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Why Has Productivity Growth Declined? Productivity and Public Investment

Alicia H. Munnell

The decline in United States productivity has been widely identified as one of the major economic problems facing the nation. This concern is understandable; productivity growth is the major determinant of the future standard of living. Economists have gone to great lengths to try to identify the reasons for the slowdown, and David Aschauer recently introduced the notion that the stock of public infrastructure, as well as the stock of private capital, may be a key to explaining changes in output from the private sector.

This study builds upon Aschauer's insight and explores whether changes in the amount of public capital, combined with the growth of private capital and labor, can explain most of the slowdown. The author concludes that the main causes of the productivity slowdown could be behind us, as long as public infrastructure receives badly needed attention. 3

How Natural Is the Natural Rate of Unemployment in Europe?

Geoffrey M. B. Tootell

European economic performance has been disappointing in the 1980s. High unemployment has been a dominant policy issue, but in order to react properly, government authorities had to determine the causes of this unemployment. If inadequate aggregate demand were the source, expansionary fiscal or monetary policy could help to solve the problem; on the other hand, if movements in labor supply were to blame, traditional macro policy would be ineffective. European officials clearly leaned toward the labor supply explanation, as aggregate demand policy remained conservative throughout the decade.

The predominant empirical literature in the mid-1980s seemed to prescribe this conservative approach. This article updates these studies. Using their methodology, the author shows that labor supply movements alone cannot explain the unemployment that occurred over most of the decade. An alternative approach suggests one possible answer, that the formation in 1979 of the European Monetary System unexpectedly tightened macroeconomic policy throughout Europe. 23

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The U.S. Professional Sector: 1950 to 1988

Steven A. Sass

The United States economy, over the course of the twentieth century, has taken on a highly professional cast. By 1988, professional, technical, and kindred workers made up 20 percent or more of the labor force in industries ranging from health care and education, to high tech manufacturing and business services, to government and entertainment. In terms of international competitiveness, income per worker, and technical advance, this group of professionalized industries forms perhaps the most successful sector of the U.S. economy.

This article provides an overview of the professionalization of the U.S. economy in the years since 1950. It looks at pace and timing of the professionalization process, paying special attention to recent changes, and examines its industrial source and demographic structure. 37

Taking Charge: Should New England Increase Its Reliance on User Charges?

Robert Tannenwald

New England relies less on user charges for its state and local revenues than any other region of the country. As a result, some policymakers maintain that increases in user charges would correct an "imbalance" in the region's revenue mix. However, the national mix of state and local revenues is not necessarily the best mix for the states of New England. The degree to which a state should rely on user charges depends on the priorities of its policymakers among competing principles of taxation, the conditions under which each principle favors user charges over taxes, and the extent to which these conditions exist within the state. Since each state has its own distinctive values and traits, the role of user charges in financing state and local government should vary across states.

This article explores the conditions under which user charges compare favorably to taxes according to the principles of efficiency, equity, and exportability. The author finds that, given conditions peculiar to New England, the region's low dependence on user charges makes sense in terms of all three principles. Moreover, in several instances where New England states do rely heavily on user charges to finance a particular public service, circumstances favor user charge financing. 56

Why Has Productivity Growth Declined? Productivity and Public Investment

Alicia H. Munnell

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The decline in United States productivity has been widely identified as one of the major economic problems facing the nation. This concern is understandable; productivity growth is the major determinant of the future standard of living. If the efficiency with which resources can be used rises at 2.5 percent per year, people can expect their real wages and their living standards to double every 28 years, or roughly once a generation. In contrast, productivity growth of 0.5 percent means that children can expect living standards only 15 percent higher than those of their parents. In this regard, the numbers look bad: labor productivity growth in the private nonfarm business sector declined from an average annual rate of 2.5 percent over 1948–69 to 2.0 over 1969–73, and to 0.5 percent from 1973 to 1979. The recent numbers are somewhat better in that labor productivity growth has averaged 1.2 percent annually since 1979, but they are still well below the heights of the post–World War II period.

Economists have written extensively on the decline in productivity growth and have gone to great lengths to try to identify the reasons for the slowdown. No one has discovered a "silver bullet," and almost all observers end up concluding that a variety of factors have contributed to the observed phenomenon. The usual suspects include the effects of the changing composition of the labor force due to the influx of teenagers and other less experienced workers; a slowing in the rate of growth of the capital-labor ratio as investment in equipment and structures failed to keep pace with the unprecedented increase in the employed labor force; a leveling-off in research and development expenditures; the diversion of investment funds to pollution abatement; the maturation of some industries, with little new technology; and changes in attitudes towards work.

In a particularly interesting article, David Aschauer (1989) recently identified a new potential culprit in the slowdown of productivity growth. Aschauer introduces the obvious, but heretofore neglected,

notion that the stock of public infrastructure as well as the stock of private capital may be a key to explaining changes in output from the private sector. His results, which show a strong relationship between output per unit of private capital and the stock of public capital, suggest that the decline in labor productivity and multifactor productivity in the 1970s may be attributable in very considerable part to the near cessation of investment in public infrastructure.

This study builds upon Aschauer's insight and explores whether changes in the amount of public capital, combined with the growth of private capital and labor, can explain most of the slowdown without appealing to a host of other factors. An additional motive, however, is to bring both the author and the reader up to date with what has been going on in the productivity area. For this reason, the article begins with a description of what is meant by productivity and an explanation of why productivity is important. The second section summarizes what has happened to various measures of productivity over the postwar period. The third section describes some of the most commonly cited reasons for the slowdown in productivity growth in the 1970s. The fourth section attempts to see whether the demographic adjustment to the labor input and the addition of public infrastructure as a capital input can explain the slowdown simply in terms of the fundamentals of the production function.

The final section speculates about the impact of future demographic and government spending developments on productivity during the 1990s. The conclusion is that the main causes of the productivity slowdown could possibly be behind us, as long as public infrastructure receives badly needed attention. Adequate public investment combined with the slow growth of the labor force should return us, if not to the spectacular post–World War II levels, then at least to twentieth century averages.

I. What Is Productivity and Why Does It Matter?

In the most general sense, productivity is a concept that measures the ratio of outputs to inputs; productivity increases if the same quantity of inputs—land, labor, and capital—produces more output. The simplest and most easily accessible productivity measure is labor productivity, which is the ratio of inflation-adjusted output to hours worked. The difficulty with this concept is that labor can increase output either by using more capital or by incorporating technical change; hence labor productivity does not permit the clear separation of the contribution to growth between increased quantities of factor inputs and the more efficient use of these inputs.

The measure that separates out the contribution to growth that results solely from improved technology or better management is multifactor productivity. The growth in this measure is calculated by subtracting from the growth in total output the direct contributions from increased amounts of capital and labor. Growth not attributed to factor inputs is then defined as multifactor productivity. Although multifactor productivity is a purer concept, it requires precise assumptions about a production function and how labor and capital are compensated, is difficult to calculate, and often is not available on an international basis. Given these problems and the fact that both productivity measures move together, labor productivity remains a useful concept.

A permanent decline in productivity growth would indeed be a source of serious concern.[1] Productivity growth is the major determinant of the increase in real wages and therefore living standards; hourly compensation adjusted for changes in purchasing power has risen at about the same rate as output per hour (chart 1). If output increases not because of productivity growth but only because more inputs are used in production, all the additional output is needed to pay the suppliers of the additional inputs at their old rates of compensation.

Productivity growth is the major determinant of the increase in real wages and therefore living standards.

Hence, in the absence of productivity growth, the only way that workers receive higher real wages is to work more hours. On the other hand, with productivity growth, the ratio of output to inputs rises and the factors of production find that they are compensated at higher real rates, as the prices for goods and services rise less rapidly than nominal wages and profits.

The increased affluence produced by productivity growth is valuable not only because it allows for

How Productivity Is Measured

Both concepts of productivity—labor productivity and multifactor productivity—can be demonstrated in terms of the traditional production function, an equation that relates the amount of outputs that can be achieved with given inputs. The most common formulation of the production function is as follows:

(1) $$Q(t) = MFP(t)*f[K(t),L(t)],$$

where: $Q(t)$ = real output
$MFP(t)$ = index of multifactor productivity or technological progress
$K(t)$ = real capital input
$L(t)$ = real labor input.

To express this relationship in terms of growth over time involves taking the differential with respect to time and rearranging the terms to yield:[2]

(2) $$\%\ Q\ \text{growth} = \%\ MFP\ \text{growth} + s_k\ \%\ K\ \text{growth} + s_l\ \%\ L\ \text{growth}.$$

The weights, s_k and s_l, are the output elasticities of factor inputs. In other words, the weight s_l indicates how much output would increase for a given change in labor input. If some further assumptions are made about factor markets and the nature of the production function, the weights can be defined more precisely. Specifically, if factor markets are assumed to be perfectly competitive, so that factors are paid their marginal product, and if the production function exhibits constant returns to scale, so that a 10 percent increase in capital and labor leads to a 10 percent increase in output, then the weights equal the relative share of total income paid to capital and labor, respectively.[3]

Equation (2) is the basic relationship for computing the growth in multifactor productivity. It shows the growth in output to be equal to a weighted average of capital and labor inputs plus the growth in multifactor productivity. Alternatively, rearranging the terms, the growth in multifactor productivity is equal to the growth rate of output less the growth of an index of inputs (equation (3)). (Remember that the difference between two growth rates is equivalent to the growth rate of the ratio of the two variables.) Hence, multifactor productivity is similar to labor productivity in that it is computed as the ratio of output to input. The difference is that in the case of multifactor productivity, the input is an index of two factors, capital and labor.

(3) $$\%\ MFP\ \text{growth} = \%\ Q\ \text{growth} - s_k\ \%\ K\ \text{growth} - s_l\ \%\ L\ \text{growth}.$$

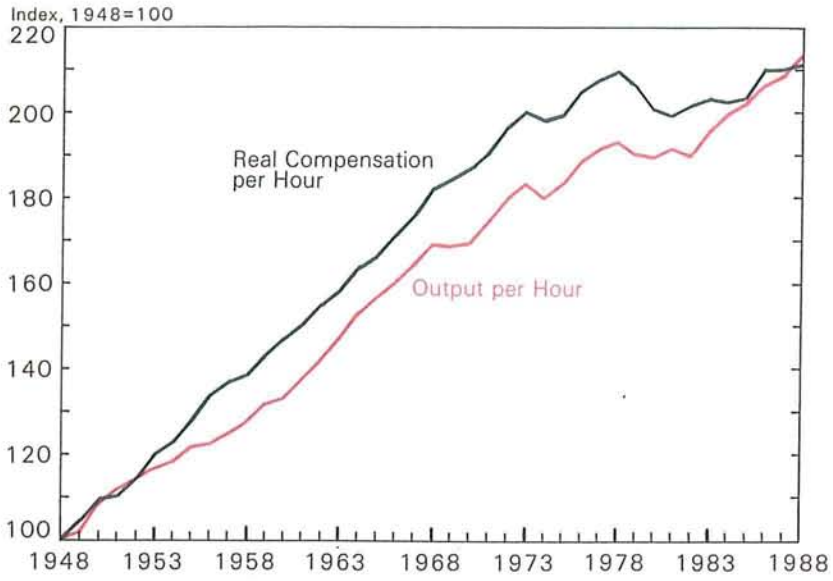
One final rearrangement of equation (2) reveals the relationship between multifactor productivity and the traditional measure of output per hour. Subtracting the growth rate of labor from both sides of the equation combined with some algebraic manipulation yields the following relationship:[4]

(4) $$\%\ Q\ \text{growth} - \%\ L\ \text{growth} = \%\ MFP\ \text{growth} + s_k(\%\ K\ \text{growth} - \%\ L\ \text{growth}).$$

This shows that the difference in the rate of growth of output and labor input, or, in other words, the growth of labor productivity, is equal to the sum of multifactor productivity growth plus the rate of change in the capital labor ratio multiplied by capital's share in total output. This latter component reflects the contribution to output growth resulting from the increased amount of capital per person. Hence, the two concepts—labor productivity and multifactor productivity—are closely related.

Chart 1

Output per Hour and Real Compensation per Hour in the Private Nonfarm Business Sector, 1948-88



Source: U.S. Bureau of Labor Statistics, unpublished data.

higher standards of living but also because it mediates social conflict. When the ratio of output to input rises, it is possible for some people to consume more without others consuming less. An environment of rising living standards makes the more affluent members of society more willing to share with those less fortunate. If the pie is not growing, people try to preserve what they have and show less concern for the poorer members of society.

Rapid productivity growth also makes it easier to trade off the production of goods and services for other products that contribute to social welfare. Using labor and capital to abate pollution or to improve worker health and safety necessarily reduces measured productivity; the factor inputs show in the denominator, but no additional output appears in the numerator. The more efficiently factors of production are used to produce conventionally measured goods and services, the more easily some of them can be diverted to satisfy social objectives.

Given the profound implications of productivity growth for standards of living, the distribution of income, and the welfare of individuals and the environment, it is extremely important to figure out what has happened to productivity growth and what can be expected in the future.

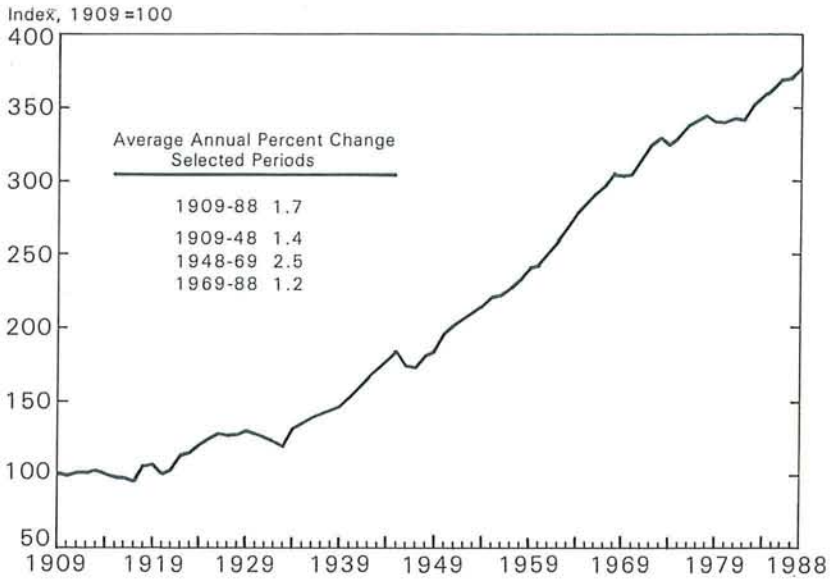
II. How Has Productivity Fared over Time?

Indexes of labor productivity and multifactor productivity for broad economic sectors and for manufacturing are published by the Bureau of Labor Statistics. Measures of output per hour have been developed for the business sector, and for the farm and nonfarm subsectors, from 1909 to the present. For the period after 1947, these data have been supplemented with comparable measures for manufacturing (total, durable and nondurable) and nonfinancial corporations. Multifactor productivity data are available for private business, private nonfarm business, and manufacturing from 1948 to the present.[5]

The following discussion will focus on the productivity data for the private nonfarm business sector. These series avoid the distorting effects created by the movement from farming to industry, and therefore offer some limited standardization. Except for a cursory mention of overall trends, separate data will not be presented for manufacturing. Denison (1989) has made a convincing argument that the present methodology, and particularly the treatment of computers, ends up attributing too much of recent growth to the manufacturing sector. Young (1989), of

Chart 2

Output per Hour in the Private Nonfarm Sector, 1909-88



Source: U.S. Bureau of Labor Statistics, unpublished data.

the Bureau of Economic Analysis, counters that Denison's study does not present convincing reasons to change the treatment of computers. Since this question is still unsettled, the paper will focus on the private nonfarm business sector.

Chart 2 shows the level of labor productivity in the private nonfarm economy over the period 1909 (the first year of official productivity measures) through 1988. In general, productivity has moved upward; a person working in 1988 could produce nearly four times more output in an hour than a person in 1909.

The strength of U.S. labor productivity is also demonstrated by international comparisons. Chart 3 shows gross domestic product per employed person for the United States and six developed countries. Although the gap between the United States and the other countries has narrowed significantly since the 1960s, the United States still has the highest level of gross domestic product per worker. Canada came closest to the United States in 1988, but its real product per civilian employee still remained 5 percent below the United States.

