supply of any factor will always increase the absolute share of all other factors taken together.
3. An increase in the supply of any factor will increase its relative share (that is, its proportion of the National Dividend) if its "elasticity of substitution" is greater than unity.

Hicks concluded (p. 121):

[I]t inevitably follows that an invention can only be profitably adopted if its ultimate effect is to increase the National Dividend. For if it is to raise the profits of the entrepreneur who adopts it, it must lower his costs of production—that is to say, it must enable him to get the same product with a smaller amount of resources. On balance, therefore, resources are set free by the invention; and they can be used, either to increase the supply of the commodity in whose production

the invention is used (if the demand for it is elastic), or to increase the supply of other commodities (if the demand for the first is inelastic). In either case, the total Dividend must be increased, as soon as the liberated resources can be effectively transferred to new uses.

Herbert Simon (1965) saw the effect of automation as increasing real wages. He argued that almost all of the productivity gains from automation go to laborers, unless automation increases the interest rate. Furthermore Simon concluded that labor-saving technological change increases the amount of capital per worker. According to Simon (p. 22):

Because of this capacity to generate the necessary capital, the industrializing countries have been able to absorb large amounts of technological progress that, on balance, has been labor saving.

The main long run effect of increasing productivity is [therefore] to increase real wages. . . . If a disequilibrium appears, it will evidence itself first in high profit levels, and the proper measures to restore equilibrium . . . are to encourage rapid public or private capital formation, which will come about at least partly because of the profits themselves.

Hence, as a matter of theory, there seems to be little reason to suppose that mechanization, automation, or any other factor causing output per unit of labor to rise is of serious concern. The only thing which would justify a more pessimistic outlook would be something which prevents prices and wages—and therefore capital and labor—from adjusting to changing economic conditions. There is nothing in theory which shows that under free-market conditions technological progress can do anything except make everyone better off.

Summarizing this position, a leading scholar in the field, Professor Nathan Rosenberg of Stanford, recently told the House Subcommittee on Science, Research, and Technology:

I do not believe that high unemployment has been primarily due to the character of technological change, nor do I see any compelling reason to believe that new technologies will have an unusual job-reducing bias in the future. Some categories of employment will, of course, suffer.

Technological change always has reduced specific categories of employment, whether it is farm workers, coal miners, railroad workers, lumberjacks, whatever. The electric light displaced the candle-maker and the automobile put saddlers and whipmakers out of business. The crucial question, it seems to me, is whether the thrust of technological change is to reduce total employment, not whether it eliminates specific jobs. . . .

It is extremely difficult to anticipate the impact of new innovations because this impact is never something which is inherent in a piece

of hardware. It depends rather on social uses and cultural contexts, on how society chooses to mobilize the technological potential of a piece of hardware.

So that I believe there is a systematic bias in our perception about the future. This bias sharpens our awareness of possible job-reducing consequences of technological change, but at the same time fails to identify the prospects for enlarged employment opportunities that flow from the ability to produce certain products more cheaply or to invent entirely new products with quite unanticipated uses and applications. . . . What I want to insist upon, in closing, is that I see no evidence to support the expectation that technological innovation is now poised to inflict unemployment of a vastly enlarged scale as compared with our historical experience.

[U.S. Congress 1983, pp. 32-34]

Some Empirical Data

A brief review of some of the empirical data which bear on the argument will be reviewed in this section. The preponderance of this evidence shows that labor invariably benefits from increasing capital formation, productivity, and technological innovation.

First let us look at labor's share of national income over the last 50 years. Obviously there has been considerable capital formation and technological innovation over this period. If there were any validity to the argument that labor suffers from such factors, it should show up as a decline in employee compensation as a share of national income. In fact, as Table 1 shows, this has been almost continually rising.

TABLE 1
TOTAL EMPLOYEE COMPENSATION AS A
SHARE OF NATIONAL INCOME

Year	Labor's Relative Share (%)
1930	63.4
1940	65.4
1950	65.1
1960	70.9
1970	75.5
1980	75.6
1983	75.2

SOURCE: National Income and Product Accounts.

Another concern might be that rising productivity will be used to produce the same output with less labor, rather than to increase output. If this were so, one would expect to see increases in productivity associated with declining employment. But as Figure 1 demonstrates, increased productivity in the economy is invariably associated with rising, rather than declining, employment. Only four years since 1948 reveal both increased productivity and reduced employment.

It is all the more remarkable that employment growth is positively correlated with productivity growth when one considers that average weekly hours worked has not changed much over the postwar period. Professor Leontief and others have suggested that the workweek may need to be shortened if future productivity is not to lead to unemployment.

