TECHNOLOGY, EMPLOYMENT, AND THE SUCCESSION OF GENERATIONS*

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Aging, Labor Force, Unemployment, Technology

A person trained in some skill expects to live out his or her working life in the exercise of that skill, becoming more and more experienced with age. Even in the United States where, ideally, no one is ever too old to undertake something new, the farmer, or press compositor, or tool-and-die maker have remained in those occupations over careers spanning forty or more years.

In most past times technical change could be taken in stride; the artisan could easily keep up with the modifications of his craft occurring during his lifetime, and only when he retired would substantial change be made as his youthful successor came on the job. A farm might be sold and mechanized when the aging operator retired. In many industries there was enough change that some employees had to move to other jobs within the firm, or to other firms, but few lost their

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occupations.

When the interval between drastic changes of work methods was 40 years or longer the individual worker had no need to adapt; when such changes take place at intervals of 20 years, the worker is forced to start a new career in mature life. It has been proven again and again that technological unemployment is a mirage. But technical change does impose the requirement of adaptability on the individual and on the economy.

The disharmony that results when the pace of technical advance comes greatly to exceed the pace of turnover of the generations is accentuated by the rise and fall in the birth rate. This provides the demographic setting of the problem that we face between now and the end of the century: the 50 percent increase in the number of people about 40 years of age, a majority of them in white-collar occupations; the impending revolution in office work that will render many of these people superfluous in their present jobs. The cohort of which we speak now suffers 20 percent unemployment, and those presently looking for jobs will be joined by many who now have attained a degree of skill and advancement.

Deaths, Births, and Resulting Age Distribution

People live longer than they used to. The increase in expectation of life was 3 years over the one decade of the 1970s and now stands at nearly 75 years (p. 71*). As recently as 1940 the expectation was less than 65 years. This extension of life

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*Page references are to the 1982-3 edition of the Statistical Abstract of the United States.

by 10 years (greater for women and blacks) makes the population in some degree older, but its effect, especially on the ages of the

the labor force, is relatively small.

The chief cause of an aging labor force is not mortality improvement, but the fall in the birth rate. In the late 1950s the rate of childbearing was such that if it had continued couples would have averaged some 3.7 children each; now the rate is down to an average of 1.8 children, just about half (p. 60). To replace itself a population requires an average of at least 2.2 children, so at present birth rates only migration would keep the national population from diminishing. Fluctuations in absolute number of births (which are what count for our problem) are spectacular (FIG. 1).

A part of the long-term reason is women seeking their own independent careers. Divorce and the threat of divorce are associated with reluctance to have children. Before we can see a rise in the birth rate we will also have to foresee a retreat from women's liberation, the family strengthened and divorce become rare, and women once more subsiding into uncomplaining domesticity. I am not one to make such a forecast. The most recent statistics (FIG. 2) show little sign of a rise in the birth rate. Instead of bearing the future workers women become workers themselves.

Labor Force at the Entering and Middle Ages

Aside from the fall in the birth rate being a problem in itself--nothing less than that the native population will