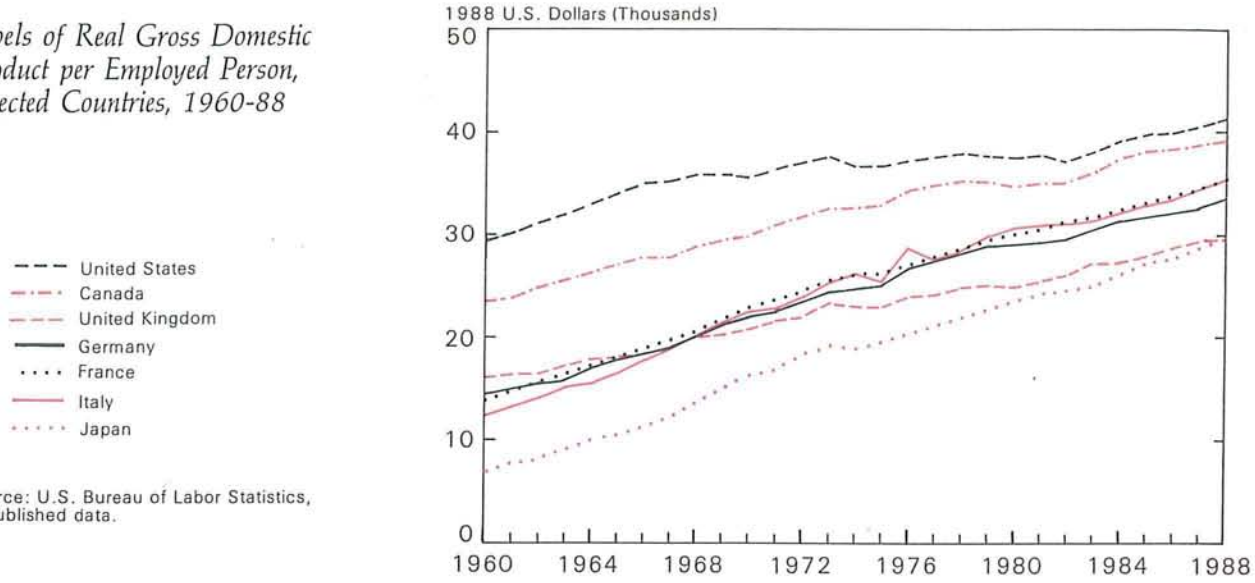
The problem in the United States is therefore not one concerning the level of productivity (output per worker is higher in the United States than in any other major developed nation) or the direction of change (except for the 1930s output per worker has increased almost every year), but rather the rate at which output per unit of labor input increases. As the previous section made clear, the rate of productivity increase determines the rate of growth of real wages and living standards. The type of international comparison that tends to cause so much alarm in the United States is presented in chart 4. The data show that since 1960 the rate of increase in real gross domestic product has been substantially greater in other major industrialized countries than in the United States. As noted frequently in the popular press, output per worker in Japan has increased more than fourfold over the last three decades, while in the United States it has gone up by less than 50 percent.

If the unfavorable comparisons were limited only to the international scene, it would be possible to explain the discrepancies largely in terms of other countries recovering from the devastation of World War II and catching up to U.S. levels. The problem is that U.S. productivity growth in the 1970s also fell sharply from its own previous heights.

Before looking at the data, one word is required

Chart 3

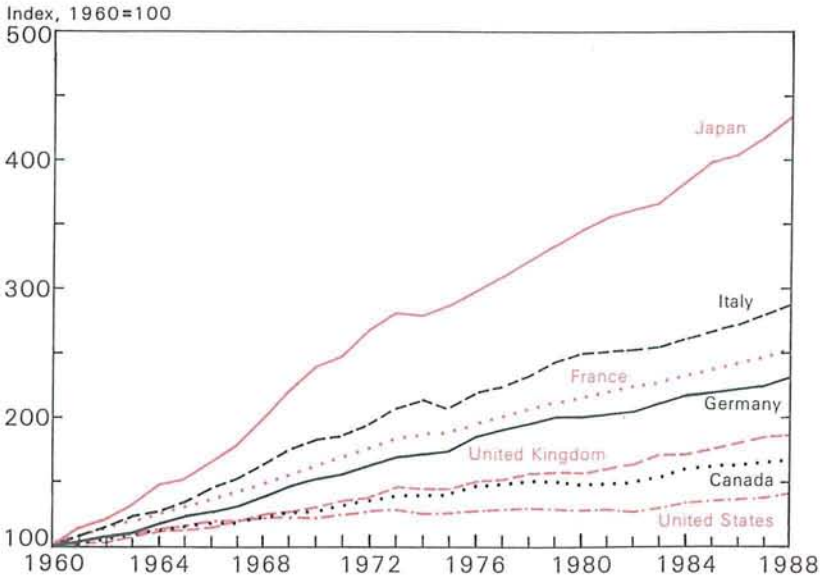
Levels of Real Gross Domestic Product per Employed Person, Selected Countries, 1960-88



Source: U.S. Bureau of Labor Statistics, unpublished data.

Chart 4

Trends in Real Gross Domestic Product per Employed Person, Selected Countries, 1960-88



Source: U.S. Bureau of Labor Statistics, unpublished data.

Table 1

Average Annual Percentage Change in Output, Factor Inputs, and Productivity Ratios for the Private Nonfarm Business Sector, Selected Periods, 1948–87

		Labor Measures		Contribution of Capital			Multifactor Measures	
Period	Output	Labor Input	Labor Productivity	Capital-Labor Ratio	Capital's Share	Capital's Contribution to Output per Hour	Capital-Labor Input	Multifactor Productivity
1948–87	3.3	1.4	1.9	2.1	35.2	.7	2.2	1.1
1948–69	3.8	1.2	2.5	2.1	35.6	.7	2.0	1.8
1969–87	2.8	1.6	1.1	2.1	34.8	.7	2.4	.4
1948–60	3.3	.8	2.5	2.1	35.2	.7	1.5	1.7
1960–69	4.5	1.9	2.6	2.1	35.9	.7	2.6	1.8
1969–79	2.9	1.8	1.1	2.1	34.7	.7	2.5	.4
1979–87	2.7	1.4	1.2	2.2	34.8	.8	2.2	.4
1948–53	4.6	1.4	3.2	1.9	35.6	.7	2.0	2.5
1953–60	2.4	.4	2.0	2.3	34.9	.8	1.2	1.2
1960–69	4.5	1.9	2.6	2.1	35.9	.7	2.6	1.8
1969–73	3.6	1.5	2.0	2.7	34.5	.9	2.4	1.1
1973–79	2.5	2.1	.5	1.7	34.7	.6	2.6	−.1
1979–87	2.7	1.4	1.2	2.2	34.8	.8	2.2	.4

Source: U.S. Bureau of Labor Statistics, Major Sector Labor and Multifactor Productivity, machine readable data, and unpublished data.

about the cyclical aspect of productivity performance. Strong aggregate demand always gives a temporary boost to productivity as workers are employed more intensively and capital is used for extra hours. A recession, on the other hand, always causes a temporary dip in productivity; not all firms have enough work and some assign employees to maintenance tasks rather than production. Two approaches have been used to eliminate this relationship between the business cycle and productivity in order to reveal the underlying trends. The first is to cyclically adjust the data by estimating the extent to which short-run fluctuations in demand lead to short-run variations in output and productivity and then remove these effects from the data. The alternative is to simply calculate productivity trend growth rates from high-employment year to high-employment year to avoid the large cyclical variations in productivity. The latter approach has been adopted here, since altering the published data makes it virtually impossible to refer back to the original sources.

Table 1 presents information about the rate of growth of total output, factor inputs and productivity in the private nonfarm business sector for various periods and subperiods from 1948 through 1987. Let us start with the simplest concept—labor productivity—and the longest time period. Over the entire four decades, total nonfarm business output increased at an annual average rate of 3.3 percent, and labor input to that sector measured in hours grew 1.4 percent, so labor productivity growth (the difference between the rates of growth of output and labor input) averaged 1.9 percent.

Breaking the post–World War II period in half shows that the overall average consists of high economic growth, 3.8 percent annually, and rapid labor productivity increases, 2.5 percent per year, before 1969 and slower growth in both output, 2.8 percent, and labor productivity, 1.1 percent, thereafter. Part of the decline in labor productivity growth may be attributable to the relationship between productivity and economic activity, but the size of the drop after 1969 is much greater than can be explained by the retardation in the growth of real output. Based on the relationship between labor productivity growth and the growth in nonfarm business output over the period 1948–69, one would predict labor productivity growth of 1.8 percent for 1969–87.

The question is what happened to cause the slowdown in the growth of labor productivity after 1969. Labor productivity consists of two components: (1) the increase in multifactor productivity or im-

proved management of resources and technical progress and (2) the contribution from the increase in the capital-labor ratio. Table 1 shows that the rates of growth in the capital-labor ratio were identical over the pre– and post–1969 periods: 2.1 percent annually.

The size of the drop in labor productivity growth after 1969 is much greater than can be explained by the retardation in the growth of real output.

Capital's share in total output, which is the weight used to determine its contribution to the growth in output per hour, remained virtually unchanged over the two periods. As a result, capital's contribution was the same before and after 1969. This means that the slowdown in labor productivity growth since 1969 appears to be due solely to a decline in multifactor productivity growth.

As discussed earlier, multifactor productivity can be thought of as similar to labor productivity except that the factor input is a weighted average of labor and capital. Subtracting the average annual growth in this combined factor input of 2.2 percent from the 3.3 percent growth in output yields an annual average growth in multifactor productivity over the 1948–87 period of 1.1 percent. This average, however, is the result of 1.8 percent annual growth in multifactor productivity before 1969 and 0.4 percent after 1969.

A finer breakdown of years yields a little more information, but not much. Specifically, the years 1973 through 1979, which have been the focus of considerable attention, show the lowest gain in labor productivity, and even a decline in multifactor productivity. Moreover, during this period the contribution of capital to output per hour also dropped to its lowest level in the postwar period. This is the result of the abrupt decline in the rate of growth in the capital-labor ratio that accompanied the influx of the baby boom into the labor market.

The basic fact is that before 1969 the United States experienced high productivity growth and now productivity growth is considerably lower. The questions that need to be answered are: Why did this drop occur? and What will happen in the future?

III. Explaining the Slowdown

This is not the first attempt to explain the slowdown in productivity growth; in fact, accounting for the slowdown has become a major industry among economists.[6] While an enormous number of popular hypotheses have been developed, none appear to explain more than a fraction of the overall decline. The following section first explores those hypotheses directly related to capital or labor, and then turns briefly to a series of other possible contributors to the slowdown.

Changes in the Composition of the Labor Force

One of the oldest, most popular hypotheses, and one that will be reexamined here, is that the skill and experience of the labor force have deteriorated significantly. The simple productivity calculations prepared by the Bureau of Labor Statistics use worker hours as the measure of labor input. This procedure gives the same weight to each hour worked, even though people differ greatly in their abilities and experience. Thus, economists have attempted to make adjustments for the quality of labor input by taking into account both changing demographic characteristics and level of education.

Demographic changes. The structure of the labor force changed dramatically as the baby boom generation moved through during the 1970s; adult males were 55 percent of employed persons in 1970 but only 47 percent in 1979. The productivity calculations assume that an hour of work by an adult male is just as useful as an hour supplied by an inexperienced teenager. But the wage rates of adult males are three times as great as those of teenagers and one and one-half times those of women (Denison 1985, Table 3-5). Economic theory suggests that the differences in wages reflect differences in productivity; if this were not true, the argument goes, employers would fire their more expensive older workers and hire less expensive younger ones.

This is a somewhat delicate argument; most observers stand ready to accept the idea that teenagers have lower productivities, but many (if not all) cannot accept the notion that women are inherently less productive than men. The wage differentials, in fact, probably have nothing to do with the inherent abilities of different groups, but most likely reflect differences in work experience.

To capture the variation in work experience resulting from the changes in the age-sex mix of the

labor force, several economists have constructed a quality-adjusted labor force variable in which workers in each demographic group are weighted by the wage for that group (Perry 1971, Baily 1981, Denison 1974, 1979 and 1985, and Darby 1984). We have updated those estimates and found results consistent with the earlier efforts. The exercise involves multiplying the annual share of total hours worked by each age-sex group (males and females aged 14–19, 20–24, 25–34, 35–64, 65 and over) by a wage weight.[7] The wage weight, which was taken from Denison (1985, Table 3-5), is the ratio of the average earnings for each age-sex group to the average earnings of males aged 35 to 64. These weighted hours are then summed over all groups. This annual adjustment is then applied to the index of hours from the Bureau of Labor Statistics to derive an age-sex adjusted index of labor input.

The results show that effective labor input grew more slowly than reported hours over the whole postwar period and that the discrepancy widened after 1969 (table 2). However, of the 1.4 percentage point decline in labor productivity from the first half of the period to the second, the changing age-sex mix of the labor force appears to explain only 0.2 percentage points. This is similar to the results found by earlier authors.

Education. One could argue that the logic that justifies wage-weighting of labor input requires adjusting also for trends in educational attainment over time. How to measure educational achievement and the effect of additional education on productivity, however, are both tricky issues.

Table 2
Average Annual Percentage Change in Actual and Quality-Adjusted Labor Input and Labor Productivity, Selected Periods, 1948–87

	Labor Input		Labor Productivity	
Period	Actual (BLS)	Quality-Adjusted	Actual (BLS)	Quality-Adjusted
1948–87	1.4	1.2	1.9	2.1
1948–69	1.2	1.1	2.5	2.7
1969–87	1.6	1.3	1.1	1.5
1948–60	.8	.7	2.5	2.5
1960–69	1.9	1.5	2.6	2.9
1969–79	1.8	1.2	1.1	1.8
1979–87	1.4	1.4	1.2	1.2
1948–53	1.4	1.5	3.2	3.1
1953–60	.4	.2	2.0	2.1
1960–69	1.9	1.5	2.6	2.9
1969–73	1.5	.5	2.0	3.0
1973–79	2.1	1.6	.5	.9
1979–87	1.4	1.4	1.2	1.2

Source: U.S. Bureau of Labor Statistics and author's estimates.

Effective labor input grew more slowly than reported hours over the whole period, with the discrepancy widening after 1969.

Darby (1981) uses median years of school as an index of education. This number remained at slightly over 8 years until the end of World War II, rose rapidly to 12 years in 1970, and then more or less leveled off, reaching 12.5 years in 1980. Hence, at first glance, a slowdown in educational achievement would appear to explain a portion of the slowdown in productivity. The median, however, simply shows that one-half of the population has at least 12 years of education and one-half has less, which is not surprising since a significant fraction of the population completes only high school. Other measures of educational attainment continued to rise throughout the 1970s; the percentage of the population that completed high school increased from 52 percent in 1970 to 66 percent in 1980, and the percent completing four years of college rose from 11 percent to 16 percent over the same ten-year period.

Other economists (Fraumeni and Jorgenson 1981, and Denison 1985) have made much more elaborate efforts to estimate the educational human capital in the labor force. They both used estimates of the extent to which an additional year of education adds to a worker's income, which puts a productivity value on a year of schooling. They also provided detailed information on the distribution of educational attainment in the work force. Both found that the U.S. work force was becoming more and more educated.

The conclusion that increased education leads to improvements in productivity, however, assumes that the quality of education has remained constant over the period. Some data indicate that educational quality may have diminished over time. Scholastic Aptitude Test

(SAT) scores have been declining since the mid 1960s after showing a slight upward trend for some years. In 1967, students averaged 466 on the verbal part of the test and 492 on the mathematical part; by 1980, these scores had declined to 424 and 466 respectively (U.S. Bureau of the Census 1989, Table 237). This trend is consistent with other studies that have shown that the rate of return to education has been falling (Freeman 1976, and Smith and Welch 1978). Baily (1981) concludes that "In contrast to improvements in education in earlier years, it seems unlikely that the further increases in recent years have been important."

In short, the major factor affecting the quality of the labor force is probably the influx of inexperienced workers that occurred in the 1970s as the baby boom was absorbed and the ranks were swelled by newly entering female workers. Weighting the age-sex groups by their relative wages is an imperfect adjustment for capturing experience differences, but the exercise does indicate that the changing mix has been responsible for part of the slowdown.

The Growth in Capital and Its Services

The other factor of production is capital, so that both a slowdown in the accumulation of capital and a slowdown in the services provided by a given stock of capital are potential causes of the slowdown. Hudson and Jorgenson (1974) in an early article suggested that the rate of capital investment may have slowed in response to the increase in energy prices. Their argument rests on the notion that automation is a major motivation for investment, and the incentive to pursue this process, which involves replacing human power with machine and energy power, is greatly reduced when the cost of energy rises. The difficulty is that the 1970s did not turn out to be a period of low investment; rather, the rate of growth in capital input remained at its post–World War II average level. Historical rates of growth, however, were inadequate to maintain capital-labor ratios in the face of the huge influx of new workers. The decline in the capital-labor ratio surely contributed to the decline in labor productivity.