The data show two things: that people have preferred to have higher real incomes rather than increased leisure during their working lives, and that people have tended to take their leisure in the form of increasingly early retirement rather than shorter workweeks. Table 2 shows that over the period 1947 through 1981, per capita gross domestic product has risen at an average annual rate of 2.1 percent, while average weekly hours worked has fallen only slightly. Had workers preferred to take all of the productivity increases over this period in the form of shorter hours rather than higher incomes, average weekly hours could have fallen 2.6 percent instead of just 0.4 percent.

TABLE 2
AVERAGE ANNUAL RATES OF CHANGE IN GDP PER CAPITA AND
AVERAGE WEEKLY HOURS, 1947-81

Years	Average Annual Percentage Change	
	GDP Per Capita	Average Weekly Hours
1947-65	1.8	-0.4
1965-73	2.3	-0.7
1973-81	1.8	-0.5
1947-81	2.1	-0.4

NOTE: GDP is Gross Domestic Product.

SOURCE: Bureau of Labor Statistics.

Table 3 shows labor force participation rates for persons age 65 years and over since 1948. As one can see, the number of people age

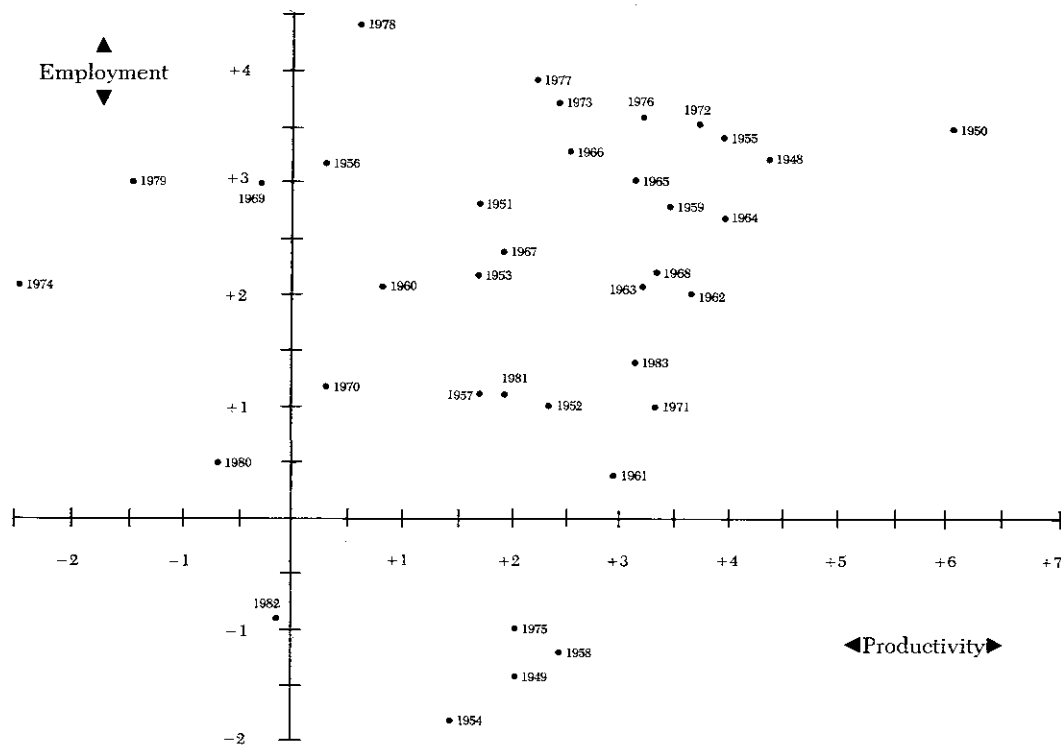


FIGURE 1
U.S. EMPLOYMENT-PRODUCTIVITY RELATIONSHIP

TABLE 3
LABOR FORCE PARTICIPATION RATES FOR PERSONS
AGE 65 YEARS AND OVER, 1948-82

Year	Labor Force Participation Rate (%)
1948	27.0
1966	24.1
1960	20.8
1965	17.8
1970	17.0
1975	13.7
1980	12.5
1982	11.9

SOURCE: Bureau of Labor Statistics.

65 or over who still work has fallen sharply and consistently since 1948. In 1948, 27 percent of all people over age 65 were still working. By 1982 only 12 percent still worked. This is all the more remarkable when one considers the increase in life expectancy and health over this period. Thus it would seem that people prefer to take their increased leisure all at once, so to speak, rather than a little bit at a time through reduced weekly hours. To the extent that increased leisure is desirable or necessary to offset rising productivity in future years, therefore, there is no reason why it must come in the form of a shorter workweek. People may simply continue the trend toward earlier retirement instead. Either way the effect on lifetime hours worked would be the same.