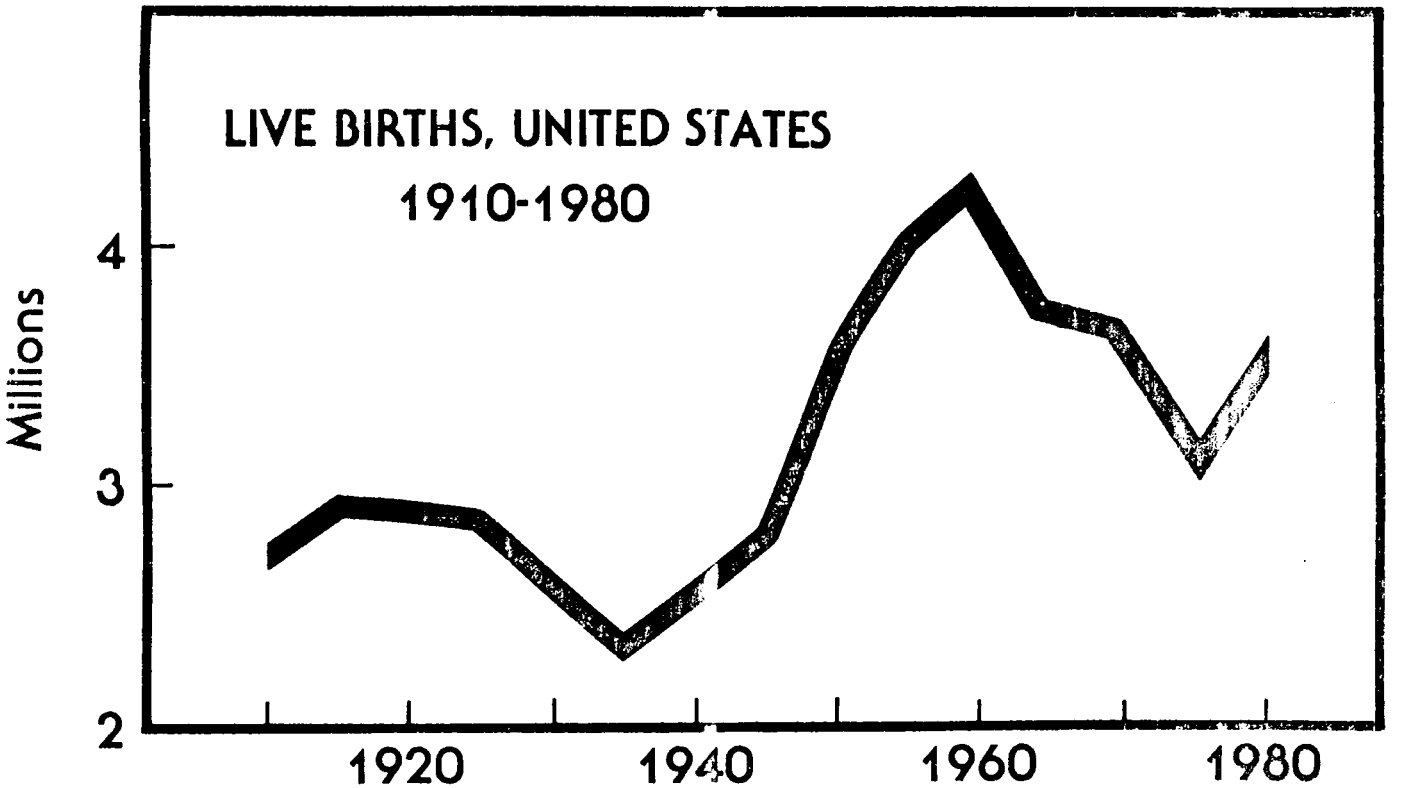

FIG. 1 LIVE BIRTHS, UNITED STATES 1910-1980

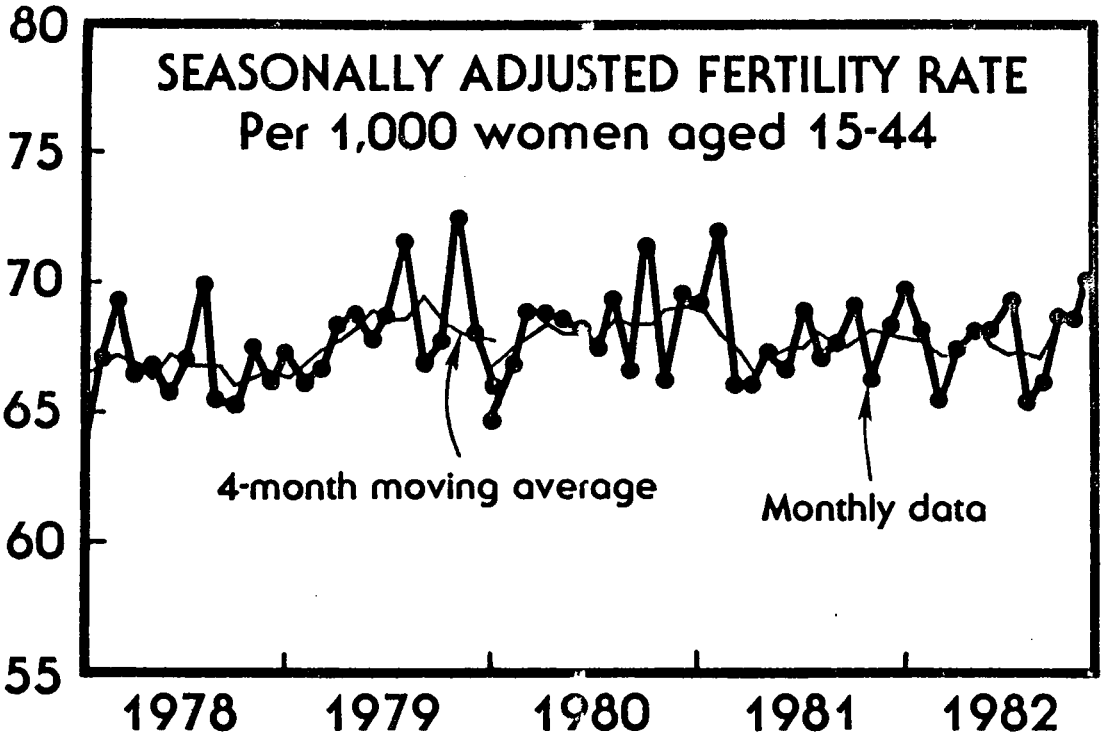

FIG. 2 SEASONALLY ADJUSTED FERTILITY RATE
PER 1000 WOMEN AGED 15-44

ultimately decline because couples refuse to have children--this low level of births leads to other problems of a more immediate nature. Twenty years after the birth rate turns down the number entering the labor force diminishes. By 1990 there will be 20 percent fewer annual entrants into the labor force than there were in 1980.

TABLE 1 shows our own projection of the U.S. population to the year 2020. Its total agrees with the U.S. Bureau of the Census (1982) medium series, but the ages are somewhat different. The USBC assumed 450,000 net immigrants, against my 700,000; on the other hand it supposed fertility would rise, which TABLE 1 does not. TABLE 2 gives the increase from 1980 to 1985, from 1985 to 1990, etc., age by age, and the baby boom stands out clearly as it advances down the age and time plane.

To see the effects of age distribution, think of the people now about 50, born in the 1930s when the number of births was very small (FIG. 3 and its stylized version, FIG. 4). This generation is blessed above all others in recent history. When it came to college age in the 1950s it found plenty of places in colleges and universities. When it graduated, again because its number was small, it had no trouble finding jobs.

After a few years on the job the fortunate people born in the the 1930s were followed by the large cohorts born in the late 1940s and 1950s, who needed supervisors, teachers, and administrators, so the small cohort of the 1930s were promoted to those positions. And even that does not exhaust their good

TABLE 1. PROJECTION OF UNITED STATES POPULATION FROM 1980 CENSUS TO THE YEAR 2020 WITH MORTALITY AND FERTILITY OF LATE 1970S; NET IMMIGRATION OF 700,000 PER YEAR
THOUSANDS OF PERSONS

	1980	1985	1990	1995	2000	2005	2010	2015	2020
0	16,344	18,308	18,545	17,890	17,185	17,070	17,406	17,652	17,549
5	16,697	16,589	18,546	18,782	18,129	17,426	17,312	17,647	17,892
10	18,241	16,994	16,886	18,840	19,076	18,424	17,722	17,608	17,943
15	21,162	18,578	17,334	17,226	19,176	19,411	18,761	18,060	17,946
20	21,313	21,545	18,969	17,729	17,621	19,565	19,799	19,151	18,453
25	19,518	21,629	21,860	19,294	18,059	17,951	19,887	20,121	19,476
30	17,558	19,715	21,815	22,044	19,492	18,263	18,157	20,082	20,315
35	13,963	17,673	19,813	21,897	22,124	19,592	18,372	18,267	20,178
40	11,668	14,030	17,697	19,813	21,873	22,098	19,595	18,389	18,284
45	11,088	11,620	13,942	17,547	19,627	21,652	21,874	19,412	18,227
50	11,709	10,901	11,420	13,681	17,194	19,220	21,193	21,408	19,011
55	11,614	11,342	10,565	11,063	13,240	16,619	18,569	20,467	20,675
60	10,086	11,042	10,785	10,051	10,522	12,577	15,768	17,610	19,402
65	8,578	9,245	10,119	9,883	9,213	9,643	11,522	14,439	16,122
70	7,000	7,483	8,062	8,822	8,617	8,034	8,409	10,042	12,578
75	4,500	5,629	6,015	6,479	7,088	6,924	6,457	6,757	8,064
80	3,500	3,112	3,889	4,155	4,474	4,893	4,780	4,459	4,665
85	1,967	2,700	2,401	2,998	3,203	3,448	3,770	3,683	3,436
TOT	226,506	238,132	248,661	258,196	265,912	272,812	279,353	285,255	290,216

SOURCE: AUTHOR'S CALCULATION

TABLE 2. PROJECTION OF UNITED STATES POPULATION FROM 1980 CENSUS TO THE YEAR 2020 WITH MORTALITY AND FERTILITY OF LATE 1970S; NET IMMIGRATION OF 700,000 PER YEAR. CHANGE FROM 5 YEARS EARLIER (THOUSANDS OF PERSONS)