The decline in the capital-labor ratio in the 1970s surely contributed to the decline in labor productivity.

When estimating productivity, the relevant input is not really the stock of capital but rather the flow of capital services. Baily (1981) argued that, even though capital formation remained quite strong, the flow of capital services may have deteriorated significantly and this deterioration may account for a significant portion of the productivity slowdown. The decline in capital services could be due to any of three factors. First, the rise in energy costs made some of the existing energy-inefficient capital obsolete. Second, pollution abatement and worker safety regulations diverted part of the flow of new investment to assets that do not help to increase output. Third, the maturing of some industrializing countries and the strong dollar made many U.S. factories uncompetitive. As a result of these developments, some capital was scrapped prematurely and, most importantly, some was never used. Although the evidence for this hypothesis is mixed, capital was probably not used as efficiently in the 1970s as in the past.

Other Explanations for the Slowdown

Some other often-cited contributors to the productivity slowdown are the increase in energy prices, the falloff in research and development expenditures, the diversion of investment funds to pollution abatement and worker health and safety improvements, and the mismeasurement of output.

The run-up in oil prices in the early 1970s is a convenient explanation because it coincided with the slowdown in productivity. The evidence in this area is mixed, with economists on both sides equally convinced of the importance or unimportance of energy prices as a contributor. Jorgenson (1988) argues that aggregate productivity slowdown is a result of slowdowns in individual industries that can be traced back to the rise in energy prices. Since the model of aggregate production excludes energy input, any negative effect of energy prices on output will be reflected in a slowdown of productivity. As noted earlier, Baily (1981) and Griliches (1988) argue that energy price changes forced companies to scrap energy-inefficient capital prematurely, or use it less intensively, and thus had a significant impact on productivity.

On the other side of this argument, Berndt (1980) concludes that energy price variations have not sig-

nificantly affected labor productivity growth primarily because energy costs are such a small portion of total costs. Denison (1985) points out that price increases occurred after productivity declines and were probably responsible for at most 0.1 percentage point of the decline. Thus, while energy's contribution to the slowdown is still a debated topic, it cannot be cited as a major contributor.

Another factor often cited as a reason for the slowdown is the levelling off in the rate of growth of research and development (R&D) expenditures. Griliches (1988), a pioneer in this area, concludes, however, that the R&D slowdown did not play a major role. Dean and Kunze (1988) and Baily and Chakrabarti (1988) also find similar results. One dissenting voice in this argument is Kendrick (1979), who attributes a substantial portion of the decline to the falloff in R&D expenditures. He finds such a large impact because he assumes not only that R&D expenditures levelled off, but also that the return on these expenditures has declined over time. The second assertion is a point of contention among economists. Thus, the preponderance of evidence indicates that although the decrease in R&D expenditures may have been of some importance, this phenomenon was not a major contributor to the productivity slowdown.

The diversion of investment expenditures to pollution abatement and worker health and safety improvement (in order to comply with federal regulation) has also been advanced as a potential cause. As discussed earlier, these types of investments are counted as part of the capital stock, and therefore as inputs, but do not produce any measured output. As with the levelling off in R&D expenditures, most studies (Crandall 1980; Denison 1985; Norsworthy, Harper, and Kunze 1979) have found that little of the slowdown can be attributed to efforts to meet increasing regulatory requirements. Gray (1984) estimated an effect on productivity about twice as large as that found by those using growth accounting. Again, the majority of findings indicate that the diversion of investment funds, while able to explain a small portion of the productivity decline, cannot be viewed as a major cause.

The last explanation that has been used to shed some light on productivity declines is the potential mismeasurement of output. Baily and Gordon (1988) found serious problems with the measurement of both output and productivity. They argue that the price indices used to deflate nominal output are highly inaccurate for some industries, especially those in the services sector, a problem which has been cited by other economists. Paradoxically, they conclude that these problems do not explain a large portion of the slowdown (0.2 percentage points of a 1.4 point decline) because although real output was understated in the 1970s, it was also understated in prior years. They do believe, however, that measurement errors may have been worsening since 1973. Their assessment requires further investigation and digestion by economists before measurement error can fully be accepted as an important contributor to the productivity slowdown.

Evidence indicates that such factors as rising energy costs, reduced R&D spending, diversion of funds to pollution abatement, and mismeasurement of output explain only a small part of the slowdown in productivity.

This brief excursion highlights the causes most often cited in the productivity slowdown puzzle and the piecemeal nature of the explanations. While several of these effects would seem intuitively to be important explanatory factors, the empirical evidence shows that most of them explain only a bit of the slowdown, and none can be considered a major contributor.

IV. The Role of Public Capital in Explaining the Slowdown

An additional explanatory factor that has not yet been thoroughly investigated is public capital. Until the recent study by Aschauer, this component of the nation's capital stock had been virtually ignored in the analyses of productivity growth. This oversight is difficult to explain, since the stock of public capital is not small. As shown in table 3, in 1987 public capital amounted to more than $2.3 trillion compared to slightly more than $4 trillion in the private sector. Even ignoring investments devoted to military purposes, the stock of public capital amounted to almost $1.9 trillion, or 45 percent of the value of the stock of private capital.

Table 3
Private and Public Capital Stock, 1987

Capital Stock[a]	Billions of Dollars	Percent of Total
Total	6487.3	
Total Private	4142.8	64
Nonfarm business	3974.6	61
Farm	168.2	3
Total Public	2344.5	36
Military	457.7	7
Nonmilitary	1886.8	29
Core infrastructure[b]	1195.7	18
Education, hospital and other buildings[c]	535.9	8
Conservation and development	155.2	2

Note: Numbers may not add to totals due to rounding.
[a]Figures include equipment and structures only. Land, inventories, and rental residential capital are excluded.
[b]Includes highways, mass transit, airports, electrical and gas facilities, water supply facilities, and sewers.
[c]Other buildings include office buildings, police and fire stations, courthouses, garages, and passenger terminals.
Source: U.S. Bureau of Economic Analysis, unpublished data.

Nearly two-thirds of nonmilitary public capital consists of "core infrastructure," which includes not only the highways, airports, and mass transit facilities that link this nation together, but also electric and gas plants, water supply facilities, and sewers that allow industry to operate. The second major category of nonmilitary public capital is buildings, including schools, hospitals, police and fire stations, courthouses, garages and passenger terminals, all of which contribute to an orderly environment that facilitates private production. The final category, which is relatively small, consists of structures used in conservation and development.

The importance of public capital to the private production process should be obvious. The construction of a highway allows a truck driver to avoid circuitous back roads and bring goods to market in much less time. The reduction in required time means that the producer pays the driver lower wages and the truck experiences less wear and tear. Hence, public investment in a highway enables private companies to produce their products at lower total cost. The condition of the highway, however, can be just as important as its existence. A highway in poor condition reduces the productivity of both private capital and labor; the wear and tear on trucks increases and the driver takes longer to make the trip, requiring greater compensation. Although less direct, similar stories can be told for police and fire stations, garages, mass transit and other components of public capital.

Not only does public nonmilitary capital consist of inputs essential to private sector output, but the growth of public capital has varied significantly over time and in a fashion consistent with the pattern of productivity growth. That is, as shown in table 4, the stock of public capital grew rapidly in the immediate postwar period when productivity growth was strong, and then increased at a much slower pace in the 1970s and 1980s when productivity growth lagged. This pattern is even more pronounced for public nonmilitary capital, which grew at an annual average rate of 4.1 percent over the period 1948–69 compared to 1.6 percent for 1969–87. Table 5 provides some additional information on growth rates by level of government.

A strong relationship between output per unit of private capital and the stock of public capital has been identified by Aschauer (1989). He also found a statistically significant relationship between the level of multifactor productivity and the stock of nonmilitary capital. This section will take Aschauer's analysis a step further by recalculating multifactor productivity from a production function that includes public as well as private capital. The object of this exercise is to see whether the slump in multifactor productivity growth in the last two decades persists after taking account of the slowdown in public investment.

Not only does public nonmilitary capital consist of inputs essential to private sector output, but the growth of public capital has varied consistently with the pattern of productivity growth.

As discussed earlier, multifactor productivity growth is the residual left after subtracting from the growth in total output (Q) the direct contributions from increased amounts of capital (K) and labor (L). These increased contributions are calculated as the

Table 4
Average Annual Percentage Change in the Real Value of Private and Public Capital Stock, Selected Periods, 1948–87

Period	Private Nonfarm Business	Public				
		Total	Military	Nonmilitary		
				Total	Core Infrastructure	Other
1948–87	3.7	2.4	.9	3.0	2.8	3.3
1948–69	4.0	3.0	−.1	4.1	3.7	5.0
1969–87	3.3	1.7	2.1	1.6	1.7	1.4
1948–60	3.7	2.4	−.5	3.7	3.3	4.5
1960–69	4.4	3.7	.4	4.7	4.2	5.5
1969–79	3.6	1.7	.1	2.1	2.0	2.3
1979–87	3.0	1.6	4.8	1.0	1.3	.3
1948–53	3.9	1.4	−2.2	3.2	2.7	4.4
1953–60	3.6	3.1	.7	4.1	3.8	4.6
1960–69	4.4	3.7	.4	4.7	4.2	5.5
1969–73	4.0	2.1	−.9	2.8	2.6	3.1
1973–79	3.3	1.5	.7	1.6	1.6	1.8
1979–87	3.0	1.6	4.8	1.0	1.3	.3

Source: U.S. Bureau of Economic Analysis, 1987, *Fixed Reproducible Tangible Wealth in the United States, 1925–85*, and unpublished data.

growth in factor inputs multiplied by their effect on output. This effect or elasticity is the percentage change in output for a given change in the relevant input. It is generally assumed that factor markets are perfectly competitive, so factors are paid their marginal product, and that the production function exhibits constant returns to scale, so that a 10 percent increase in private capital and labor leads to a 10 percent increase in output, which means that the elasticities applied to the growth of capital and labor are equal to their relative shares of total income. Since these shares have been very stable over time, the traditional equation for multifactor productivity growth (MFP) looks as follows:

$$\%\ \text{MFP growth} = \%\ \text{Q growth} - .35\ (\%\ \text{K growth}) - .65\ (\%\ \text{L growth}).$$

Introducing the average growth rates for total output, capital, and labor over the period 1949–87,

$$\%\ \text{MFP growth} = 3.3 - .35(3.6) - .65(1.4),$$

and the average annual increase in multifactor productivity can be shown to equal 1.1 percent.

To take account of nonmilitary public capital (G) in the multifactor productivity calculation involves

Table 5
Average Annual Percent Change in the Real Public Nonmilitary Capital Stock, Selected Periods, 1948–87

Period	Total	Federal	State & Local
1948–87	3.0	1.4	3.3
1948–69	4.1	2.0	4.7
1969–87	1.6	.8	1.7
1948–60	3.7	1.9	4.3
1960–69	4.7	2.1	5.3
1969–79	2.1	.5	2.4
1979–87	1.0	1.1	.9
1948–53	3.2	3.1	3.3
1953–60	4.1	1.1	5.0
1960–69	4.7	2.1	5.3
1969–73	2.8	0	3.3
1973–79	1.6	.8	1.8
1979–87	1.0	1.1	.9
Addendum: 1987 Amounts (billions)	$1,887	$264	$1,623

Source: U.S. Bureau of Economic Analysis, 1987, *Fixed Reproducible Tangible Wealth in the United States, 1925–85*, and unpublished data.

subtracting an additional term reflecting the growth in public capital times its impact on output. In other words, the equation becomes

$$\%\ \text{MFP growth} = \%\ \text{Q growth} - a(\%\ \text{K growth}) - b(\%\ \text{L growth}) - c(\%\ \text{G growth}).$$

The issues to be resolved are the values for a, b and c and whether or not the three coefficients sum to one. That is, does the assumption of constant returns to scale hold once public capital is included?

The basic rationale for government provision of goods and services is that these commodities will not be produced by the private market. The classic case is a good or service whose benefits may be provided to everyone in a town or a nation at a cost no greater than that required to provide it to one person (national defense). The benefits of the good cannot be divided up and people cannot be excluded from using it. The inability to exclude those unwilling to pay means that a profit-making producer would have no incentive to supply such items.

Sometimes government provision is called for even if exclusion is possible, as in the case of bridges or the interstate highway system. The reason is that these types of infrastructure can produce services with enormous economies of scale; although the initial fixed cost might be quite large, the marginal cost of providing one more crossing or road trip is nearly zero. Therefore, while it would be feasible to exclude those unwilling to pay from using the project, such exclusion would be inefficient.

The basic rationale for government provision of goods and services is that these commodities will not be produced by the private market.

Given that economies of scale play such a key role in determining the public provision of a good or service, one might be tempted to conclude that public capital in total may yield economies of scale within the production function. Such a leap may not be warranted, however. While a given highway may yield economies of scale, the construction of additional highways within the national production function may not. For example, the first phase of highway construction in the late 1940s and 1950s probably had an enormous impact on aggregate output, most likely in the realm of increasing returns to scale. As more roads were built, however, the increase in output as a result of the new construction may well have declined, so that the relationship would be more accurately described in terms of constant returns. In the same vein, a doubling of the highway system would probably produce diminishing returns.

Because of the uncertainty about the impact of public capital on output, Aschauer estimates two forms of a capital productivity equation: one that assumes that the production function exhibits constant returns to scale over private inputs and increasing returns to scale overall, and one that assumes constant returns to scale across all factors, public and private. The estimated equations, however, provide no basis for distinguishing between the two assumptions.

In an effort to get a more precise answer to the question of returns to scale and also to confirm Aschauer's results, which, if robust, have wide-ranging implications, we updated and reestimated in a slightly different form some of the productivity equations. Regardless of the precise form of the estimated equation, the process begins by rewriting the production function to include public capital. The easiest way to conceptualize how public capital fits into the production function is to view the flow of government services as enhancing the output from both labor and private capital. Hence, public capital becomes another input in the production function and the equation looks as follows:

$$Q = (MFP)*f(K,L,G).$$

Assuming a generalized Cobb-Douglas form of technology yields a more specific relationship between inputs and outputs:

$$Q = MFP*K^aL^bG^c.$$

Translating this equation into logarithms produces a linear function that can be estimated:

$$\ln Q = \ln MFP + a\ln K + b\ln L + c\ln G.$$

Instead of subtracting the log of capital from each side as Aschauer did, we subtract labor in order to have the more familiar labor productivity measure on the left-hand side. Hence, the first equation to be estimated is

$$\ln Q - \ln L = \ln MFP + a\ln K + (b - 1)\ln L + c\ln G.$$

Table 6

Regression Results: Labor Productivity, Private and Public Capital, Annual Data 1949–1987

Equation for Output Per Hour (lnQ − lnL)							rho	$\bar{R}^2$	SE	DW
				Private Capital Only						
(1) No Constraint:	lnA	+ alnK	+ (b−1)lnL	+ dCU						
	5.84	.62	−.96	.62			.96	.998	.0101	1.88
	(5.4)	(2.6)	(4.6)	(5.8)			(28.6)			
(2) a + b = 1:	lnA	+ a(lnK − lnL)	+	dCU						
	4.28	.55		.41			.93	.997	.0112	1.77
	(33.4)	(3.2)		(4.4)			(25.7)			
				Including Total Nonmilitary Public Capital						
(3) No Constraint:	lnA	+ alnK	+ (b−1)lnL	+ clnG	+ dCU					
	4.45	.64	−1.02	.31	.66		.74	.998	.0099	1.68
	(7.3)	(4.1)	(4.4)	(3.2)	(5.8)		(4.7)			
(4) a + b = 1:	lnA	+ a(lnK − lnL)	+	clnG	+ dCU					
	2.73	.26		.37	.18		.99	.995	.0144	1.39
	(.9)	(.9)		(1.9)	(1.3)		(9.2)			
(5) a + b + c = 1:	lnA	+ a(lnK − lnL)	+	c(lnG − lnL)	+	dCU				
	4.12	.56		.33		.60	.73	.998	.0097	1.67
	(103.9)	(12.6)		(5.0)		(11.8)	(5.5)			
(6) a = c:	lnA	+ a(lnK + lnG)	+	(b−1)lnL	+ dCU					
	3.57	.41		−.67	.49		.71	.998	.0101	1.56
	(14.4)	(14.1)		(5.8)	(6.7)		(5.9)			
(7) a = c and a + b + c = 1:	lnA	+ a(lnK + lnG − 2lnL)			+ dCU					
	4.30	.34			.49		.96	.998	.0103	1.73
	(27.9)	(4.1)			(5.5)		(30.6)			

Note: t-statistics in parentheses; Q = index of private nonfarm business output; A = the level of technology; K = index of private nonfarm business capital services; L = index of labor input in the private nonfarm business sector; G = index of the stock of nonmilitary public capital; and CU = capacity utilization rate in manufacturing.