Another question is whether mechanization and automation are adversely skewing the income distribution, as Lester Thurow and others have argued. Table 4 shows the shares of income for various income classes since 1947. The data show no trend toward greater income inequality, despite enormous structural changes in the economy over this period. In 1947 the share of income going to the top 5 percent was 17.5 percent of the total. In 1982 it was 16 percent. In 1947 the share of income going to the middle three-fifths was 52 percent; in 1982 it was 52.6 percent. Robert Samuelson (1983, p. 2673) concludes: "[T]here is no indication that 'high-technology' or 'service' jobs are splintering the middle class."

Conclusion

Historical and theoretical evidence argue against the idea that technological innovation will create permanent unemployment. Those

TABLE 4
SHARES OF INCOME FOR SELECTED YEARS
(Percent Distribution of Aggregate Income)

Year	Lowest Fifth	Second Fifth	Middle Fifth	Fourth Fifth	Highest Fifth	Top 5 Percent
1947	5.0	11.9	17.0	23.1	43.0	17.5
1950	4.5	12.0	17.4	23.4	42.7	17.3
1960	4.8	12.2	17.8	24.0	41.3	15.9
1970	5.4	12.2	17.6	23.8	40.9	15.6
1980	5.1	11.6	17.5	24.3	42.7	16.0

SOURCE: U.S. Department of Commerce, Bureau of the Census.

who conclude otherwise are usually mechanically extrapolating from current trends, without considering the new jobs that may be created—jobs that the Bureau of Labor Statistics has not thought of yet. As historian Daniel Boorstin recently observed:

People said the telephone would replace the mails, the radio would replace the telegraph, the TV would replace the radio. But what new technology does is discover unexpected roles for the old. Who would have thought people would walk around wearing radios, or that radios would play the role they do in automobiles?⁹

Since the manner in which society will ultimately deal with technology is, by definition, unknown, it is rather foolhardy even to attempt to project the employment effects of technology. The ultimate impact of the computer may come in ways we cannot even imagine today.

It is interesting that the only major effort to project the impact of automation on employment, while considering interrelationships among industries and technologies, was done by Professor Leontief using an input-output model. This model is of interest specifically because it showed that once all the interrelationships were worked through, technological unemployment was not predicted to be a significant problem in the year 2000 (Leontief and Duchin 1983). This result, however, seems to run counter to Professor Leontief's earlier statements (Leontief 1982). Perhaps it only proves that the deeper one delves below the superficial notion that automation automatically creates unemployment, the more likely one is to conclude that it does not.

⁹Quoted in Krucoff (1984).

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“IS INDUSTRIAL INNOVATION DESTROYING JOBS?”: A COMMENT

Leland B. Yeager

Worries that technological progress threatens chronic unemployment go back several centuries but keep popping up in superficially modernized versions. The relevant theories and evidence need reviewing from time to time. Mr. Bartlett (1984) deserves congratulations on his extensive and judicious review. Once again Luddite worries have been answered.

A discussant is expected to raise some quibbles. Let us put them behind us at the start. I am skeptical about some of the evidence Bartlett provides. Table 1, for example, showing employee compensation rising as a share of national income between 1930 and 1983, proves less than may appear at first glance; for employees, as distinguished from farmers and other self-employed persons, were composing a growing share of the total labor force. The loosely scattered points for particular years in Figure 1 again do not prove much. Bartlett's general argument does not depend on the questionable tables and charts, however. They serve as little more than decoration anyway.

As Bartlett says, technology is a micro matter, affecting the industrial pattern of employment. Total employment and total unemployment are largely macroeconomic phenomena, depending on macroeconomic policy and on how swiftly markets and wage- and price-setting processes can cope with macroeconomic disturbances.

Suppose technological advance raises productivity in a particular line of production. If demand for its products is sufficiently price-sensitive, employment even in that particular line may rise. If the demand elasticity is not that high, the increased real output in the technologically advancing sector still constitutes additional real power to demand the outputs of other sectors.

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Say's Law, as interpreted by W. H. Hutt in particular, is relevant here. Bartlett makes pretty much the same point. Fundamentally, in an advanced economy, people specialize in producing particular goods and services to exchange them away for the specialized outputs of other people. Any particular output thus constitutes demand for other (noncompeting) outputs. Technologically improved capacity to produce some things constitutes increased capacity to demand other things and so to demand the inputs for making them. Since supply constitutes demand in that sense, there can be no fundamental problems of oversupply on the whole in relation to demand.