	1980	1985	1990	1995	2000	2005	2010	2015	2020
0	16,344	1,964	237	-655	-705	-115	336	246	-103
5	16,697	-108	1,957	237	-653	-703	-114	335	245
10	18,241	-1,247	-108	1,954	236	-652	-702	-114	335
15	21,162	-2,584	-1,244	-108	1,950	236	-650	-700	-114
20	21,313	232	-2,576	-1,240	-108	1,944	235	-648	-698
25	19,518	2,111	231	-2,566	-1,235	-107	1,936	234	-646
30	17,558	2,157	2,100	230	-2,552	-1,229	-107	1,926	233
35	13,963	3,710	2,140	2,084	228	-2,533	-1,219	-106	1,911
40	11,668	2,362	3,668	2,116	2,060	225	-2,504	-1,205	-105
45	11,088	532	2,322	3,605	2,080	2,025	221	-2,461	-1,185
50	11,709	-808	518	2,262	3,512	2,026	1,973	216	-2,398
55	11,614	-272	-777	499	2,176	3,379	1,950	1,898	208
60	10,086	956	-257	-734	471	2,055	3,191	1,841	1,792
65	8,578	667	874	-235	-671	431	1,878	2,917	1,683
70	7,000	483	580	760	-204	-583	374	1,633	2,536
75	4,500	1,129	386	464	608	-164	-467	300	1,307
80	3,500	-388	777	266	319	419	-113	-321	206
85	1,967	733	-299	597	204	245	322	-87	-247
TOT	226,506	238,132	248,661	258,196	265,912	272,812	279,353	285,255	290,216

SOURCE: AUTHOR'S CALCULATION

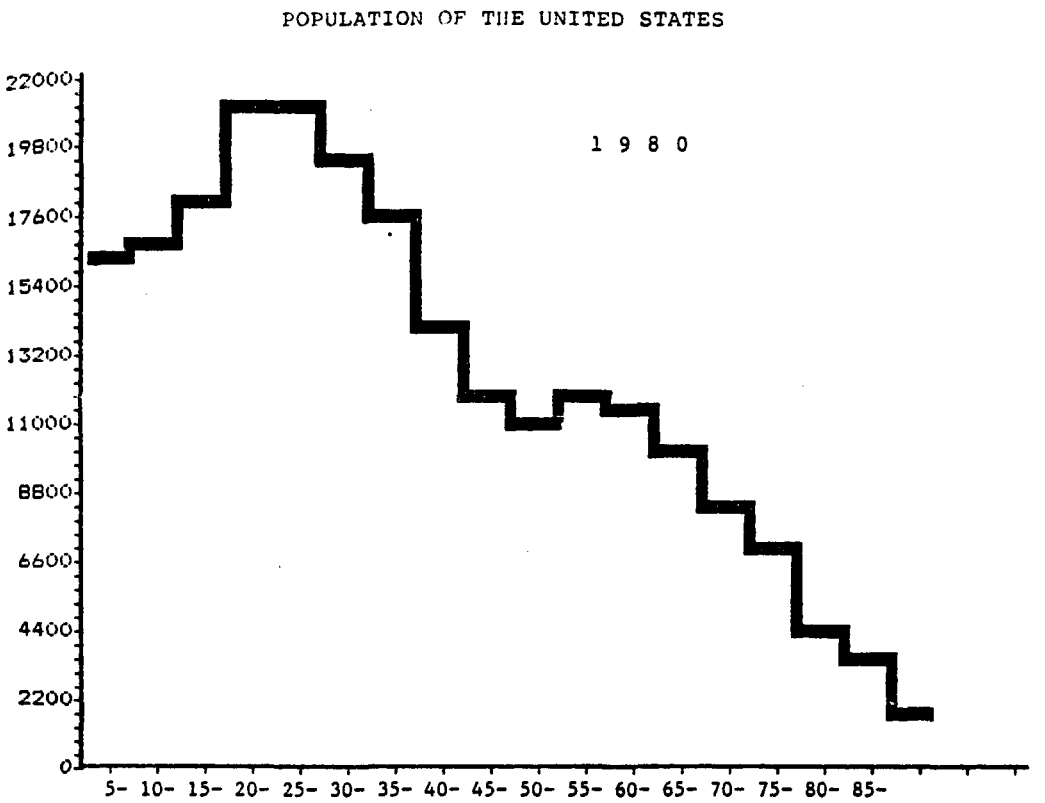

FIG. 3 AGE DISTRIBUTION OF U.S. POPULATION AT APRIL 1980 (THOUSANDS OF PERSONS)