To test for economies of scale, two additional equations are also estimated. The first assumes that constant returns to scale hold only for the private inputs, but that the entire production function shows increasing returns to scale. This assumption is captured by setting a + b = 1, so that the equation looks as follows:

$$\ln Q - \ln L = \ln MFP + a(\ln K - \ln L) + c\ln G.$$

The alternative assumption is that constant returns to scale applies to the entire production function, so that a + b + c = 1. Imposing this second constraint produces the third equation:

$$\ln Q - \ln L = \ln MFP + a(\ln K - \ln L) + c(\ln G - \ln L).$$

Three sets of equations were estimated—one with private capital only, one introducing total nonmilitary capital, and one including only the core infrastructure portion of public capital. The output, hours, and private capital data are the same as those used by the BLS to calculate multifactor productivity. Labor is measured as hours worked and private capital is introduced as the services flowing from the private capital stock.[8] The question was whether to construct a service series for the public capital stock as well; we followed Aschauer and simply assumed that services were proportional to the stock in the public sector. The equations also include the level of capacity utilization in manufacturing in order to reflect the cyclical nature of productivity.

The regression results, which are summarized in tables 6 and 7, confirm Aschauer's finding that public capital does indeed belong in the production function.[9] Both total nonmilitary public capital and core infrastructure enter with coefficients similar to

Table 7

Regression Results: Labor Productivity, Private Capital and Core Infrastructure, Annual Data 1949–87

Equation for Output Per Hour (lnQ − lnL)								rho	$\bar{R}^2$	SE	DW
				Including Only Core Infrastructure							
(1) No Constraint:	lnA	+ a lnK	+ (b−1)lnL	+ c lnGC	+ dCU						
	4.37	.62	−1.06	.37	.68			.67	.998	.0096	1.68
	(6.9)	(4.0)	(4.5)	(3.9)	(6.1)			(3.9)			
(2) a + b = 1:	lnA	+ a(lnK − lnL)	+	c lnGC	+ dCU						
	3.32	.44		.21	.37			.85	.997	.0113	1.73
	(3.2)	(2.3)		(.9)	(4.1)			(6.1)			
(3) a + b + c = 1:	lnA	+ a(lnK − lnL)	+	c(lnGC − lnL)	+	dCU					
	4.09	.56		.39		.63		.65	.998	.0094	1.67
	(104.2)	(16.2)		(7.2)		(12.7)		(4.6)			
(4) a = c:	lnA	+ a(lnK + lnG)	+ (b−1)lnL	+ dCU							
	3.65	.45	−.78	.55				.61	.998	.0096	1.60
	(17.3)	(17.70)	(7.78)	(8.1)				(4.9)			
(5) a = c and a + b + c = 1:	lnA	+ a(lnK + lnG − 2lnL)	+	dCU							
	4.09	.49		.63				.69	.998	.0100	1.43
	(109.0)	(34.7)		(13.7)				(5.5)			

Note: t-statistics in parentheses; Q = index of private nonfarm business output; A = the level of technology; K = index of private nonfarm business capital services; L = index of labor input in the private nonfarm business sector; GC = index of the stock of public nonmilitary core infrastructure; and CU = capacity utilization rate in manufacturing.

those found by Aschauer and are generally statistically significant. The coefficients of 0.31 to 0.39 imply that a 1 percent increase in public capital would raise labor productivity by 0.31 to 0.39 percent.

The equations also seem to provide some information about returns to scale; the equation based on the assumption a + b + c = 1 has a somewhat smaller standard error than the unconstrained equation and a noticeably smaller error than the equation based on the assumption that constant returns apply only to the private factors of production. Hence, the answer to the question regarding the values of a, b and c appears to be that c = 0.33 and a + b + c = 1.

The difficulty, however, is that the coefficient for private capital of 0.56 in equation (5) of table 6 is much larger than one would have thought based on factor shares, and this implies a very low elasticity of output with respect to labor; with constant returns to scale, if a = 0.56 and c = 0.33, then b = 0.11. These figures are difficult to reconcile with the relationship between a and b embodied in the traditional assumption of a = 0.35 and b = 0.65, which are the shares of total income going to private capital and labor, respectively.

One explanation for the counterintuitive coefficient for capital is that a variable has been omitted from the equation, and indeed the size and significance of the first order serial correlation coefficient indicate that a systematic pattern exists that has not been identified. The introduction of a trend and some additional cyclical variables, however, does not solve the problem.

As a last resort, some further constraints were imposed on the estimated equations. Specifically, equation (6) of table 6 assumes that the elasticity of output with respect to private and public capital are the same (a = c), while equation (7) assumes both that the elasticities are the same (a = c) and that the production function evidences constant returns to scale (a + a + b = 1). Neither set of constraints seemed to cause any problem and the latter produces results that are somewhat more consistent with observed income shares.

Having estimated values for a, b, and c, the next step is to recalculate multifactor productivity using these values and the growth in labor, private capital and public capital. Because of the variability in the estimated and implied elasticities of private capital and labor, two separate calculations were made. The

Table 8
Average Annual Percent Change in Multifactor Productivity of Private Nonfarm Business Sector, Selected Periods, 1948–87

Period	BLS	Including Public Capital and Quality-Adjusted Labor Option A[a]	Option B[b]
1948–87	1.1	.8	1.1
1948–69	1.8	1.0	1.2
1969–87	.4	.6	.9
1948–60	1.7	.9	1.2
1960–69	1.8	1.1	1.4
1969–79	.4	.5	.8
1979–87	.4	.7	.9
1948–53	2.5	2.1	2.3
1953–60	1.2	.0	.3
1960–69	1.8	1.1	1.4
1969–73	1.1	1.0	1.4
1973–79	−.1	.2	.4
1979–87	.4	.7	.9

[a]Option A assumes the coefficients for private capital, labor, and public capital are 0.34, 0.32, and 0.34, respectively.
[b]Option B assumes that the coefficients for private capital, labor, and public capital are (0.66 x 0.35), (0.66 x 0.65), and 0.34, respectively.
Source: U.S. Bureau of Labor Statistics and author's estimates.

first was based on the coefficients from equation (7), which implies

A) % MFP growth = % Q growth − 0.34(% K growth) − 0.32(%L growth) − 0.34(% G growth).

The second alternative was based on the assumption that the elasticities of the private factors of production are proportional to their shares of total income. This means that the elasticity of output with respect to public capital was assumed to equal 0.34, and the remaining portion (0.66) was divided proportionately between private capital and labor. This means that

B) % MFP growth = % Q growth − (0.35 x 0.66) (% K growth) − (0.65 x 0.66)(% L growth) − 0.34 (% G growth).

Both reestimated series also include quality-adjusted labor input.

Table 8 shows the average annual percent changes in the reestimated measures of multifactor productivity and compares them with the original BLS index. The BLS multifactor productivity measure slows from an annual rate of increase of 1.8 percent before 1969 to 0.4 percent annually after 1969. Part of that decline can be explained by the slower output growth in the last 20 years; in fact, based on the pre-1969 relationship between output growth and productivity increases, one would have expected multifactor productivity growth of 1.3 percent in the post-1969 period. That is, a 0.5 percentage drop in multifactor productivity growth would have been expected. Instead, multifactor productivity growth declined by 1.4 percentage points, which means that nearly a full percentage point decline in multifactor productivity remains unexplained.

Once public capital is included in the production function, the decline in multifactor productivity growth is much more in line with expectations. The results imply that much of what had been attributed to multifactor productivity growth in the first half of the period really reflected increased output that was due to the buildup of public infrastructure. And much of the decline in multifactor productivity growth after 1969 has reflected the near cessation of public investment. In other words, much of the drop in published multifactor productivity numbers may reflect the omission of public capital from the calculation of inputs rather than a decline in technological innovation.

Much of the drop in published multifactor productivity numbers may reflect the omission of public capital from the calculation of inputs rather than a decline in technological innovation.

The lack of a serious decline in multifactor productivity does not negate the documented decline in the growth of labor productivity from 2.5 percent over 1948–69 to 1.1 percent over 1969–87. Labor productivity growth did slow by 1.4 percent and was responsible for a dramatic slowdown in the growth of wages and living standards. What the foregoing analysis demonstrates is that, contrary to the figures shown in table 1, the entire decline is not attributable

to a fall in multifactor productivity. Rather, of the 1.4 percentage point decline in the growth of labor productivity, only 0.3 percent can be attributed to slower multifactor productivity growth and 1.1 percent is due to the decline in the rate of growth in the public capital-labor ratio. This ratio, which grew at an average annual rate of 2.9 percent over 1948–69, did not increase at all during the 1969–87 period.

V. Conclusions

What does all this discussion imply for labor productivity growth in the 1990s and thereafter? First, the data presented in table 1 show that labor productivity growth has already rebounded from the very slow growth experienced in the 1970s. While labor productivity growth averaged only 0.5 percent during the 1973–79 period, it has risen at a rate of 1.2 percent per year since 1979. Observers who simply extrapolate the poor 1970s performance into the future are making a mistake.

One factor contributing to the rebound is a return to the historic rate of growth in the private capital-labor ratio, now that the baby boom generation has been absorbed into the labor force. The average annual increase in the private capital-labor ratio, which had dipped to 1.7 percent between 1973 and 1979, has now returned to historic levels of slightly greater than 2 percent. The other factor contributing to the rebound in labor productivity growth is the turnaround in the growth of multifactor productivity. Even when properly calculated from a production function that includes public capital, multifactor productivity growth showed a sharp drop during the 1970s. Growth has now returned to more traditional levels. The public capital-labor ratio, however, continues to decline, acting as a drag on the growth in labor productivity. The public capital-labor ratio, which had been increasing until 1973, fell by an average annual rate of 0.5 percent over the period 1973–79 and continued to fall by 0.4 percent annually over 1979–87.

What rates of growth in output per worker can we expect in the 1990s and beyond? Assuming conservatively that multifactor productivity growth stays simply at its current level of 0.9 percent (table 8, option B) and the growth of the private capital-labor ratio remains at its post-World War II average of 2.1 percent, labor productivity should grow at 1.4 percent annually.

This number will be lower, however, if investment in public capital continues to fall behind the growth in labor. Currently, the shortfall in public investment appears to be dragging down labor productivity growth by roughly 0.1 to 0.2 percentage points. Simply raising the growth in public capital to the level of the growth in labor input would eliminate this drag. Increasing investment in public capital so that the public capital-labor ratio increased by 1.0 percentage points annually, could raise labor productivity growth to 1.7 percent annually. Investing in public capital to the point where the public capital-labor ratio grew at the same rate as that for private capital could raise the annual growth of labor productivity to 2.1 percent.

The options are clear and manageable. The drop in labor productivity has not been due to a decline in the growth of some mystical concept of multifactor productivity or technical progress. Rather, it has been due to a decline in the growth of public infrastrucure. Policymakers have direct control over the means to reverse this decline. The need to do so is also evident. Collapses of bridges and highways seem to provide ample evidence that the United States has not been maintaining its public capital, much less undertaking any enhancements.

To prevent any further deterioration in the nation's infrastructure, the United States needs to start repairing and constructing. The new public spending need not equal the rates observed following World War II when major improvements were undertaken, but it does need to substantially exceed the current inadequate efforts. This renewed growth in public capital will not only stop the erosion, but will also raise the rate of growth in capital per worker and thereby labor productivity growth. Although suggesting any particular number for the future is necessarily speculative, with renewed efforts to rebuild the public infrastructure there is no reason why labor productivity growth should not return to the 1.7 percent average that the United States has enjoyed on average for most of the 20th century.

Increasing government spending for public capital in an era of large structural federal deficits and financial pressures on state and local governments is a difficult task. But failing to do so will result in serious additional burdens for our children and lower levels of productivity growth than Americans should otherwise expect.

[1] The following discussion draws heavily from Rees (1980).

[2] Moving from equation (1) to equation (2) involves a little rearranging of the terms. Differentiating (1) $Q(t) = MFP(t)f[K(t), L(t)]$ with respect to t yields:

$$(1a) \qquad \dot{Q} = \dot{MFP}f(K,L) + MFP(t)[(df/dK)\dot{K} + (df/dL)\dot{L}].$$

Dividing by Q(t) yields:

$$(1b) \quad \dot{Q}/Q(t) = \dot{MFP}/MFP(t) + (MFP(t)/Q(t))(df/dK)\dot{K} + (MFP(t)/Q(t))(df/dL)\dot{L}.$$

Remembering that $Q(t) = MFP(t)f(K,L)$ yields:

$$(1c) \quad \dot{Q}/Q(t) = \dot{MFP}/MFP(t) + [(df/dK)/f(K,L)]\dot{K} + [(df/dL)/f(K,L)]\dot{L}.$$

Multiplying the second term by K(t)/K(t) and the third by L(t)/L(t) yields:

$$(1d) \quad \dot{Q}/Q(t) = \dot{MFP}/MFP(t) + [((df/dK(t))K(t))/f(K,L)](\dot{K}/K(t)) + [((df/dL(t))L(t))/f(K,L)](\dot{L}/L(t)).$$

Setting $s_k = [((df/dK(t))K(t))/f(K,L)]$ and $s_l = [((df/dL(t))L(t))/f(K,L)]$ yields:

$$(2) \qquad \dot{Q}/Q(t) = \dot{MFP}/MFP(t) + s_k\dot{K}/K(t) + s_l\dot{L}/L(t).$$

[3] With competitive factor markets and constant returns to scale:

$$df/dK(t) = p_k \text{ and } df/dL(t) = p_l$$
$$f(K,L) = p_kK(t) + p_lL(t)$$

and the weights are equal to:

$$s_k = \frac{p_kK(t)}{p_kK(t) + p_lL(t)}$$

$$s_k = \frac{p_lL(t)}{p_kK(t) + p_lL(t)}$$

$$s_k + s_l = 1$$

where: p_k = rental price of capital
p_l = price of labor.

[4] Subtracting L/L(t) from both sides of equation 2 yields:

$$\dot{Q}/Q(t) - \dot{L}/L(t) = \dot{MFP}/MFP(t) + s_k\dot{K}/K(t) + s_l\dot{L}/L(t) - \dot{L}/L(t)$$
$$= \dot{MFP}/MFP(t) + s_k\dot{K}/K(t) + (s_l - 1)\dot{L}/L(t).$$

Remembering $s_l - 1 = -s_k$ yields:

$$\dot{Q}/Q(t) - \dot{L}/L(t) = \dot{MFP}/MFP(t) + s_k\dot{K}/K(t) - s_k\dot{L}/L(t)$$
$$= \dot{MFP}/MFP(t) + s_k(\dot{K}/K(t) - \dot{L}/L(t)).$$

[5] *Availability of Productivity Measures for Major Sectors of the Economy*

Productivity Measure	Input	Index Availability	Dates Available
Output per hour of all persons:			
Total Private[a]	Labor	Annually	1909 to present
Nonfarm	Labor	Annually	1909 to present
Farm	Labor	Annually	1909 to present
Business[b]	Labor	Quarterly	1947 to present
Nonfarm business	Labor	Quarterly	1947 to present
Nonfinancial corp.	Labor	Quarterly	1947 to present
Manufacturing	Labor	Quarterly	1947 to present
Durable	Labor	Quarterly	1947 to present
Nondurable	Labor	Quarterly	1947 to present
Multifactor productivity:			
Private business	Labor, capital	Annually	1948 to present
Private nonfarm business	Labor, capital	Annually	1948 to present
Manufacturing	Labor, capital	Annually	1948 to present
KLEMS[c] multifactor productivity:			
Manufacturing and 20 2-digit SIC manufacturing industries	Labor, capital, energy, materials, services	Annually	1948 to present

[a] "Total Private" differs from "Business" in that it excludes government enterprises. In 1981, output of government enterprises consisted of 2 percent of total business output.

[b] Includes government enterprises; private business labor productivity and multifactor productivity measures exclude such enterprises.

[c] Capital (K), labor (L), energy (E), materials (M), and purchased services(S) as inputs.

[6] Baily (1986) provides a brief and comprehensive overview of the literature.

[7] Hours worked for each cohort was calculated from BLS unpublished Current Population Survey data using the following equation:

Hours = A*W*(C/D),
where: A = annual average number of persons at work in nonagricultural industries
W = annual average weekly hours worked in nonagricultural industries
C = annual average number of employed persons in private nonfarm business (government workers, private household workers excluded)
D = annual average number of employed persons in nonagricultural industries.