Any apparent problem of that sort traces to impediments to exchanging goods and services for each other, impediments that discourage employing labor and other factors to produce goods destined for exchange. Exchanges and production and employment may be thwarted—markets may fail to clear—because of wrong prices. Wrong relative prices may conceivably be the difficulty. Realistically, though, the more important difficulty—to judge from the abundant evidence supporting the monetarist theory of business fluctuations—is a wrong overall wage and price level in relation to the nominal quantity of money. For various compelling reasons, price setters and wage negotiators can hardly be expected to cope swiftly with monetary disturbances. Attention should focus, therefore, on money and monetary policy. One can hardly make sensible recommendations about employment and unemployment without understanding the macroeconomics involved, that is, the monetary theory. I suppose Bartlett and I agree on this familiar but crucial point.

We may make one concession to those who focus on the micro effects of technological progress. A changing world means a changing pattern of employment, with persons temporarily unemployed while changing jobs. Some persons become unemployed more than temporarily, particularly those nearing retirement age. If technological progress should grind to a halt, however, and if, in addition, consumers' tastes should cease changing—if economic life should come to rotate indefinitely in the same old ruts—then workers and jobs would come to match each other in the fullest conceivable degree. Frictional unemployment would be at a minimum.

Would we really want this stagnant state of affairs? Technological progress raises incomes and wealth and so incidentally raises people's individual or collective capacity to cope with unemployment between jobs.

An economy with improving opportunities for workers and consumers and investors and entrepreneurs is bound to be a world of change. One response to change is resistance—protectionism in the

broadest sense. It tends to concentrate the burdens of change on those sectors and persons that, perhaps for political reasons, are relatively least able to obtain protection. (Protection is, after all, a relative matter. All-around equal protection is a nonsensical concept.) A different response is characteristic of a free-market economy. Business firms and workers facing new competition or adverse shifts in consumers' tastes have the option of slowing the loss of customers and jobs by accepting reduced prices and wages while seeking more attractive opportunities for adjustment. In a free economy, workers, businessmen, and investors can sort themselves into more and less risky lines of endeavor according to their own diverse tastes for chances of gain balanced against risks of unemployment or loss. Entrepreneurs will discover ways of making mutually advantageous offers to displaced workers and owners of displaced productive assets. Safety nets will be provided by private and perhaps by governmental programs.

Bartlett has been dealing with complaints about one particular respect in which the real world is deemed unsatisfactory—unemployment attributable to technological progress. Almost unlimited anecdotal evidence can be found to support any particular complaint. It is easy to trot out evidence that job opportunities have been shrinking in connecting telephone calls or setting type or picking crops. It is easy to commit the fallacy of composition and imply that the particular shrinkages will add up to shrunken total employment.

With regard to employment and unemployment, as with regard to other problems of a changing world, it is routinely easy to maintain that somebody, meaning the government, should do something. The idea of an industrial policy gains strength from its vagueness. Everyone wants the right measures taken. Industries and jobs that are the wave of the future should be encouraged; declining industries and their workers should be helped to make adjustments. (Politicians do not, of course, talk of actually phasing out particular industries and jobs.) It is easy to overlook the fact that, in a world of scarcity, steering resources and demands toward particular occupations entails steering them away from others. It is easy to overlook the costs while emphasizing the benefits of proposed measures.

Overlooking costs is especially easy for participants in the political process. They may forget, for example, that government credit programs and even government credit guarantees divert credit into some uses *and away from others*. Is it possible, I wonder, that politicians and their audiences overlook the central fact of economics? Resources are scarce, and allocating some to particular lines of production means withholding them from others. Someone might object that this point

does not apply at times of depression and general unemployment. As Bartlett and I have argued, however, such conditions, in which the central fact of scarcity apparently fails to hold, are a phenomenon to be understood by macroeconomics and monetary theory.

Industrial policy appeals to a spurious consensus. (Insightful remarks occur in Hayek 1944, pp. 54–55, 61–71.) People want the right measures taken, of course; but different people have different ideas of what specific measures are the right ones. Special economic interests, politicians, and bureaucrats can see opportunities to shape industrial policy to their own particular advantage.

Talk of industrial policy “meets the politicians’ need to sound modern and intellectual but is sufficiently vague to avoid sharp analysis and criticism.” Ad hoc interventions to “assist” American industry to adjust to a changing world economy overwhelmingly take “the form of protecting existing industries rather than promoting adaptation to new ones. It is no accident that this has happened. That is the nature of politics and of the bureaucracy” (Stein 1984, p. 365).