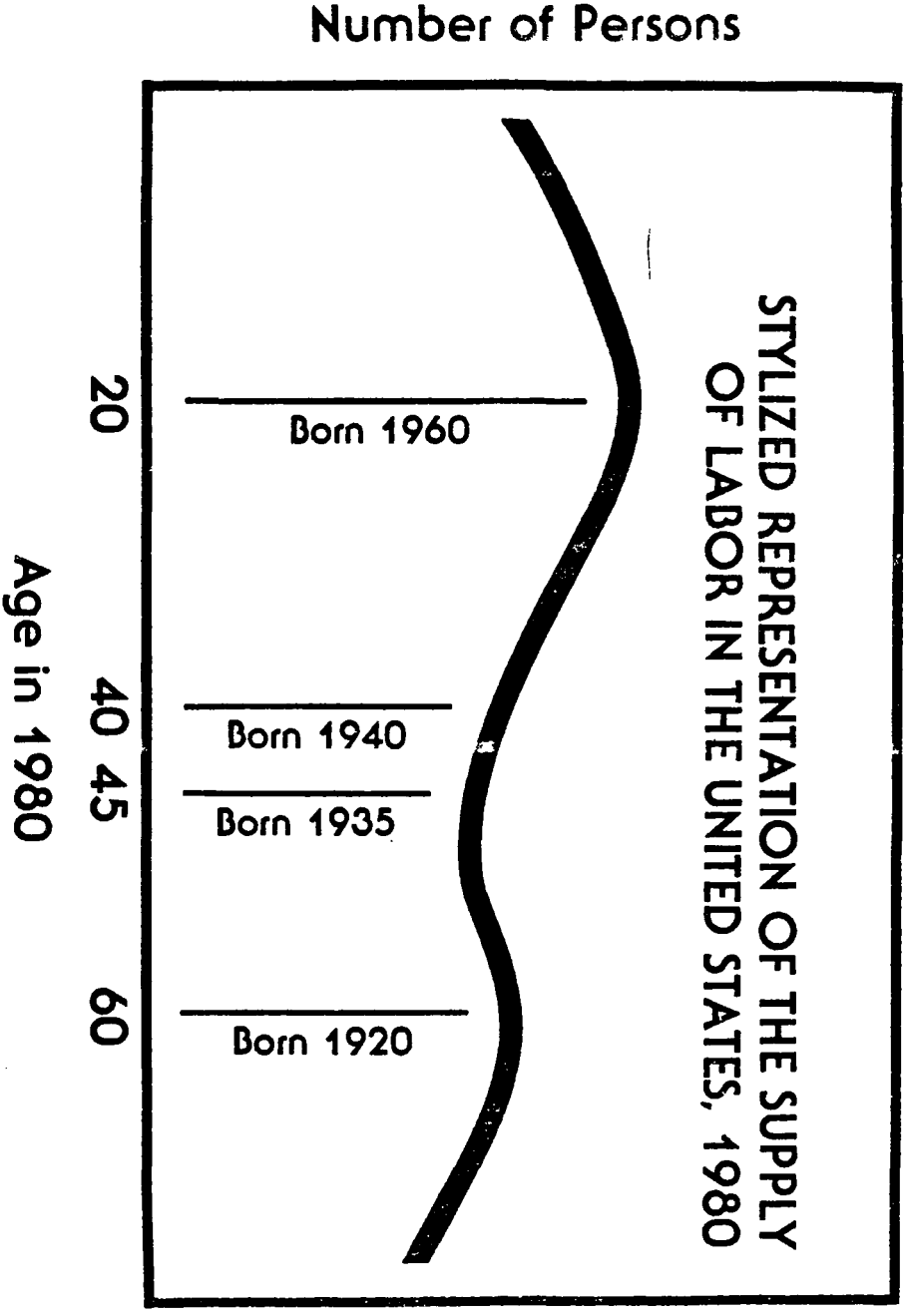

FIG. 4 STYLIZED REPRESENTATION OF THE SUPPLY OF LABOR IN THE UNITED STATES, 1980

fortune. During the next 10 years the numerous executives and others born in the 1920s and now in senior positions will retire, and many high-level jobs will have to be filled. In their youth the cohorts of the 1930s were pushed up by the numerous generation younger than they; now they are pulled upward into the jobs left vacant by the retirement of those older. And finally these lucky people will have good pensions; the relatively many persons of working ages will be able easily to pay the needed social security taxes for them. The demographic factor is superimposed on all individual characteristics of ability, luck, and influence.

All of this applies in reverse to those born in the 1950s and 1960s. At each of the four career stages mentioned above they will suffer the disadvantages of their large number in relation to earlier and later generations. Such advantages and disadvantages, arising out of the baby boom and baby bust, provide an explanation of birth fluctuations (Easterlin 1980).

The prospective shortage of people in their 20s and the crowding in the 30s and 40s is heavy with consequences for those involved and for the country. The conjunction of this peculiar age distribution with technical advance is the central point of our subject.

Three Technological Revolutions

Productivity gains do not occur simultaneously in all industries. The 1920s discovered interchangeable parts and so revolutionized the making of machinery; sewing machines, automobiles, typewriters, were the early products of this radical

change. The painstaking operation of cutting and fitting, filing and sanding, machining each item separately, in effect custom work from beginning to end, became obsolete, and with it the operatives skilled in cutting and fitting. Mass production of parts with specified tolerances and subsequent routine assembly greatly increased the output of many jobs and eliminated others. Skilled fitters and other artisans were replaced by assembly-line workers. Without interchangeable parts the automobile could never have become our dominant means of transportation.

Tractors and harvesters began to be used on a large scale in the nation's fields during World War I, and World War II gave the movement further impetus. By 1956 more than a million combines were at work on American farms (Rasmussen, p. 83), and these, along with expansion of the irrigated area, the use of fertilizers and higher yielding crop varieties, raised output per worker by 6 percent per year for a time. At the beginning of the century it took about 250 man-hours to raise 100 bushels of wheat. Now the same quantity takes 4 hours. The labor force in agriculture steadily declined; where at one time it was the majority of the nation's workers, it is now 3 percent. TABLE 5 shows how fast the farm labor force has fallen since 1950, at the same time as output increased, and the United States became the world's granary (TABLE 6). Employment expanded as people went from agriculture, a primary industry, to manufacturing, a secondary industry, and from manufacturing to tertiary activity, much of which is information processing.

What the 20s were for manufacturing and the 50s for agriculture, the 80s will be for office work. Some of us already have

experience with computers, and by 1990 the majority of those who work in offices, including men and women (not, as with typewriters, women only), experienced and beginners, old and young, will be doing most of their work in front of a keyboard and a video display tube. Such information handling as bank and insurance company records, reservations, billing and general accounting is rapidly being computerized, a movement in which actuaries have pioneered. The speed-up due to electronic equipment is greater than any speed-up that was possible in agriculture or industry. Even a home computer makes calculations thousands of times faster than a desk calculator, and a mainframe millions of times faster. One existing machine can retrieve the entire text of the Encyclopedia Britannica and send it on its way by laser beam in one minute's time.

The computer plays an increasingly important role in the design of machines. Computer-aided design not only replaces many draftsmen, but it does some kinds of work much better. One can afford to have many views of a proposed mechanical part, not just top, front and side views; the computer can seem to turn it over and show it gradually moving around in the display. If the part is to be fitted with another part the two can be shown on the video screen and the fit examined without the time-consuming machining of prototypes. When the designer, sitting at his video screen, is satisfied, he produces a tape to control the machine tool that makes the actual parts in quantity (Gunn, p. 121).

Computers play an increasing part also in the design and manufacture of computers themselves. The computer population is

TABLE 5 SELECTED INDEXES OF FARM INPUTS: 1950 TO 1981
(1967=100)

INPUT	1950	1955	1960	1965	1970	1975	1980
TOTAL	104	105	101	98	100	100	106
Farm labor	217	185	145	110	89	76	65
Farm real estate	105	105	100	99	101	96	96
Mechanical power and machinery	84	97	97	94	100	113	128
Agricultural chemicals	29	39	49	75	115	127	174
Feed, seed, and livestock purchases	63	72	84	93	104	101	119
Taxes and interest	82	88	94	100	100	101	96
Miscellaneous	87	94	105	109	109	104	117

SOURCE: Statistical Abstract 1982, p. 673.

TABLE 6 SELECTED FARM PRODUCTS--U.S. AND WORLD PRODUCTION AND EXPORTS: 1980

(METRIC TONS, EXCEPT COTTON)

ITEM	United States	World	U.S. as percent of world
PRODUCTION			
Wheat	64	439	14.6
Corn for grain (million)	169	405	41.7
Soybeans (million)	48.8	80.6	60.5
Rice, rough (million)	6.6	396	1.7
Tallow and greases (1000)	3,157	6,103	51.7
Tobacco, unmanuf. (1000)	811	5,259	15.4
Vegetable oils (million)	9.9	39.2	25.2
Cotton (1000 bales)	11,122	65,561	17.0
EXPORTS			
Wheat (million)	41	94	43.6
Corn (million)	59	78	75.6
Soybeans (million)	19.7	25.1	78.5
Rice, rough (million)	3.0	13.0	23.1
Tallow and greases (1000)	1,520	2,380	63.9
Tobacco, unmanuf. (1000)	272	1,307	20.8
Vegetable oils (million)	1.5	12.3	12.2
Cotton (1000 bales)	5,926	20,140	29.4

SOURCE: Statistical Abstract 1982, p. 678.

thus self-reproducing.