[8] For a detailed explanation of the calculation of capital services, see U.S. Bureau of Labor Statistics (1983), Appendix C.

[9] The contribution of public capital to the overall equation is a little difficult to discern from the results reported in table 6. The problem is that the equations as originally estimated had very low Durbin-Watson (DW) statistics, signalling the presence of significant positive serial correlation in the residuals of the equation. To deal with this problem, the equations were re-estimated with a correction for first order autocorrelation and the corrected results are shown in table 6. This correction significantly reduces the standard errors of the equations containing only private capital, while it improves the precision of the equations with public capital only slightly. Therefore, the gain from the introduction of public capital is not evident in a reduction in the standard error, but rather in the reduction in the size and significance of the rho coefficients.

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How Natural Is the Natural Rate of Unemployment in Europe?

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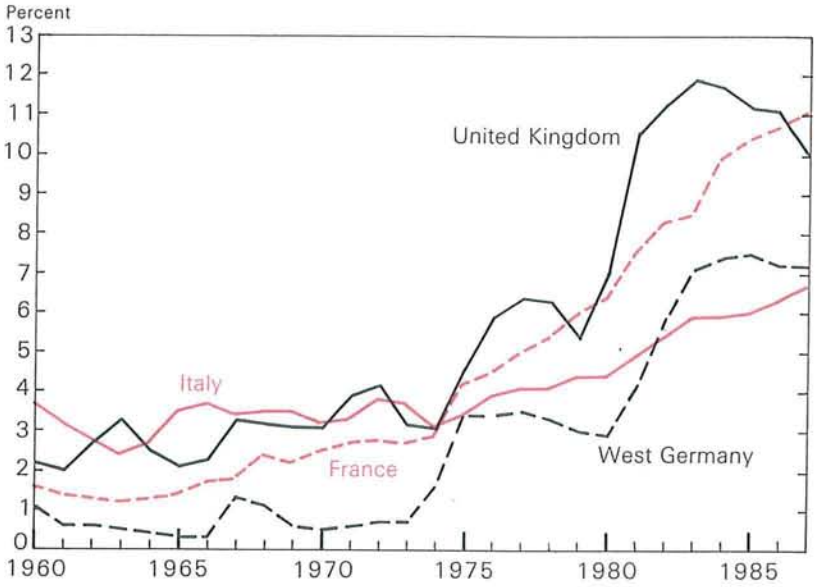
High unemployment has been the dominant economic policy issue in Europe over the last decade. The dispute centers on the nature and causes of unemployment in general. On the one hand, neoclassical economists argue that flexible prices clear markets, making all unemployment voluntary. In this view, traditional macroeconomic remedies would increase wages and prices, not decrease unemployment; only government policies that reduce the costs of labor to employers, like lower social security contributions or wage subsidies, would successfully increase employment. In contrast, Keynesian economists attribute high unemployment to a deficiency in the demand for labor. The solution, from this perspective, is to expand demand with conventional macroeconomic policies. Although each side in the debate possesses impressive theoretical models to support its view, ultimately the dispute must be settled empirically. This article reviews the most general and compelling empirical literature on the European problem. The initial work clearly recommends a neoclassical policy approach to increase employment. Yet evidence from the latter part of the decade is shown to contradict this dominant interpretation, suggesting that insufficient aggregate demand is the source of the European unemployment.

Chart 1 illustrates the unemployment problem in the four major European economies. In all of these countries the percentage of the work force unable to find a job has roughly doubled over the last ten years and doubled to quintupled since the first oil shock. In contrast, aside from cyclical swings, unemployment in the United States has remained roughly constant over the same time period. Furthermore, while cyclical variation has been large in the United States, chart 1 reveals the lasting duration of the European problem. The persistence of these unemployment rates over the last ten years must be explained in any complete analysis of the data. Such a study requires an examination of the factors that determine both labor demand and labor supply. It is necessary, therefore, to empirically identify these variables, examine

Chart 1

European Unemployment Rates, 1960-87



how they have changed, and test whether their movements have been sufficient to explain unemployment of the magnitude witnessed in Europe over the last nine years. Once the origin of the problem has been identified, the optimal direction of policy can be selected.

I. Characterizing Unemployment

To appreciate the policy debate, as well as the empirical research, requires an understanding of the theory. A simple labor supply–labor demand diagram can be used to illustrate each side of this dispute.

Classical Unemployment

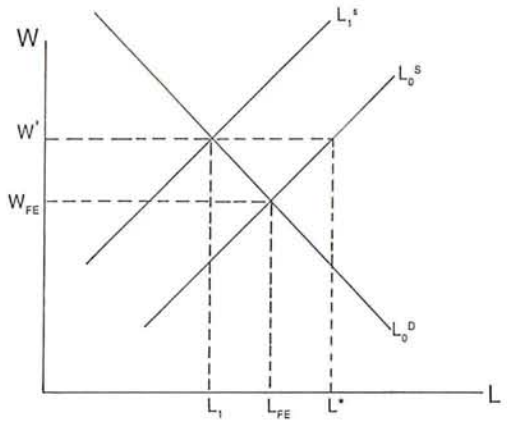
In figure 1 labor demand, L_0^D, is a downward-sloping function of the real wage, represented by w. The position of this curve depends on the technology of the firm as growth in labor productivity, for example, shifts the schedule outward and increases the amount of labor demanded at each real wage. The supply of labor, on the other hand, is an upward sloping function of w; a rise in real hourly compensation increases the opportunity cost of leisure, which induces people to work or to work longer. A shift up in the labor supply curve is the traditional neoclassical explanation for a decrease in employment.[1] In figure 1 the economy begins at full employment, L_{FE}, with the real wage equal to the full employment real wage, w_{FE}. A labor supply shift, from L_0^s to L_1^s, results in a rise in the real wage and a decline in employment. In broad terms, European government officials analyzed the decline in their employment growth precisely in this neoclassical context. As a result, the manipulation of traditional instruments of aggregate demand management was not perceived as a viable solution to their problem.

Although shifts in the labor supply curve could account for a decrease in employment, other aspects of the data cannot be explained by figure 1. At w', L_1 labor supply equals labor demand. This movement in labor supply does not produce an excess supply of labor; therefore, the unemployment rate in Europe should not increase. This conclusion is clearly contradicted by the evidence in chart 1. The above analysis also offers no explanation as to why labor supply suddenly and simultaneously decreased in every country in Europe, yet remained constant in the United States and Japan. Overlooking these two facts could seriously distort the policy selection. The exist-

ence of unemployment implies that government policy predicated on the belief that the labor supply had merely shifted would be inadequate; any policy that solely attempts to increase the supply of labor would be insufficient to attain full employment. Furthermore, even if the decline in employment were simply caused by movement in the labor supply curve, failing to understand the causes of that movement provides little information on how to reverse it, or whether it should be reversed at all. A policy of government inaction could not be defended using this simple analysis.

Several recent theoretical papers have attempted to reconcile the neoclassical model with the European data.[2] They argue that the labor supply curve is not only unstable but depends on past employment. Specifically, their story goes, the oil price shocks of the middle and late 1970s decreased the demand for labor by reducing labor productivity. Along with the assumption of rigid real wages, this decline in labor demand produced short-run unemployment. As unemployment rose, union membership declined. Since it is assumed that unions do not care about their ex-members, this fall in union membership increases the real wage offered to the firm as the monopoly union need not worry about employing as many workers. In short, the real wage rose because union labor supply decreased. Even after real oil prices plummeted in the mid-1980s and increased labor demand to its previous level, the union maintained these high real wages to benefit its lower membership. As shown in figure 1, the decrease in union membership shifts the labor supply curve relevant to the firm, the supply of union labor, to L_1^s, increasing the real wage to w' and decreasing employment to L_1. Unemployment equal to $L^* - L_1$ results because the total labor supply in the economy, represented by L_0^s, includes both union and nonunion workers. Although the assumptions of the model are essentially neoclassical, unemployment and its persistence are possible. The excess supply of labor does not drive down the wage as unions are both too powerful and too plentiful. Because this theory so vitally depends on the power of those workers currently "inside" the union, it will simply be referred to as the insider version of the neoclassical explanation.

Figure 1



One strength of the insider theory is its ability to predict the different unemployment experiences in the United States and Europe.

The insider theory also offers an explanation for the divergent experiences of the United States and Europe. Union power can explain the persistence of high real wages as well as the different reactions of Europe and the United States to the oil shocks of the 1970s. Unionization rates are extremely high in Europe. Furthermore, European union and nonunion wages tend to move in unison. In this respect, the insider theory seems to fit the European data well. In the United States, on the other hand, much lower unionization rates prevent changes in membership size from significantly affecting the equilibrium wage, and the lack of a strong positive link between union and nonunion wages allows the nonunion sector to absorb any unemployed union members. One strength of the insider theory is its ability to predict the different unemployment experiences in the United States and Europe.

If the insider theory accurately describes the source of the unemployment in Europe, a fairly specific policy program can be adopted to alleviate the problem. As the decline in labor supply originates from union behavior, policy prescriptions aimed at

directly affecting union actions could be effective. Besides the direct subsidization of employment, one approach the government could take is to lessen union control over both the union and the nonunion wage. Encouraging management to stand firm against union demands would help reduce union power over its own wage. Alternatively, unions could be restricted in their ability to cut nonworking members from their membership rolls, which might temper real wage demands. Yet the success of such policies is not promising, as government control over these variables is tenuous. Even so, the Thatcher government has clearly attempted to decrease union power in Britain, enduring the endless strike by coal miners, for example, while the West German government seems content to tolerate whatever unemployment rate is necessary to bring the nonunion wage down.

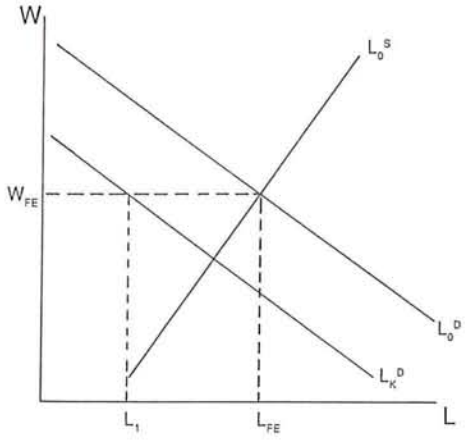
Keynesian Unemployment

Keynesians, on the other hand, explain unemployment with shifts in labor demand, not labor supply. They argue that a reduction in aggregate demand reduces the demand for labor given the real wage. Many variations of the basic Keynesian model, assuming either perfect or imperfect competition and flexible or inflexible prices, can explain this decrease in labor demand.[3] For example, if it is assumed that the firm is constrained in the amount of output it can sell when aggregate demand is low, labor demand becomes a function of both the productivity of labor and the level of aggregate demand. Such an economy is portrayed in figure 2. As aggregate demand declines, the labor demand curve shifts down to L_K^D. At

Different aggregate demand policies can explain the divergent United States and European unemployment experiences.

the constant real wage equilibrium employment falls to L_1.[4] The new employment level is identical in figures 1 and 2, although the reasons for its decline are much different. As in the insider case, unemployment results, this time equal to $L_{FE}-L_1$, but the optimal policy to eliminate it changes.

Figure 2



Traditional macroeconomic instruments can effectively reduce Keynesian unemployment. More expansionary fiscal or monetary policy raises aggregate demand, shifts the labor demand curve back to its original level, and removes the excess supply of labor. This increase in employment does not aggravate inflation because the unemployed labor is willing to work at the going wage; firms need not raise wages to attract new workers. In fact, different aggregate demand policies can explain the divergent United States and European unemployment experiences. In the early 1980s, European and United States government officials reacted much differently to the worldwide recession. A huge fiscal expansion in the United States, powered by large tax cuts and a defense spending boom, along with a loosening of monetary policy after 1982 quickly moved the country toward full employment. The persistence of the European recession can be explained by government reluctance to increase aggregate demand sufficiently. The Keynesians can, therefore, explain the simultaneous increase in European unemployment and the divergent experiences of the United States and Europe; the explanation hinges on the proclivity of officials in each region to utilize the policy instruments that successfully alleviate unemployment.

Since both the insider and the Keynesian theories are consistent with at least a cursory examination of the data, the choice of the proper policy is unclear. An empirical test must be derived that can reveal

which theory explains the current European unemployment. Although unemployment occurs in both models, the two explanations can be distinguished by their different predictions about the real wage.[5] If the current real wage is greater than w_{FE}, as in the insider version of the neoclassical framework, the government should attempt to decrease whatever impediments exist to real wage flexibility; it should reduce union power and attempt to uncouple union and nonunion wages. If the real wage is currently at or near its full employment level, as in the Keynesian case, then the preferred policy would involve either expansionary fiscal or monetary action. Since the relationship of the current real wage to the full employment real wage signals the optimal policy, the empirical work in this area has exclusively examined European real wages.

An empirical test must be derived that can distinguish which theory explains the current European unemployment.

II. The Methodology

The empirical approach taken in this article follows the efforts of several authors.[6] This paper's initial work updates the results, and parallels the methodology, of Bruno and Sachs (1985) and Bruno (1986), studies that most strongly support the insider explanation; thus, if the conclusions are at all biased, it is toward the neoclassical diagnosis. The essence of the empirical debate is illustrated in the previous two figures; whether unemployment is classical or Keynesian depends on whether the real wage that would produce full employment given perfect price flexibility, w_{FE}, is lower than the real wage actually occurring in these European countries, w'. The difference between the actual real wage and w_{FE} is defined as the real wage gap and is positive (negative) when actual real wages are above (below) their full employment level. If the real wage gap is greater than zero, then unemployment would be consistent with the insider theory. If no wage gap is present, however, only a Keynesian exegesis is possible. To begin the empirical analysis, the value of w_{FE} must be established. Unfortunately w_{FE} cannot be directly observed so the value of the real wage gap is estimated. Once the wage gap has been produced, the sensitivity of employment to the real wage must be quantified in order to determine whether any increase in the real wage gap has been sufficient to explain employment movements of the order experienced in Europe over the last decade.

The full employment real wage depends on both labor demand and labor supply. The demand for labor derives from the firm's production process. In equation (1) labor, capital, and other inputs are used to manufacture output, Q.

$$(1) \quad Q = F(K,L, \ldots) \text{ where } K = \text{capital } L = \text{labor}$$

In the short run, capital is assumed fixed. When firms maximize profits, they hire labor up to the point where the cost of the last hour of labor hired is equal to the return to the firm that results from that one hour increase in labor input. In perfect competition, this cost is the nominal hourly wage, W, and the return is the price of the output, P, times the number of units of output that hour of labor produces, the marginal product of labor or the MPL. This condition for firm profit maximization is given in equation (2), where $(\partial Q/\partial L) = MPL$.

$$(2) \quad P*(\partial Q/\partial L) = W \quad \text{or} \quad \partial Q/\partial L = W/P$$

Alternatively, profit maximization requires firms to continue to hire labor until the MPL equals the real wage, as shown in the second part of (2).[7] This description of firm behavior is essential to the empirical derivation of the real wage gap, as the w_{FE} is now linked to a variable that is more readily available from the data. Substituting the labor supply at full employment into equation (2) and finding the full employment MPL, produces the full employment real wage.

$$(3) \quad w_{FE} = (W/P)_{FE} = \frac{\partial Q(K,L_{FE} \ldots)}{\partial L}$$

Since this expression depends on the production function, a brief examination of the technology of the firm is needed to complete the derivation of w_{FE}.

Without knowing the exact production function of the firm, finding the full employment MPL would be impossible. However, for a broad classification of technologies, the average product of labor, the APL, is an appropriate surrogate for the marginal product.[8]

The APL is easily obtained from the data; one need only divide real output by total hours employed. Yet, the APL only measures the realized APL, regardless of the economy's position along the business cycle. Since peak years generally indicate full employment, however, it is assumed that the realized APL in those years coincides with the full employment APL. Thus, as shown in equation (3), the full employment real wage is defined as the full employment APL. To remain consistent with the previous literature, the peak years chosen are 1960, 1973, and 1979. The w_{FE} between these years is assumed to change at a constant rate; any technological innovations and labor force compositional effects embedded in this measure are smoothly and constantly incorporated into the w_{FE}. Note that by choosing three peak years, growth rates of the w_{FE} between the 1960–74, the 1975–79, and the 1980–87 periods are allowed to differ. This divergence is desirable as empirical work has conclusively shown a slowdown in labor productivity growth since 1974. Finally, since no European country has come close to a peak year in the 1980s, the w_{FE} after 1979 is constructed using a simple average of the previous two historical rates.