Controlling a market economy through ideal interventions would require the controllers to have the same knowledge of wants, resources, technology, and all sorts of local and fleeting details that planners would need to run a centrally planned economy successfully. The whole vast literature on economic calculation under socialism is relevant here.

So are the contributions of the public-choice theorists to our understanding of the political system. Can anyone still seriously believe that the democratic process is capable of producing a coherent program of detailed interventions sensibly oriented toward national economic objectives? In governmental decision making, responsibility is fragmented, remote and long-run repercussions relatively neglected, and economic theory often scorned.

Consider the minimum-wage law and how it affects the opportunities of young people, particularly disadvantaged young people, to get a start on the economic ladder and so gain in experience, in self-respect, and in worth to employers. If the political system will not behave sensibly even on this relatively clear issue, what earthly reason is there for expecting it to behave sensibly in exercising the increased power over the pattern of economic activity and the level and pattern of employment that the devotees of industrial policy want to give to it?

Shortly before the start of our conference, the directors told me that Professor Leontief would not attend after all and that I should try to fill the gap by rambling on for several extra minutes. In the absence of the case for an activist industrial policy that Professor

Leontief would probably have provided, we must turn our attention to what Congressman LaFalce said in his opening remarks.

LaFalce gave us a prime example of political argumentation. His delivery—his professional eloquence—was effective, and the substance of his message was *plausible*. He warned us of a false dichotomy—central planning or the market. (Professor Etzioni, in his remarks, also warned against polarization of the issue.)

Shouldn't we be *concerned*, LaFalce asked, with lagging productivity, with the problems of particular industries, with impending growth of Japanese shares in American markets, and even with the thousands of lobbyists in Washington seeking specific bits of industrial policy? Who is to examine the various policies and proposals? Who will undertake coordination? Don't we need a forum for discussion? Shouldn't the U.S. government impose conditions in return for its assistance to particular industries, as the International Monetary Fund does in aiding countries?

LaFalce apparently thinks that lack of enthusiasm for proposed legislation betrays lack of concern about the targeted problems. He prefers a positive stance. This view is understandable. Politicians do their job, and gain attention, by perceiving problems and offering solutions.

The unsatisfactory character of industrial policy so far—LaFalce mentioned the existing hodgepodge of government banks for various purposes—itself serves as an argument for pursuing rationalization and coordination through new committees and commissions. Pointing to the sorry record so far draws from the activists the reply: "Precisely! We're going to change all that" (if I may paraphrase Molière). Nothing succeeds like failure.

In certain circles the need for industrial policy is taken as axiomatic, like—as P. T. Bauer has observed—the need for central planning in underdeveloped countries. "Indeed, once a case is treated as axiomatic empirical evidence becomes irrelevant. Whatever the actual course of events, it can always be adduced in support of a policy which is axiomatically deemed desirable: progress as evidence of its success and lack of progress as evidence of the need for its reinforcement" (Bauer 1972, p. 73).

Professor Etzioni published a psychological article in 1972 on people's propensity to look to Washington for solutions to all sorts of problems. Etzioni noted the empty, symbolic character of many ostensible solutions. Speeches are made, conferences held, commissions appointed, bills passed, agencies established, funds appropriated, and programs launched, often doing little of substance to treat

the problems involved, some of which were mere pseudoproblems in the first place. Yet activist politicians get credit for being *concerned*.

A good understanding of economics must be something of a handicap for a politician. It inhibits either his promise-making or (unless he is a good actor) his projection of sincerity, and neither inhibition helps him play the political game.

I further conjecture that the members of the councils and commissions that Congressman LaFalce wants to establish will tend to be persons amenable to rhetoric like his. We should take note of what sort of argumentation over economic issues tends to flourish in the public and political arena. TV viewers and newspaper readers have short attention spans, to judge from how the media strive to grab their attention by oversimplifying and overdramatizing issues and linking them with disputes between colorful personalities. Now, how many more of the decisions in our economy do we really want to subject to this sort of argumentation?

In conclusion, I'd like to try to relieve the audience and myself of some worries. Let's not worry about accusations of falsely polarizing the issue we have been discussing into one of government planning or the market. Let's not be intimidated by the argument that we always have had and necessarily must have some sort of industrial policy or the other and that the only live question is *what sort*. We are expected to accept the rhetoric about framing policy consciously and in a coordinated way rather than haphazardly and piecemeal.

Yet such rhetoric does not justify an activist industrial policy, a policy of displacing market processes and giving more and more influence to the political process and to politicians, lobbyists, and self-styled experts. After all, an alternative remains, as Professor Rabushka and Mr. Albertine have reminded us. It is the alternative of stripping away the negative, the counterproductive, the fragmented and illogical industrial policy that we have experienced so far.

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