Office Change Will Be Greater than Agriculture or Manufacturing

The computer will be especially important because the American labor force has become so predominantly white-collar. When the 1920s brought the assembly line and interchangeable parts to American manufacturing, and the 1950s saw massive application of machinery, fertilizers, and irrigation in agriculture, the number of employees was far smaller than those that will be affected by the revolution in office methods of the 1980s and 1990s. Agriculture had 7 million workers in the 1940s, manufacturing has never had more than 22 million, while office workers in the 1980s number 45 million, nearly doubling since 1960 (TABLE 7, with increases shown in TABLE 8).

The computer-wordprocessor is eliminating such occupations as proofreading, hand veryifying of accounts, hand writing of checks, much typing, practically all hand typesetting of books and newspapers. I have a colleague whose book on mathematical sociology is about to appear, heavy with formulas, composed entirely by the author on his own terminal. Instead of sending the publisher a manuscript, he sent him a tape; the advantages include speed, lower cost, and the virtual elimination of printing errors. Since office workers are more than twice as numerous as manufacturing operatives, the effect of such computer application on employment is potentially twice as great as the effect of robots in manufacturing.

The revolution in office work is going to be more serious than its predecessors in manufacturing and agriculture for three

TABLE 7 EMPLOYED WORKERS BY SEX AND OCCUPATION
U.S. 1960-1980 (THOUSANDS OF PERSONS)

	1960	1965	1970	1975	1980
			TOTAL		
TOTAL	55,778	71,088	78,627	84,783	97,270
PROF.TECH.	7,469	8,872	11,140	12,748	15,613
MAN.ADMIN.	7,067	7,340	8,289	8,891	10,919
SALES	4,224	4,499	4,854	5,460	6,172
CLERICAL	9,762	11,141	13,714	15,128	18,105
BLUECOL.	24,057	26,247	27,791	27,962	30,800
SERVICE	8,023	8,936	9,712	11,657	12,958
FARM	5,176	4,053	3,126	2,936	2,704
			MALES		
TOTAL	43,904	46,340	48,960	51,230	55,988
PROF.TECH.	4,766	5,596	6,842	7,481	8,692
MAN.ADMIN.	5,968	6,230	6,968	7,162	8,067
SALES	2,544	2,641	2,763	3,137	3,377
CLERICAL	3,145	3,279	3,481	3,355	3,605
BLUECOL.	20,420	22,107	23,020	23,220	25,110
SERVICE	2,844	3,194	3,285	4,400	4,919
FARM	4,219	3,295	2,601	2,476	2,218
			FEMALES		
TOTAL	21,874	24,748	29,667	33,553	41,282
PROF.TECH.	2,703	3,276	4,298	5,267	6,921
MAN.ADMIN.	1,099	1,110	1,321	1,729	2,852
SALES	1,680	1,858	2,091	2,323	2,795
CLERICAL	6,617	7,662	10,233	11,773	14,500
BLUECOL.	3,637	4,140	4,771	4,742	5,690
SERVICE	5,179	5,742	6,427	7,257	8,039
FARM	957	758	525	460	486

OFFICE WORKERS

	TOTAL	MALE	FEMALE
1960	24,298	13,879	10,419
1965	27,353	15,105	12,248
1970	33,143	17,291	15,852
1975	36,767	17,998	18,769
1980	44,637	20,364	24,273

SOURCE: Statistical Abstract 1981, p. 401.

TABLE 8 FIVE-YEAR INCREASES IN NUMBER OF EMPLOYED WORKERS BY SEX AND OCCUPATION, U.S. 1960-1980 (THOUSANDS)

	1960-1965	1965-1970	1970-1975	1975-1980
		TOTAL		
TOTAL	5,310	7,539	6,156	12,487
PROF.TECH.	1,403	2,268	1,608	2,865
MAN.ADMIN.	273	949	602	2,028
SALES	275	355	606	712
CLERICAL	1,379	2,573	1,414	2,977
BLUECOL.	2,190	1,544	171	2,838
SERVICE	913	776	1,945	1,301
FARM	-1,123	-927	-190	-232
		MALES		
TOTAL	2,436	2,620	2,270	4,758
PROF.TECH.	830	1,246	639	1,211
MAN.ADMIN.	262	738	194	905
SALES	97	122	374	240
CLERICAL	134	202	-126	250
BLUECOL.	1,687	913	200	1,890
SERVICE	350	91	1,115	519
FARM	-924	-694	-125	-258
		FEMALES		
TOTAL	2,874	4,919	3,886	7,729
PROF.TECH.	573	1,022	969	1,654
MAN.ADMIN.	11	211	408	1,123
SALES	178	233	232	472
CLERICAL	1,245	2,371	1,540	2,727
BLUECOL.	503	631	-29	948
SERVICE	563	685	830	782
FARM	-199	-233	-65	26

INCREASE IN NUMBER OF OFFICE WORKERS*

	TOTAL	MALE	FEMALE
1960-1965	3,055	1,226	1,829
1965-1970	5,790	2,186	3,604
1970-1975	3,624	707	2,917
1975-1980	7,870	2,366	5,504

*White collar, but excluding sales personnel.

SOURCE: Statistical Abstract 1981, p. 401.

reasons:

(1) The potential gain in efficiency through automation is much greater: Henry Ford's methods could increase productivity in a ratio of 5 or 10 to one; with a computer at least some employees can increase in a much higher ratio.

(2) The fraction of the labor force is greater; we have long since passed the point where half of our labor force is white collar; agriculture in the 1950s and manufacturing in the 1920s involved a smaller fraction of the labor force and very much smaller absolute numbers.

(3) There is a heavy concentration of people at the middle working ages most affected--the baby boom generation. FIG. 5 shows their spectacular rise. Too young to retire, will they be too old to learn new trades? The large cohort of the baby boom is subject to heavy youth unemployment now; many of those now employed will lose their occupations in the next decade.

Machines Displace People?

Any laborsaving device looks as though it renders someone's labor superfluous. If a man or woman is replaced by a machine and nothing else happens, the total employment of the economy is reduced by one. Yet to suppose that all else remains the same is nonsensical. Any automation forces a series of other changes.

The new machine would not be introduced unless it was to someone's advantage. It costs less than the wages of the worker displaced by it, and the difference makes someone better off.