A rigorous examination of the forces shifting the labor supply curve would complicate this approach. Although attempts have been made to include this analysis, the methodology in this area is suspect.[9] Therefore, the real wage gap is obtained by subtracting the full employment average product in any one year from the real wage realized in that year while normalizing this series to zero over the relatively stable years of 1965 to 1969.[10] The actual real wage utilized in this analysis is the gross hourly labor compensation costs in manufacturing deflated by the product price. This study uses only manufacturing data because the assumption of perfect competition is more likely to hold in the more competitive traded goods sector, the marginal product is so clearly defined in manufacturing, and the data in this sector are readily available for all countries.

The results of this procedure for France, West Germany, Italy, the United Kingdom, and the United States are given in table 1. Not only are the first four countries the largest economies in Europe, but also they have suffered huge unemployment increases throughout the 1980s. The United States is included only for the sake of comparison, as our unemployment rate began falling after 1982. As previous research indicates, the above measure of the European real wage gap rose over the 1970s and early 1980s. In fact, every European country, except for Italy, had excessive real wages through the early 1980s. In contrast, through 1981 the real wage in the United States showed no comparable increase, which could explain that country's different economic performance. Based upon the data through 1982, European policymakers appeared to be correct in their assessment that the unemployment problem could not be helped by an increase in aggregate demand. The actual real wage was clearly greater than w_{FE}, signifying that European firms were too high on the full employment labor demand curve, not on a labor demand schedule that had shifted in. The evidence through 1982, therefore, seemed to reinforce the European policymakers' decision to refrain from expansive aggregate demand policy.

Table 1
Real Wage Gaps for Selected Countries, 1965–87
Percent

Year	France	West Germany	United Kingdom	Italy	United States
1965	−1.5	−2.8	2.2	.33	.83
1969	.48	4.4	−1.2	2.5	.22
1973	3.1	10.1	8.3	10.6	3.3
1975	8.3	12.7	13.6	14.8	.10
1979	13.4	14.9	23.0	9.2	6.7
1981	12.7	14.3	26.1	−3.1	5.8
1982	13.7	9.0	26.3	−2.9	6.7
1985	1.6	2.1	22.9	−6.0	10.4
1986	−6.1	−5.5	23.9	−13.4	11.0
1987	−11.0	−9.4	26.0	−15.0	9.4

The most recent data, however, do not support that policy decision. Although this study exactly replicates the methodology in the major research that supports the insider view, the real wage gap in the later part of the decade has plummeted in three of the four European countries examined in this article. In Italy, France, and West Germany this decline has been well over 20 percent, more than reversing the original increase. If the insider version of the neoclassical analysis is correct, all things being equal, the unemployment problem in Europe should be significantly corrected by now. Charts 2 to 5 plot the co-movement of the real wage and the unemployment rate for each of the European countries studied. Before the 1980s the real wage gap tended to move with the unemployment

Unemployment Rate and Real Wage Gap

Chart 2

West Germany

Chart 3

France

Chart 4

United Kingdom

Chart 5

Italy

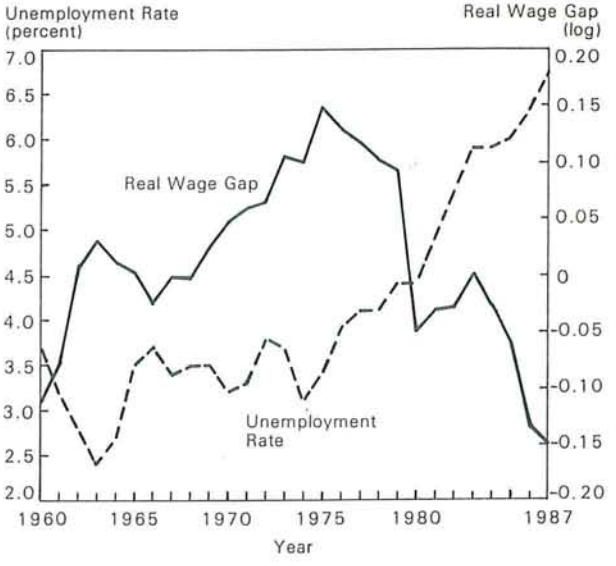


Table 2
Determinants of the Unemployment Rate, Selected Countries, 1962–87
Dependent Variable = Unemployment Rate (t-statistics in parentheses)

	West Germany		France		United Kingdom		Italy		United States	
Independent Variables	(I)	(II)	(I)	(II)	(I)	(II)	(I)	(II)	(I)	(II)
REAL WAGE GAP(−1) (logs)	−.36 (−.161)	−1.48 (−.707)	−3.21 (−1.34)	−5.87 (−2.38)	3.10 (.549)	3.45 (.648)	−2.63 (−1.57)	−1.82 (−1.23)	−3.74 (−.415)	−6.36 (−.698)
REAL WAGE GAP(−2) (logs)	5.70 (2.77)	3.03 (1.44)	2.05 (.770)	.05 (−.018)	12.18 (2.01)	15.53 (3.10)	1.74 (.980)	1.35 (.925)	−2.55 (−.260)	−12.30 (−1.33)
REAL MONEY BALANCES (−1) (logs)	−9.44 (−5.90)	−9.62 (−7.15)	−.32 (−.213)	−.95 (−.618)	−5.15 (−2.48)	−5.31 (−2.60)	−1.73 (−1.27)	−2.19 (−1.98)	−12.78 (−2.77)	−18.33 (−4.10)
REAL MONEY BALANCES (−2) (logs)	−4.70 (−2.96)	−6.35 (−3.56)	−.77 (−.583)	−3.54 (−2.47)	1.21 (.531)	.76 (.336)	.521 (.470)	.207 (.202)	−7.85 (−1.65)	2.29 (.583)
WORLD TRADE	−2.07 (−1.20)		−4.94 (−2.62)		−5.15 (−1.04)		1.13 (.539)		−1.31 (−.296)	
WORLD TRADE(−1)	−2.57 (−1.56)		−3.12 (−1.83)		−.57 (−.128)		−2.43 (−1.13)		10.93 (2.66)	
Standard Error of Regression	.22	.25	.25	.34	.71	.73	.24	.23	.54	.60

rate in all of these countries. Since the turn of the decade, however, this relationship has broken down; in France, West Germany, and Italy the unemployment rate has not followed the plunge in the real wage gap.[11] Clearly, a complete description of European unemployment using only real wage gaps is suspect at best. To investigate this suspicion, the next section statistically analyzes the relationship between European unemployment, real wages, and other potential explanatory variables.

III. Real Wage Gaps and Unemployment: The Results

If real wage gaps are to be used to explain high European unemployment, then a more rigorous statistical investigation of their relationship is required. For the sake of comparison this study follows Bruno (1986), examining the relationship between unemployment rates and a variety of independent variables.[12] Specifically, each country's unemployment rate is related to its real wage gap and various measures of its aggregate demand. In the short run, aggregate demand can affect the demand for labor if wages are slow to adjust, while a long-run story would require a Keynesian explanation similar to that in section I. Initially, this study will parallel Bruno (1986) as closely as possible in order to analyze why this insider theory has failed over the past five years. To begin the examination, unemployment is regressed on time, lags of the logarithm of the real money stock, a dummy variable to pick up the post-1975 labor productivity slowdown, various lags on the real wage gap, and a world trade variable. The time parameter attempts to account for any trend movement in the unemployment rate over the sample period while the world trade variable seeks to proxy for world aggregate demand. Various government deficit variables were tested to account for fiscal policy but are not reported here since they were insignificant for all countries.[13] Finally, all regressions are corrected for the first-order serial correlation normally found when regressing time series variables.

Table 2 contains the results of the regressions fit to the 1962–87 period for the five countries. Looking at equation I, the money stock variable is significant and correctly signed for three of the five countries. Increases in the real money supply decrease the unemployment rate in West Germany, the United Kingdom, and the United States. Contrary to the

insider explanation of unemployment, however, the real wage gap measures are correctly signed and statistically significant in only two of the countries. The United Kingdom and West Germany stand alone as economies where real wages seem to account for unemployment movements. In fact, the real wage gap coefficients in the remaining countries are generally incorrectly signed, implying that a rise in real labor costs, all else held constant, decreases the unemployment rate. Furthermore, what is striking about even the correctly signed real wage-unemployment relationships is their instability. Excluding the insignificant world trade variables from the regressions, as is done in the second equation in table 2, produces statistically unimportant real wage gap coefficients for West Germany.[14] Without strong prior beliefs that the world trade variable belongs in the regression, its low statistical significance recommends its removal; when this variable is excluded, only the United Kingdom has a positive and significant real wage coefficient over the entire 1960–87 sample.

In short, current unemployment in Europe cannot be classified in this insider version of the neoclassical framework even when applying the same criterion as in the original studies. Not only did these measures of the real wage gap fall throughout the 1980s while unemployment rates remained roughly constant, but the relationship between these two variables became much less statistically significant as the sample was updated. This result tends to dispute the most persuasive empirical work supporting the insider explanation of European unemployment. In fact, except for the United Kingdom, European unemployment far more favors a Keynesian interpretation, where a lower level of employment with a constant real wage indicates insufficient labor demand. Before any firm conclusions can be drawn, however, two issues must be explored: (1) Are the insignificant real wage gap coefficients due to incorrectly modeled aggregate demand variables? and (2) What has caused the collapse of the relationship between real wages and the unemployment rate, which apparently has occurred since the completion of the previous research?

IV. The Breakdown of the Classical Relationship

One problem with the regressions in table 2 could be their failure to choose the correct independent variables to represent aggregate demand. Although the lags of the real money supply are often significant and correctly signed, theory suggests several measures that might better indicate the expansionary or contractionary direction of monetary policy. In fact, central banks traditionally affect investment and consumption through the interest rate. Replacing the log of the real money stock with the real interest rate could alter the real wage gap results.

The evidence clearly supports the conclusion that the relationship between the real wage gap and the unemployment rate broke down in the 1980s.

Another possible measure of central bank intentions is the term structure of the interest rates. Generally, monetary authorities directly affect short-term rates; thus, expansionary monetary policy would produce a decline in short-term interest rates relative to their long-term counterparts. However, replacing the real money supply variable with either of these alternatives does not improve the performance of the coefficients on the real wage gap. These results are excluded from the tables as the parameters for the term structure and the real interest rate are rarely significant. In short, using a variety of measures of aggregate demand does not change the basic findings of the previous section.[15] The evidence clearly supports the conclusion that the relationship between the real wage gap and the unemployment rate broke down in the 1980s.

The Relationship over Time

Exactly when this collapse occurred is uncertain. Given Bruno's more positive real wage results, it might be assumed that the breakdown began after Bruno's sample ended, in 1982. If the regressions fit to Bruno's time frame show strong positive real wage gap coefficients, then a post-1982 change in this relationship is suggested.[16] The real wage gap coefficients for equation I fitted to the 1960–82 sample are given in table 3. The parameters on the real money stock variables were roughly similar to those in the

Table 3
Determinants of the Unemployment Rate, Selected Countries, 1962–82
Dependent Variable = Unemployment Rate (t-statistics in parentheses)

Independent Variables	West Germany (I))	France (I)	United Kingdom (I)	Italy (I)	United States (I)
REAL WAGE GAP(−1) (logs)	−1.21	−.81	−3.08	−2.15	−3.03
	(−.466)	(−.438)	(−.403)	(−.974)	(−.494)
REAL WAGE GAP(−2) (logs)	8.03	.23	11.80	2.24	15.66
	(3.72)	(.133)	(1.60)	(1.14)	(1.64)

full sample and are not included in the table. The link between unemployment and the real wage gap does, in fact, strengthen slightly. The negative coefficient for France moves toward zero and becomes less significant, while the German real wage coefficients become more positive and more significant. Both the U.S. and the Italian net real wage coefficients become correctly signed and move toward statistical relevance. For the United Kingdom, however, the shorter sample actually worsens the relationship as the coefficients remain roughly constant between the entire sample and the sub-sample, but their statistical relationship becomes less certain. Though these parameters on the gap as a whole perform better than the 1962–87 coefficients, these results do not impressively support the insider neoclassical explanation, as only West Germany has a correctly signed and statistically significant coefficient. Certainly, 1982 does not seem to be a turning point in this relationship.

One possible explanation for the breakdown in the real wage–unemployment relationship involves the formation in 1979 of the European Monetary System.

Perhaps a more valuable test for the turning point in these regressions would include a hypothesis concerning its cause. One possible explanation for the breakdown in the real wage–unemployment relationship involves the formation in 1979 of the European Monetary System, the EMS. The EMS is a system of exchange rate controls. Although its exact mechanism is not without debate, it can be compared to the old Bretton Woods regime, with the West German mark taking on the role of the U.S. dollar. The agreement calls for all member countries to fix their exchange rate to the mark. This commitment allows West Germany to set monetary policy throughout Europe, since central bankers in the remainder of Europe lose control of their money supplies when required to maintain a fixed deutsche mark exchange rate. As an illustration, assume West Germany is running very tight monetary policy. Any attempt by the French to decrease their interest rates below West Germany's by increasing the supply of francs is completely frustrated. With a fixed exchange rate, the French central bank is forced to buy back all the newly issued francs as they flee to West Germany to take advantage of the mark's higher return. As the French support the franc, the French money supply and interest rate return to their original levels. In fact, exporting West Germany's monetary discipline is one of the major arguments for the mark as the base currency in the EMS.

With the formation of the EMS, these other countries, with vastly diverse institutions and inflationary histories, suddenly began to import the West German inflation rate. This change not only shocked any already preset wage contracts, but also profoundly altered the variables that had historically affected each country's domestic inflation. For example, how relevant is Italian unemployment to Italian monetary policy? The answer can be radically different if the West German Bundesbank, rather than the Italian central bank, fixes the Italian interest rate. Note that this movement from Italian to West German control over the Italian interest rate does not merely represent a change in the value of the interest

Table 4
Determinants of the Unemployment Rate, Selected Countries, 1962–78
Dependent Variable = Unemployment Rate (t-statistics in parentheses)

Independent Variables	West Germany (I))	France (I)	United Kingdom (I)	Italy (I)	United States (I)
REAL WAGE GAP(−1) (logs)	−2.87	5.58	−.59	−21.15	8.00
	(−1.00)	(3.00)	(−.150)	(−6.00)	(.951)
REAL WAGE GAP(−2) (logs)	6.58	−.62	19.41	20.12	12.95
	(2.88)	(−.36)	(3.68)	(6.27)	(1.40)
REAL MONEY BALANCES(−1) (logs)	−10.30	−3.17	−10.00	5.89	−13.44
	(−4.74)	(−3.80)	(−5.18)	(3.18)	(−3.01)
REAL MONEY BALANCES(−2) (logs)	1.87	2.70	2.85	−3.91	−7.60
	(.710)	(4.19)	(.992)	(−2.75)	(−2.39)
Standard error of regression	.19	.10	.36	.17	.35

rate, but embodies a change in the variables that determine that rate. Any event that alters such relationships is referred to as a regime shock. Thus, a regime shock caused by the institution of the EMS could be the source of the original unemployment in Europe. After 1979, the fixed exchange rates and the continued tight policy of the Bundesbank prevented the European central banks from loosening policy in reaction to the rise in unemployment. If, in fact, difficulties do arise in wringing unemployment out of the system, this process is one possible Keynesian explanation of the European unemployment. The remainder of this article takes a variety of tacks to examine the validity of this hypothesis.

Unemployment and the EMS

A policy regime shock that results in Keynesian unemployment would have several empirical implications. The formation of the EMS would manifest itself in the full sample regression as a collapse in the relationship between the real wage gap and unemployment. Before the shock, while on the full employment labor demand curve, this relationship would be stable. Once the labor demand curve shifted down, however, the constant in the unemployment regression would increase over the post-shock sample, while the shift would break down the relationship between real wage gaps and unemployment over the entire period. Furthermore, the traditional aggregate demand variables would not capture the effects of the formation of the EMS as the relationship of these variables to unemployment would have changed, not just their levels.

To test whether, indeed, a strong correlation existed between the real wage gap and the unemployment rate before the formation of the EMS, the same regression is fitted over the 1962–78 sub-sample. The results in table 4 reveal a much stronger unemployment–real wage relationship over this pre-EMS period, than over the full sample or the 1962–82 sub-sample. One of the two Italian coefficients is now correctly signed and statistically significant. The French estimates are positive and significant, which completely reverses the perverse French results found over the previous two sample periods. The West German and U.K. coefficients remain positive and statistically important. Further, the relationship between unemployment rates and the aggregate demand variables improves. Over the 1962–78 sub-sample, each country has at least one correctly signed and statistically relevant money stock coefficient. Although not reported here, even the real interest rate coefficients improve over this shorter sample. These general results strongly suggest that some shock shattered the connection between European real wages and unemployment in 1979.