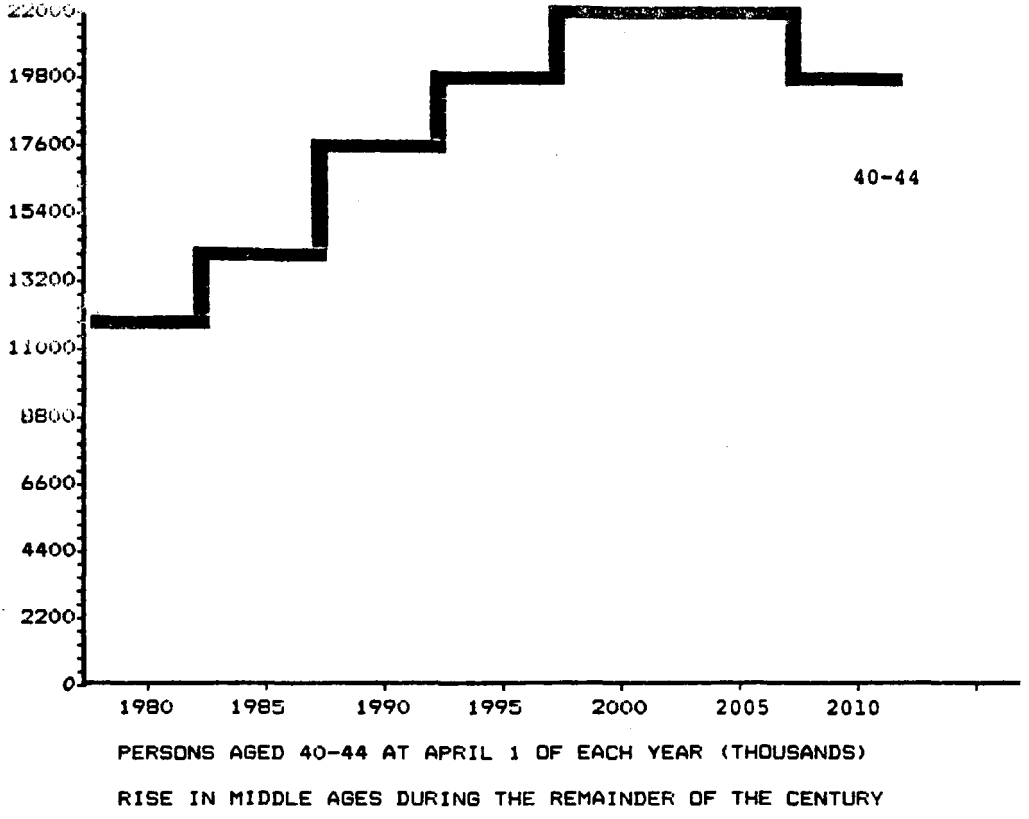

FIG. 5 FUTURE POPULATION OF THE UNITED STATES PROJECTED FROM THE 1980 CENSUS; BIRTH AND DEATH RATES OF LATE 1970s

The difference may go as profit to the owners of the enterprise; it may go as higher wages to the employees who remain; it may go to the customers as a reduction in the price of the product. Most likely all three groups will share the benefit. That means they have more money to spend on something else. They may buy consumption goods, or they may invest the benefit. Either way it is capable of giving employment, of hiring the person initially displaced by the machine (Sauvy 1980).

From Adam Smith onward economists have agreed on one thing: that the displacement of people by machines is an appearance only; the reality is that the displaced person has ample opportunity to find new employment just by virtue of the income that the machine generates. Those countries with the most laborsaving machinery also have the least unemployment. Unemployment is worst in the poorest countries; as nations develop, i.e., as they increase their stock of capital, including laborsaving devices, unemployment diminishes.

Despite such evidence, the advent of electronic automation causes apprehension. Those who were ejected from agriculture could go into manufacturing; those expelled from manufacturing went into office work; where will those released from office work go? The answer is not obvious, especially as the office workers are now far more numerous than farm or factory workers ever were, so that the scale of the reabsorption problem is incomparably larger. And even though technology as such does not create unemployment, it does reshuffle the work force, and in the resulting exchanges of jobs less adaptable individuals can be left out. Perhaps they cannot acquire the skills to make the new

products demanded by those who benefited from automation; perhaps the enterprise to organize and hire them is lacking.

Is Reducing Hours of Work a Solution?

Historical Statistics shows hours of work in manufacturing as 51.0 per week in 1909, 44.2 in 1929, and 37.7 in 1939. Since the war they have fallen very little. All of our institutions militate against cutting hours.

To explain to both employers and employees that the national unemployment ratio of 10 per cent would be wiped out today if everyone would work four hours less per week, would avail nothing. The employee thinks of the job as his property, the most precious piece of property he owns, and the employer has every interest in encouraging this attitude. Unemployment is something both read about in the press, but it has little to do with their business.

Youth unemployment is indeed a problem today, but that is changing. Persons aged 16-19 were 25.5 percent of the total unemployed in 1978, but they had dropped to 17.7 percent by June of 1982 (p. 392). In 1978 they were the peak birth cohorts of 1961, in 1982 the smaller cohorts of 1963-66. One can forecast that the proportion of the unemployed aged 16-19 will continue to diminish as the fraction of the population in those ages diminishes.

It is not youth unemployment that should be our concern, but unemployment of the cohort that is now youthful, a very different matter. As they age, those without jobs become even less capable of holding a job. The initial unemployment of many puts them at

a severe disadvantage. And many of those with jobs, who have acquired skill and advancement, will find themselves in their 40s undercut by the computer revolution and required to start over again in a new line of work. These are two facets of the problem confronting the baby boom generation.

An Underclass?

Black unemployment rates have been nearly twice as high as white throughout the 1970s. By 1982 17 percent of all black workers were unemployed. Among black teenagers the rate had risen by mid-1982 to 47 percent, against 19 percent for white teenagers (p. 392). Discrimination could well be less important in this than the simple mismatch of qualifications and job requirements. Blue-collar workers have always had about twice the rate of unemployment of white-collar; by 1982 the rate was 19.3 percent for blue-collar and only 5.90 percent for white-collar (p. 392).

Even with renewed prosperity a high level of unemployment could continue among certain parts of the population that have an initial disadvantage of poor schooling. Experience is an essential ingredient of competence, and if people do not qualify for the starting jobs that would give them experience they are handicapped for life. Would that alone cause the labor force to divide into two groups, one competent, the other unqualified and unemployed? The biggest harm that could come out of present tendencies is the emergence of a class that is unemployable. Retraining and remotivating the individuals in question and stimulating enterprise and innovation are the solution; that is

easier to do in a homogeneous society like Japan than in one as heterogeneous as the United States.

The American capacity to make jobs is great, and one aspect is the expansion of our tertiary employment. TABLE 9 shows that we lead the world, both in the number of white-collar workers and also in their ratio to production workers. Our proportion of teachers, physicians, and other professional occupations is unsurpassed.

Job Creation Has Greatly Exceeded Unemployment

This ability of the American economy to create tertiary jobs was seen even during the 1970s--a decade of recession and unemployment. Employment in the United States rose from 79 million in 1970 to 99 million in 1980. During those same ten years unemployment did go up from 4.1 million to 7.6 million, but the rise of 3 1/2 million is small compared with the 20 million additional persons working. Only in the 1980s has employment settled down to about 100 million and unemployment risen to 10 million, but these are only three years to set against the record of the preceding 30. If we take the period since OPEC raised oil prices, the number of employed rose from 85.1 million in 1973 to 99.8 million in 1982, while the unemployed went up from 4.4 to 10.4 million. Even in this worst dozen years since the Great Depression jobs increased twice as much as the unemployed.

In the longer period since 1947, we find that jobs rose from 57 million to 100 million and the unemployed from 2 million to 10 million, or only one fifth as much. Think of the categories the economy was able to absorb: the World War II veterans returning

TABLE 9 SUM OF TECHNICAL, PROFESSIONAL, ADMINISTRATIVE AND CLERICAL WORKERS IN RELATION TO THE LABOR FORCE FOR 16 COUNTRIES (THOUSANDS OF PERSONS)

COUNTRY	TOTAL	TECH..CLER	CUM	PER CENT	RANK
US 1980	106,821	46,305	46,305	43.35	1
JAPAN 1980	57,076	17,647	63,952	30.92	2
GERM.W 1980	27,640	9,856	73,808	35.66	3
UK HYP	26,735	9,357	83,165	35.00	4
FRANCE HYP	23,244	9,298	92,463	40.00	5
ITALY HYP	21,313	7,460	99,922	35.00	6
BRAZIL HYP	39,874	5,981	105,903	15.00	7
POLAND 1978	17,962	4,735	110,639	26.36	8
CANADA 1981	11,585	4,494	115,133	38.79	9
INDON 1977	48,947	2,608	117,740	5.33	10
AUSTRAL 1980	6,651	2,337	120,078	35.14	11
SPAIN 1979	13,302	2,185	122,262	16.43	12
KOREA S 1980	14,454	1,996	124,258	13.81	13
NETHERL 1977	5,058	1,829	126,087	36.16	14
EGYPT 1979	10,024	1,785	127,873	17.81	15
SWEDEN 1980	4,318	1,727	129,600	40.00	16

from Europe and Asia, the subsequent massive entry of women into work, the baby boom, and legal and illegal immigration that in some years numbered more than one million. While other countries closed their doors to immigration as soon as recession struck, the United States continues to admit hundreds of thousands each year, and our forecast seems safe in assuming that the long-term net average will be 700,000. Furthermore, within the labor force great shifts took place from rural to urban jobs. Farm workers fell from 7.9 million in 1943 to 3.4 million in 1982. Many kinds of service declined--taxidrivers, domestic servants, deliverymen, barbers--these are no longer the kinds of jobs people want to perform.

No one can doubt that at a certain point the economy has to cease producing goods and move into tertiary activities. The United States is ahead of Europe and Japan in that, just as it was the leader in mass-production manufacturing and scientific agriculture. Notice (TABLE 10) how the U.S. share of world exports of manufactures declined from 1960 to 1980. No country can increase production of goods by 5 percent a year for long without turning out so many goods that one would not be able to move around among them. Long before that production puts intolerable strains on the environment, materials, and energy supplies. The American economy has conformed to this circumstance ahead of all others. The number of manufacturing operatives has been virtually constant for decades; nearly all of the enormous increase in employment has been tertiary.

TABLE 10 U.S. SHARE OF WORLD EXPORTS OF MANUFACTURES: 1960-1981

YEAR	U.S. MANUFACTURES EXPORTS TOTAL ($billion)	PERCENT OF WORLD EXPORTS
1960	12.7	25.3
1965	17.3	22.5
1970	29.4	21.1
1975	71.0	19.1
1980	144.0	18.3
1981	154.3	20.7

SOURCE: Statistical Abstract 1982, p. 781.

The Effect of Aging on Production and Profit

The smaller cohort entering working age has been welcomed and congratulated. It will have no trouble finding jobs, and in fact will be sought after and correspondingly well paid, and its prosperity may spread to other parts of the labor force. Besides, with about 20 percent of young people now unemployed, how can we find it anything but good that the entering job seekers will be fewer? Even if the recession continues, which we hope it will not do, the 20 percent unemployment among youth will be more than offset by a drop of 25 percent in their number over the next ten years. Even if every one of them proves employable, there will still be a shortage of young people. The average age of the labor force will rise.

Good again, some will say. An older labor force is a more experienced and more skilled labor force. Older people are more productive; the proof is that they are paid better. How can we but benefit from an older, more experienced, more skilled and better paid labor force?

I have already referred to the inapplicability of much hard-won skill and experience in an era of rapid technical change, but another drawback of aging presents itself: the conventions of salary setting. Quite aside from inflation, workers expect a salary increase each year. Especially if they stay a long time with one firm, they must be rewarded for their loyalty and encouraged to do further good work by steadily increasing pay. Many of the most prestigious employers start their future executives at salaries lower than are offered elsewhere; the applicant to IBM thinks of the lifetime salary in prospect,

compares that with what he would get from some firm that is willing to start him off higher, and chooses IBM. This is truer for while-collar than for blue-collar employment; it is truer in Japan than it is in the United States. Let us think, then, of the gradient of salary with age, varying among countries and among firms within countries.

The gradient of productivity with age is harder to measure; we have no good ways of even describing productivity in many kinds of white-collar work, let alone measuring it, but the concept is clear enough: the productivity gradient is the difference that the person makes to output as compared with what output would be with a younger person. Beyond a certain age the gradient of productivity is flatter than the gradient of pay. Employers would often make gains by dismissing their older employees and replacing them with more productive and lower-paid juniors. A university might make some immediate gains in quality as well as financial savings by dismissing its senior faculty and replacing it with well chosen assistant professors; after all, senior faculty and new Ph.D's do the same work. But I do not propose this, and it will not happen, because long-term considerations of morale and loyalty would make such a policy disastrous.

Hence we can expect that for some time there will be a continuance for organizational reasons of the discrepancy between the profile of pay and that of productivity, and with these two curves in place the disadvantage of aging can be great. If the gradient of pay with age is 3 percent, and of productivity 1