In fact, a statistical test can be performed to measure the stability over the 1962–78 and 1979–87 sub-periods of the relationship between unemployment and the independent variables on the right-hand side of the equation. To enhance the degrees of

Table 5
Chow Statistic for Regression II, Determinants of the Unemployment Rate, 1962–1978

	REGRESSION II CHOW STATISTIC
West Germany	6.43
France	31.71
United Kingdom	16.14
Italy	1.74
United States	2.73

freedom, this test was performed for the equations without the world trade variable. This measure is given in table 5 as the Chow statistic. The larger the value, the less likely the structural relationship is constant over time.[17] At a value of 3.87, one is 99 percent sure that the two regressions represent two separate structural relationships, and that a regime shock occurred in 1979. The actual values range from a low of 1.74 for Italy to a high of 31.71 for France. It comes as no surprise that the countries whose real wage parameters are most affected by the change in sub-samples, France, West Germany, and the United Kingdom, have the three largest values. Thus, statistical support for the hypothesis that a regime change adversely affected the unemployment regressions seems fairly strong. Certainly something occurred in 1979 to affect this relationship, although conclusive proof that the source of the change was the formation of the EMS is difficult to provide.

Further attempts, however, were made to specify the cause of the structural shift. As previously mentioned, a surprise monetary policy shift caused by a change in the exchange rate system could cause a permanent shift in unemployment, as the labor demand curve moves to a lower level; thus, tests of whether the post–EMS constant term had increased were performed. A variety of different dummy variables covering the EMS years were tested. The results were mixed. For example, if the world trade variable is excluded, then the EMS dummy is positive and significant for France and West Germany; yet when the trade variable is included, the dummy is significant in only West Germany. The real price of oil was also included in these regressions in an attempt to control for OPEC price shocks, yet it had no effect on the results. Another statistical approach for this test is to pool the regressions in order to compensate for a small sample size. The problem with this procedure is its assumption that the coefficients for each variable are identical for every country, which strongly contradicts the findings so far in this paper. Regardless, the parameters on the real wage gap and the EMS dummy are significant and correctly signed in these pooled regressions. These tests tend to rule out other possible causes of the structural shift, like oil price changes, while further suggesting the EMS as the source.

More general analysis also supports the EMS hypothesis. For example, if the EMS produced the collapse in the real wage–unemployment relationship, one would expect West Germany and the United Kingdom to be the least affected by this change. The EMS regime shock should have little effect on the West German equations since their labor markets are accustomed to the Bundesbank's policies. Furthermore, the United Kingdom should not be greatly affected by the formation of the EMS as it is the only European country that has yet to commit itself to the fixed exchange rates dictated by the European union. Table 3, in fact, reveals that Britain and Germany are the only two countries in the study with significant real wage gap variables over the entire sample. Furthermore, the Chow statistic measuring the stability of the regressions over time shows the United States to be more consistent than any other country in the sample but Italy. Even though the United States could easily have been shocked in 1979, for example by the institution of reserve targeting by the Federal Reserve, the only non-European country in the group had one of the lowest Chow statistics. Taken as a whole, the evidence clearly indicates an event in 1979 that disrupted what had been a relatively stable relationship between the real wage gap and unemployment. One possible explanation for this collapse would be the most significant event to affect Europe at that time, the formation of the EMS.

Statistical support for the hypothesis that a regime change adversely affected the unemployment regressions seems fairly strong.

V. Conclusion

The results in this paper suggest that the unemployment problem in Europe is not due to excessive real wages. The Bruno and Sachs (1985) and Bruno (1986) studies are the major works that found significant real wage gaps in the early 1980s; thus, by using their methodology this paper gives the recent insider-based neoclassical explanation its best chance to perform. Yet incorporating the recent data into their framework clearly rejects this analysis of European unemployment along with its policy prescriptions. The real wage gaps are shown to increase throughout the late 1970s and the early 1980s, but they decline abruptly since the end of those studies. As unemployment declines have not followed the fall in the real wage gap, a more Keynesian source of unemployment in Europe is suggested. The origin of this involuntary unemployment could have been the institution of the European Monetary System, which produced a serious monetary shock and monetary regime change in Europe. Although some single-country studies have suggested the need for policies to increase labor supply, this paper indicates the need for expansionary aggregate demand policy also. Further, the complaint of many European government officials that increases in aggregate demand would only increase inflation is without foundation if, as this paper implies, these European countries are off their full employment labor demand curves. In fact, recent experience in Germany, although not in the United Kingdom, has clearly shown unemployment to be falling without any pressure on the rate of inflation.

This debate has been cast not just in terms of policy but in a theoretical context because the issue is much more general than the current European experience. Unemployment has dropped out of the policy debate in the United States because of our sustained expansion of the last seven years. Neoclassical models of unemployment dominate American labor market analysis. Yet, the battle between the neoclassical and the Keynesian theorists still rages in Europe. The recent European experience emphasizes that this debate is not simply some arcane academic exercise.

Recent European experience emphasizes that the debate between the neoclassical and the Keynesian theorists is not simply some arcane academic exercise.

Thus, this paper is not merely an examination of the currently optimal European policy, but a reminder that if any shock resulted in unemployment of that magnitude in the United States, policymakers should not reflexively assume that perfectly flexible prices necessitates a labor supply explanation. They did that very thing sixty years ago and to some extent are doing it in Europe now, at a tremendous cost in wasted resources.

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[1] The most recent version of neoclassical business cycle theory postulates shifts in both labor supply and labor demand curves. What drives these models, however, are short-run shocks to technology. Thus, the decline in employment that is produced in these paradigms should be of brief duration, not the long-run problem experienced in Europe this decade. If the technological disturbance were a long-run phenomenon, it would be accounted for in this empirical study.

[2] See, for example, Sachs (1986) and Blanchard and Summers (1986a,b).

[3] Coen and Hickman (1987) examine both perfect and imperfect competition. Solow (1986) assumes imperfect competition. The usual approach under perfect competition follows Barro and Grossman (1971) and Muellbauer and Portes (1978), who assume some sort of price or wage rigidity. Yet, Clower (1965) discusses Keynesian theory in a perfectly flexible world.

[4] Neo-Keynesian theory is rather agnostic about what actually happens to the real wage. It could fall, equating supply with the new level of demand, or it could rise, depending, as Clower (1965) points out, on the dynamics of nominal wages and prices out of equilibrium. It is drawn as a constant here for ease of exposition.

[5] Excessive real wages are necessary but not sufficient for insider unemployment. As mentioned in footnote 4, Keynesian unemployment can co-exist with high real wages. The economy could be both on a lower labor demand curve and at a higher real

wage than that which would sustain full employment. Yet since high real wages are a necessary condition for the insider theory, this test can rule out insider unemployment.

[6] Essential for the technique used in this paper are Bruno and Sachs (1985) and Bruno (1986). Other works which approached this problem somewhat differently are Artus (1984) and Coen and Hickman (1987).

[7] It is assumed that the more labor hired given the levels of other inputs, the less productive is that last hour of labor. This diminishing marginal productivity of labor explains the downward slope of the labor demand curve in figure 1. The slope of the labor demand curve ensures that the equilibrium condition in equation (2) is attainable.

[8] Specifically, if Cobb-Douglas technology is assumed, the logarithm of the average product of labor is merely a constant away from the logarithm of its marginal product. This constant may be ignored as it is the change in this variable that is important, not its level.

[9] Artus (1984) and Coen and Hickman (1987) attempt to incorporate labor supply variables. Forecasting full employment from demographic data on labor force participation rates is, however, notoriously inaccurate. Furthermore, empirical estimates of the labor supply curve reveal it to be relatively stable and very inelastic with respect to the real wage. It therefore seems highly doubtful that shifts in the labor supply curve have caused much of the problem. If the labor supply curve is not extremely variable, then Bruno and Sachs's method cannot be attacked for ineffectively including labor supply movements.

[10] This normalization is used as it is generally assumed that Europe was at full employment during this period so any deviation of wages away from that level would represent excess real wages.

[11] It should be pointed out that Bruno and Sachs (1985) and Bruno (1986) also constructed an alternative measurement of the real wage gap. Its purpose was to account for cyclical movement along the labor demand curve and short-run episodes off the curve due to adjustment costs. Replicating this measure produced results that generally conformed with those for the method discussed in the body of this paper. They are not reported here since the unemployment regressions that follow are similar to those in Bruno (1986), and Bruno only reports these results using the first measure of the real wage gap.

[12] These equations are informal reduced form regressions used in an attempt to control for the simultaneity problems in this type of study. Although a complete structural model is not constructed, it is possible and commonplace to get reduced forms of this type out of more rigorously specified paradigms.

[13] For the United States the Federal Reserve estimate of the real, full-employment, government deficit was used. Unfortunately this variable was impossible to find for the European countries; thus the real deficit in each country was run in its place. None of these variables were statistically significant in the regressions, and therefore, they are not reported in this paper. These results conform to those of Bruno (1986), except for the United States.

[14] A recent paper by John Pencavel (1989) makes essentially this same point.

[15] These results are also robust to the addition of other types of explanatory variables. Different dummies were included in an attempt to capture the effects of different disturbances, such as oil shocks. In fact, even the real price of oil was included in these regressions. None of these variables affected the results.

[16] Bruno and I actually get slightly different results for these regressions. Primarily this is due to the updating of the base year that the U.S. Bureau of Labor Statistics used for the calculation of the real value added in manufacturing. Since the weights changed, some of our results will differ. I also updated his deviations from trade trend, although regressions using his trend years fared no better. Essentially, however, his results were not all that much more conclusive for the real wage gap explanation in these countries.

[17] This test is essentially an F-test performed on the null hypothesis of sub-sample stability.

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The U.S. Professional Sector: 1950 to 1988

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The United States economy, over the course of the twentieth century, has taken on a highly professional cast. Using Bureau of the Census occupational definitions, just 4 percent of all persons employed in 1900 were "professional, technical, and kindred" workers. But this "professional ratio" doubled to 9 percent by 1950; and it doubled again, to 18 percent, by 1988 (chart 1). Professional, technical, and kindred workers have also become prominent across a far broader range of industries in the years since 1950. Such workers then clustered in a small corner of the economy. But by 1988, they made up 20 percent or more of the labor force in industries ranging from health care and education, to high tech manufacturing and business services, to government and entertainment. In terms of international competitiveness, income per worker, and technical advance, this group of professionalized industries forms perhaps the most successful sector of the U.S. economy.

What distinguishes professionals from other workers is their vocational relationship to formal bodies of knowledge. While intellectuals live for ideas, Max Weber once quipped, professionals live off ideas. Industries employing large numbers of professionals thus depend on the productivity of knowledge workers, the evolution of formal knowledge systems, and the movement of ideas into practice. This close relationship to conceptual systems typically differentiates the management of work and the sources of change in professionalized industries from patterns observed elsewhere in the economy.

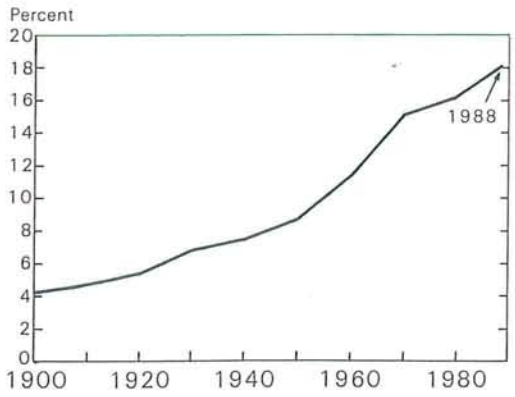
Professional work typically involves the custom application of expertise to discrete cases or projects. Because the expertise resides with the employee, and because the work is largely nonrepetitive, management must delegate a significant amount of authority to professional subordinates. Managers are thus largely removed from direct supervision of the work process.[1] And unless they can readily measure work outputs, which is often not the case, they find it difficult to monitor the

performance of professional workers. Professional organizations do develop explicit managerial structures where cases or projects involve the coordination of many professionals; where there are significant economies of scale or scope; or where market coordination fails. Large engineering and entertainment projects need close coordination; hospitals and universities can economize by operating on a larger scale; welfare organizations and consulting firms can often capture economies of scope; and health maintenance organizations have expanded because of breakdowns in the medical payment system. But where highly professional organizations do expand, the necessary delegation of authority to professional, technical, and kindred workers dilutes managerial authority. This renders management more difficult, narrows spans of control, and raises the cost of oversight.

The dynamic nature of professional conceptual systems further differentiates professional industries from the rest of the economy. In professions with strong research establishments, be they in universities, work establishments, government agencies, or elsewhere, technical change has been routinized through research seminars and laboratories, professional journals and associations, and public and private regulatory bodies. The direction of technical change, however, remains quite unpredictable. The shape of computers, the therapy for ulcers, and the interpretation of twentieth-century history will all be quite different within a decade. Such volatility renders more difficult long-term investment decisions, whether in physical or human capital. And enterprises must remain flexible to accommodate disruptions flowing as a matter of course from professional activities.

Chart 1

Ratio of Professional, Technical, and Kindred Workers to Total Employed Persons, 1900-88



What distinguishes professionals from other workers is their vocational relationship to formal bodies of knowledge.

This article is an introductory overview of professionalization of the U.S. economy in the years since 1950. After a look at professional concentrations by industry in section I, section II defines the industrial source of the rising U.S. professional ratio. Section III begins the process of identifying a sector of professional industries in the U.S. economy. Section IV looks at the pace and timing of the professionalization process, paying special attention to recent changes, and section V examines its demographic structure. The article concludes with some limited policy recommendations.

I. Out of Obscurity

Discussions of recent economic change in the United States have largely overlooked the emergence of a sector of professional industries. Students of industrial structure seem more concerned with the dramatic fall in manufacturing's share of total U.S. employment than the rise of professionalized industries; most have directed their attention to the decline of the old, not the shape of the new. Various authors have nevertheless discussed topics touching on professionalization. They have written on the rise of an "information economy," the development of "high tech" manufacturing, and the growth of certain professional service industries. The "professional sector" concept focuses on knowledge and ideas, not information; and it groups high tech, professional service, and other industries on the basis of similarities in the

Sources and Definitions

It is a thankless task defining which occupation is and which is not "professional," or whether one occupation is more professional than another. Professional status is widely desired, while criteria for inclusion or comparison are vague: many workers claim to perform their duties in a professional manner, and most occupations aspire to the privileges and social standing of lawyers and physicians. Thus the U.S. Bureau of the Census's occupational definitions were eagerly adopted.

The measure of industry professionalization used in the study is the ratio of "professional, technical, and kindred workers," as defined by the Bureau of the Census, to the industry's total employed labor force. The measure does not distinguish different degrees of "professionalism" among occupations. In addition, the "professional, technical, and kindred" classification is more inclusive than that of "professional" alone. According to the 1970 Census enumeration, it includes accountants; computer specialists; engineers; librarians, archivists, and curators; life and physical scientists; physicians, dentists, and related practitioners; nurses, dietitians, and therapists; health technologists and technicians; social scientists; social and recreational workers; teachers, except college and university; engineering and science technicians; technicians, except health, engineering, and science; writers, artists, and entertainers; and other professional, technical, and kindred workers (including actuaries, architects, clergymen, lawyers, mathematicians, personnel and labor relations workers, statisticians, and college and university teachers).

The use of this Census definition has the virtue of simplicity and allows comparison with other work. And the figures needed to compute professional ratios are available in the decennial census publications and in the Bureau's Current Population Survey tapes. The study used the decennial censuses of 1950, 1960, and 1970, along with data from the Current Population Survey for 1980 and 1988 (U.S. Bureau of the Census, 1954, 1963, 1972, 1982, 1988).