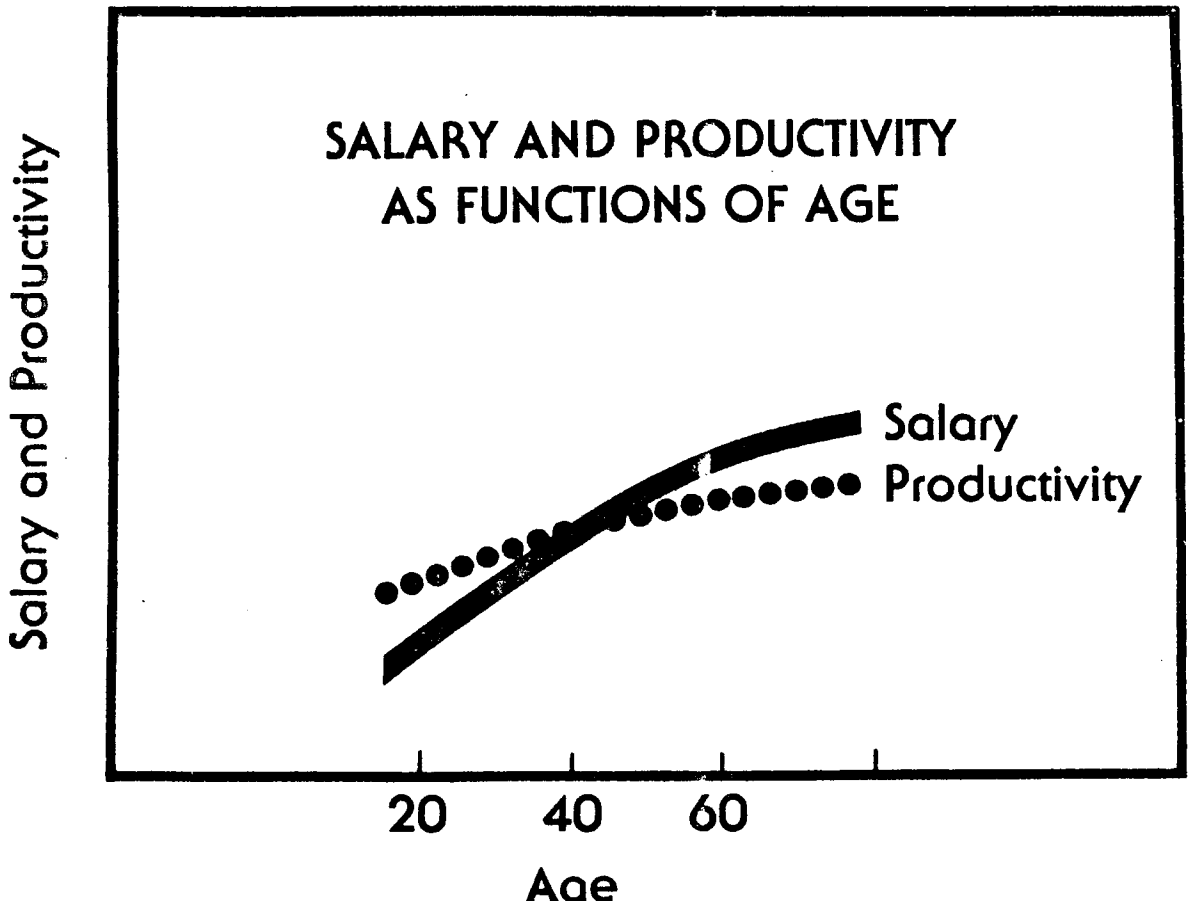

FIG. 6 SALARY AND PRODUCTIVITY AS FUNCTIONS OF AGE

cannot become computer programmers--the very efficiency of computers limits the number of individuals who will earn their living by making, repairing, operating or programming, who will be directly involved with either hardware or software. The activities that have expanded are in the fields of travel, entertainment, selling, local government. Such jobs will demand a certain level of culture and literacy, and perhaps this will encourage a return to liberal education, so neglected today. It could be that liberal arts will be the dominant vocational training of the 1990s.

The most effective retraining of workers is not enough. They cannot be useful without managers and enterprisers. The training of enterprisers is even more elusive than the training of workers, but we have to fine some way to produce and encourage them.

In any political system the claims of a failing enterprise are always stronger than the claims of a new industry that is only potentially in existence. Government yields to pressure from the workers who are in place and the managers who represent these workers. What corresponding pressure can new or half-formed industries exert? The activities of the future cannot lobby members of Congress; the potential for them is not even perceived except by persons of exceptional vision. Yet these are the ones that will give the more durable employment, help the balance of payments, provide long-term contributions to government revenues through taxes, increase productivity, increase wealth. We now have plenty of evidence that government bureaucrats and politicians, however great their competence in

some things, are not at their best when it comes to anticipating the future and educating the public for it.

The new situation will call for the retraining of people to keep up with new methods and equipment. A man or woman of 45, compositor or toolmaker rendered obsolete by the computer, will need two or three years to be reeducated, not in another equally narrow skill, but in some occupation consonant with the times. We may even be enlightened enough to allow people to draw two or three years of their old-age pension in advance in order to accomplish this occupational recycling. They would repay the actuarial equivalent in years of delay in retirement.

Conclusion

This paper has concentrated on how to employ the 20 or so million increase of the labor force around the age of 40 between now and the end of the century. We can take it that the average long-term growth will be greater than that of the present, but such growth alone will not solve the problem, as the unemployment of the boom times of 1972 and 1978 showed. The baby boom cohort has 20 percent unemployment now, when it is in its 20s. Are its members destined to be followed through their lives by the insecurity that such a rate implies? If they become less adaptable as they age, their unemployment can only increase.

The problem would be difficult enough even if technology were static, but that is hardly the situation. What hit industry in the 1920s, and agriculture in the 1950s, will hit office work in the 1980s. People could move from the primary to the secondary, from the secondary to the tertiary; where do those

displaced in the tertiary go? The problem is difficult in proportion as the number of individuals is large: some 45 million American workers out of the 100 million total are now in offices. The displacement threatens to be far larger than the numbers in agriculture or industry ever were.

The fate of the baby boom cohort is tied to a broader question: are jobs indefinitely expandable in the face of increased productivity? My answer is yes. If wants are infinite the economy can grow indefinitely--not in goods production, but in a combination of goods and services. If wants are finite, then as the point is reached where some of the population have no further wants they will consent to work fewer hours and so permit jobs for others; that condition is not yet in sight. This covers all possibilities: either the economy is expandable or else people buy leisure as unfilled wants contract.

That only makes for full employment if those who are ejected either by technical advance or by saturation of wants can insert themselves back into the currents of production and trade. My argument is that they can, but there are conditions: there must be enterprisers to employ them, and they must have the skills and adaptability to fit into the new work that is being created. And of course there must be the capital and the materials with which they can work. Of the several components needed for putting the unemployed people back into the circuits of commerce, the enterpriser seems to be the most critical.

The dilemma is a particularly sharp one for the United States, always a heterogeneous society, depending for its

progress on competition and adversary processes. If a part of the population comes to be identified as culturally distinct, labelled as unreliable and unadaptable, and so left out of the employment circuits, then that will make them so. The best training for work is work; deprive people of work for a period of time and they become incompetent. Our big danger is the creation of a permanent underclass.

To summarize the argument in one sentence: Technical advance is not in itself a menace to employment, but trouble lies ahead for the big generation that will be in their 40s between now and the end of the century, if they prove unadaptable to new kinds of work or if the enterprise needed for their employment is not forthcoming. Those older need not preoccupy us, first because they are fewer, second because they will retire soon in any case; those younger are also fewer; they are growing up in the computer age and will for the most part have chosen occupations that fit with the new technology.

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