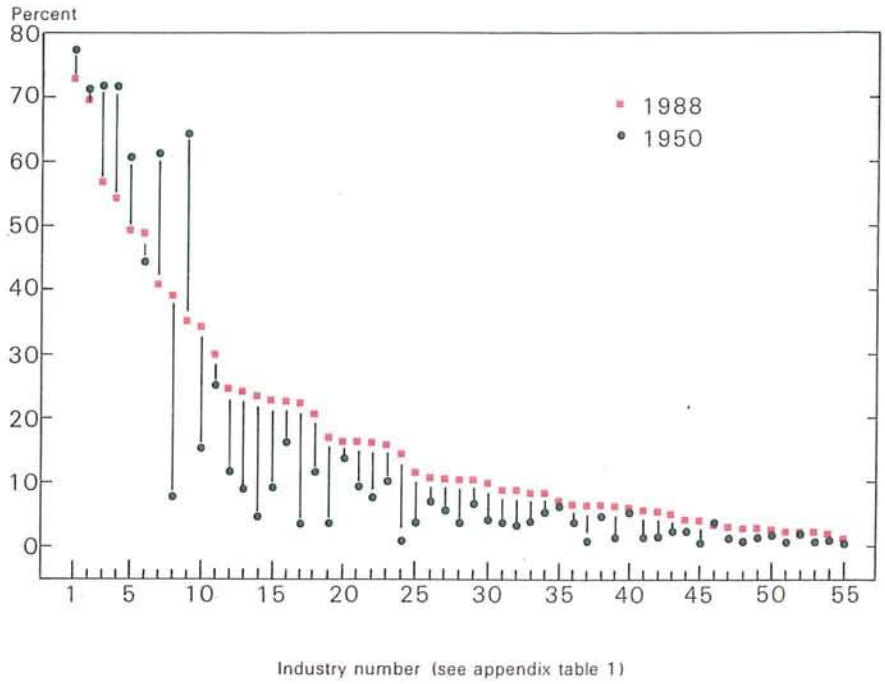
The Census Bureau, unfortunately, dramatically changed its occupational classification scheme in the early 1980s, making the 1980 decennial Census and the post-1982 Current Population Surveys not readily comparable to earlier years. This study crossed this divide, examining data for 1950, 1960, 1970, 1980, and 1988. So one classification scheme had to be chosen, and data converted from the other. For two reasons, the older scheme and its "professional, technical, and kindred worker" classification was selected. First, this decision involves the conversion of just one year of data: as the Current Population Survey for 1980 used the old classification scheme, only figures for 1988 need be converted. Second, the earlier classification seems more congruent with common usage. The new scheme, for example, excludes accountants from the "professional" rubric.

To make the 1988 count of "professional, technical, and kindred" workers comparable to the numbers published in earlier years, first the current "professional specialty" and "technicians and related support" occupational categories were combined. Occupations reclassified out of or into the combined "professional, technical, and kindred worker" category were then added or subtracted. Where the new scheme moved parts of occupations across these category lines, specific Current Population Survey observations were reassigned at random, according to probabilities provided in Census publications. The major changes from current practice involved the inclusion of accountants, personnel and labor relations workers, sales engineers, and therapy assistants; and the exclusion of decorators and window dressers, health trainees, and practical nurses. For documentation of the classification changes, and the source of the probability weights, see Vines and Priebe (1989).

While changes in the classification of industries have not been as dramatic as those of occupations, they also presented problems. Some changes could be accommodated, such as shifting ordnance back to miscellaneous manufacturing and the U.S. postal service back to government in the 1988 count. Others, such as the 1970 movement of government welfare services from government to welfare and religion, could not. Unaccommodated industry changes were relatively rare, and do not influence the general conclusions. Among the industries included in the residual "Other Professional Industries" group are offices of actuaries, artists, authors, and psychologists, and government and nonprofit research organizations.

Chart 2

Professional Ratios: Detailed Industries 1950 and 1988



composition of their work forces and their relationship to formal knowledge systems. The usefulness of the professional sector concept depends on the significance of these characteristics.

The professional sector has escaped identification in part because the basic map of U.S. industrial structure—the 1-digit Standard Industrial Classification scheme—has been a poor guide to the professionalization process.[2] Of the broad industrial categories in the S.I.C., miscellaneous services employs the highest proportion of professional workers. But miscellaneous services is a residual grouping, not a coherent sector. Professional ratios moreover vary widely among the subsidiary industries of 1-digit divisions. As the incidence of big business cuts across the traditional S.I.C. lines, so it is with professionalization.

For a better view of the professionalization of U.S. industry, we require a finer industrial classification. Chart 2 and appendix table 1 array fifty-five industries according to their 1988 professional ratios, and give industry ratios for 1950 and 1988.[3] The 1950 and 1988 arrays in chart 2 are similarly shaped, albeit with some differences that will be explained below. In each array there is a small clump of highly professionalized industries with professional ratios above 40 percent. There follows a rapid drop-off to industries with professional ratios somewhat above the national average. Then begins a long array of industries whose ratios gradually descend to insignificant levels. In the end we come to industries wherein professionals clearly provide subordinate and peripheral services.

The clump of industries with exceptionally and consistently high professional ratios—the eight most professionalized in 1950 and eight of the top nine in 1988—are classified by the Bureau of the Census within its "Professional and Related Services" grouping. (This category, in turn, forms part of the "miscellaneous services" S.I.C. division.) These eight industries—accounting services, education, engineering and architectural services, hospitals, other health care, legal services, welfare and religious services, and "other" professional services—will be called the "Professional and Related Services*" industries, for the remainder of this article.[4] Each produces professional services as its primary output. Whether this group should be accepted as the pro-

fessional sector of the U.S. economy is discussed below.

As shown in chart 2 and appendix table 1, professional ratios at the high end of the array declined over time. In 1950, professional, technical, and kindred workers made up 63.4 percent of all persons employed in the Professional and Related Services* industries. But this ratio fell to 48.9 percent by 1988. Of the eight industries, only hospitals employed a greater proportion of professionals in 1988 than it had in 1950.[5] All other Professional and Related Services* industries grew more dependent on nonprofessional labor over this thirty-eight year period, most of them significantly more dependent.

Outside of the Professional and Related Services* industries, professional concentrations rose in forty-seven of the remaining forty-eight industries. (These ratios are given in appendix table 1.) In seven of these industries—aircraft, chemicals, communications, electrical machinery, mining, miscellaneous manufactures, office machinery, and professional equipment/instruments—professional ratios rose by more than 10 percentage points between 1950 and 1988. Only in construction did professionals become more scarce: there the ratio fell only from 3.7 to 3.2 percent. The process of professionalization clearly extended beyond the Professional and Related Services* group, and the rising professional concentrations in these industries contributed to the doubling of the U.S. ratio.

The "professional sector" concept focuses on knowledge and ideas, not information; and it groups industries on the basis of similarities in the composition of their work forces and their relationship to formal knowledge systems.

Given the contrasting changes in professional concentrations at the high and low ends of the spectrum, two questions arise. The first deals with the industrial origins of the increase in U.S. professionalization. It asks whether the rising professional ratios in the general economy explain the phenomenon, or whether expanding employment shares of highly professionalized industries, such as the Professional and Related Services* industries, led the upsurge. The second question deals with the identification of a professional sector. In 1950, a huge gap in professional ratios separated the Professional and Related Services* industries from the remainder of the economy. But in the intervening years, mainstream industries professionalized quite rapidly; and the occupational structure of Professional and Related Services* industries became more like the rest of the economy. Drawing a line around a professional sector thus becomes more difficult over time. These questions will be addressed in the following two sections.

II. The Industrial Sources of U.S. Professionalization

A shift-share analysis, detailed in the appendix, decomposes the change in the overall professional ratio into the two above-mentioned effects. The procedure measures a ratio effect, or the influence of a change in each industry's professional ratio on the national rate; a share effect, or the impact on the national rate of a shift in each industry's share of total employment; and an interaction effect that cannot be allocated between the ratio and share effects. These effects are then totaled across industry groups.

Table 1 presents results of the shift-share analysis for the 1950–88 period. (Details for the fifty-five industries are provided in appendix table 1.) Looking at the national totals for the ratio and share effects, we see both were positive. Rising industry professional ratios and above-average employment growth in the highly professionalized industries both contributed to the increase in the U.S. ratio. The share effect, however, was far larger than the ratio effect. The professionalization of the U.S. work force between 1950 and 1988 was clearly driven by the expanding share of total U.S. employment held by highly professionalized industries.

The Professional and Related Services* industries were by far the most highly professionalized U.S. industries in 1950. And between 1950 and 1988, these eight industries expanded their share of the employed labor force from 8.2 to 21.0 percent. With their large initial professional concentrations, and this tremendous employment growth, the shift-share analysis attributes the bulk of all share effects to the Professional and Related Services* group. Of the 8.9

Table 1
Contribution to Movements in the National Professional Ratio: Share and Ratio Effects

	1950 Total Employment (thousands)	Employment Share (percent)	Professional Ratio (percent)	1988 Total Employment (thousands)	Employment Share (percent)	Professional Ratio (percent)	Effects (percentage points)			
							Ratio	Share	Interaction	Total
All Industries	55,805	100.0	8.7	112,569	100.0	18.0	2.4	8.9	−2.0	9.3
Professional & Related Services* Industries	4,566	8.2	63.4	23,655	21.0	48.9	−1.2	8.2	−2.0	5.1
All Other Industries	51,239	91.8	3.8	88,914	79.0	9.7	3.5	.7	0	4.2

Note: 780,000 employed persons not allocated by the Bureau of the Census in 1950 have been included in the all other industries group.
Source: U.S. Bureau of the Census (1954a, 1988), and author's calculations.

percentage point increase in the national professional ratio attributed to shifting employment shares, 8.2 points are assigned to these eight industries. Shifts among industries outside this group accounted for just the remaining 0.7 percentage point.

Changes in industry professional concentrations resulted in a much milder 2.4 percentage point increase in the national ratio. And as in the case of shifting employment shares, the pattern in the Professional and Related Services* industries differed quite sharply from that elsewhere in the economy. As noted earlier, professional ratios fell in all but one of the eight Professional and Related Services* industries while rising in all but one of the remaining forty-seven. Ratio changes in the former group reduced the national rate by 1.2 percentage points; in the latter they raised the national rate by 3.5 points. Outside of the Professional and Related Services* industries, rising professional concentrations were thus the major factor increasing the national ratio.[6]

Of the 9.3 percentage point gain in the U.S. professional ratio from 1950 to 1988, the shift-share analysis attributes the majority, 5.1 percentage points, to the Professional and Related Services* industries. Tremendous growth in the group's employment share overwhelmed its falling professional concentrations. Elsewhere in the economy, ratio and share effects were both positive and combined to raise the national rate by 4.2 percentage points. Here, however, rising industry professional concentrations had a far greater effect than shifting employment shares. The two industry groups thus contributed somewhat similarly to the increase in the national professional ratio. But in each, the pattern of growth was distinct.

III. Defining a Professional Sector

The decline in professional ratios among the Professional and Related Services* industries and the increases elsewhere in the economy brought the professionalization of the two groups closer together. In 1950, 63.4 percent of all those who worked in the Professional and Related Services* group held professional, technical, or kindred occupations. The remainder of the economy made do with 3.8 professional, technical, or kindred workers per hundred persons employed. By 1988, professional ratios were 48.9 and 9.7 percent, respectively. The disparity between groups fell even more according to other indicators. In 1950, a 19.0 percentage point gap separated the lowest professional ratio in the Professional and Related Services* group from the highest elsewhere in the economy. But the two groups actually overlapped in 1988. The lowest concentration of professionals in a Professional and Related Services* industry (other health services) was below that of one outside the group (office machinery, which includes computers). Distinguishing between professionalized and nonprofessionalized industries thus becomes more difficult.

Contributing to this convergence was the fact that, in the general economy, the largest absolute increases in professional concentrations occurred in those industries that had the highest initial ratios. Ten industries outside the Professional and Related Services* group had professional ratios above 20 percent in 1988: aircraft and parts; business services; chemicals and allied products; communications; electrical machinery, equipment, and supplies; entertainment and recreational services; mining; office

Table 2

Occupational Distribution: Professional and Related Services Industries, 1950 and 1988.*

Percent

Industry	Profes-sional	Managers	Clerical Workers	Sales Workers	Craft Workers	Laborers & Operatives	Service Workers
1950 Occupational Distribution							
Other Prof. Inds.	77.3	3.3	10.2	.5	3.3	2.2	2.5
Accounting Services	71.8	3.0	23.9	.4	.3	.3	.1
Education	71.7	1.5	7.9	.2	2.7	2.4	13.3
Engin./Architech.	71.1	4.7	15.0	.7	4.9	4.0	.6
Other Health Services	64.3	2.1	20.1	.2	1.6	1.8	9.9
Welfare & Religion	61.3	2.2	12.4	.3	1.9	3.9	17.7
Legal Services	60.6	.7	36.7	.1	.6	.4	.8
Hospitals	44.5	1.6	9.1	.1	3.2	5.0	36.3
Prof. & Related Serv.* Total	63.4	1.7	12.2	.2	2.5	2.9	16.9
1988 Occupational Distribution							
Other Prof. Inds.	72.7	9.3	11.1	.8	.8	2.5	2.0
Accounting Servs.	56.4	11.7	29.9	.4	1.1	.3	.3
Education	53.9	8.1	17.0	.8	1.6	3.6	14.3
Engin./Architech.	69.2	10.6	13.1	.8	2.4	2.8	.3
Other Health Servs.	34.8	8.0	18.4	.4	1.8	2.3	33.9
Welfare & Religion	40.5	8.4	19.9	.6	1.1	4.3	25.1
Legal Services	49.0	4.0	46.2	0	0	.2	.6
Hospitals	48.5	5.7	17.5	.4	2.2	1.9	23.0
Prof. & Related Serv.* Total	48.9	7.7	19.2	.6	1.6	2.8	18.7
Percentage Point Change in Occupational Distribution, 1950–88							
Other Prof. Inds.	−4.6	6.0	.9	.2	2.5	.3	−.5
Accounting Servs.	−15.3	8.7	6.0	0	.8	0	.1
Education	−17.8	6.5	9.1	.6	−1.1	1.2	1.0
Engin./Architech.	−1.8	5.9	−1.9	0	−2.4	−1.2	−.4
Other Health Servs.	−29.5	5.9	−1.7	.2	.2	.5	24.0
Welfare & Religion	−20.7	6.2	7.5	.3	−.7	.4	7.4
Legal Services	−11.6	3.3	9.6	−.1	−.6	−.2	−.2
Hospitals	4.0	4.1	8.4	.3	−1.0	−3.1	−13.2
Prof.& Related Serv.* Total	−14.5	5.9	7.0	.4	−.8	−.1	1.8

Source: U.S. Bureau of the Census 1954a, 1988.

machinery (including computer equipment); professional and photographic equipment and watches/instruments; and public administration.[7]

While most American industries were professionalizing, the occupational structure of the Professional and Related Services* industries grew closer to that found elsewhere in the economy. The declining concentration of professional, technical, and kindred workers was nearly matched by increasing proportions of clerical and managerial personnel (see table 2). Clerical workers showed the greatest proportional gain of any occupational group among the eight Professional and Related Services* industries. Changes in clerical concentrations nevertheless varied substantially, and in two cases actually declined.[8] The employment of managers meanwhile increased in all eight Professional and Related Services* industries, rising from a minuscule 1.7 percent to a more

Table 3
The Professional Sector Defined Two Ways, 1950 through 1988
Professional Ratio

	1950		1960	
Professional Ratio above 20%	Other Prof. Inds*	77.3	Engin/Architech*	71.4
	Accounting Services*	71.8	Education*	67.3
	Education*	71.7	Other Prof. Inds*	66.0
	Engin/Architech*	71.1	Accounting Services*	65.8
	Other Health*	64.3	Legal Services*	58.2
	Welfare & Religion*	61.3	Other Health *	54.4
	Legal Services*	60.6	Welfare & Religion*	53.0
	Hospitals*	44.5	Hospitals*	40.2
	Entertainment	25.2	Aircraft	22.3
Professional Ratio above National Average	Business Services	16.4	Entertainment	19.5
	Aircraft	15.4	Business Services	17.6
	Petro/Coal Products	14.0	Office Machinery	17.4
	Chemicals	11.8	Prof. Equip/Instruments	16.2
	Public Administration	11.7	Chemicals	15.6
	Non-Profit Orgs.	10.2	Elec. Machinery	15.2
	Printing	9.5	Petro/Coal Products	15.1
	Prof. Equip/Instruments	9.3	Public Administration	13.7
	Elec. Machinery	9.2	Non-Profit Orgs.	12.9
	National Ratio:	8.7		11.3
Professional Sector: Defined as industries with professional ratios above 20 percent				
	Professional Ratio:	59.3		55.1
	Employment Share:	9.2		12.5
Professional Sector: Defined as industries with professional ratios above the national average.				
	Professional Ratio:	33.4		35.3
	Employment Share:	20.0		24.8

Note: All industries listed have professional ratios above the national average.
Industries above the dotted line have professional ratios above 20 percent.
* Professional and Related Services* Industry
Source: U.S. Bureau of the Census 1954a, 1963a, 1972a, 1980, and 1988.

significant 7.7 percent of total employment in the group. Some of these new managers probably directed the activities of the expanded clerical corps; and this 7.7 percent managerial share was lower than the 10.9 percent share found elsewhere in the economy. But the size of this increase in share, and its consistency across all eight professional service industries, suggests that professionals were working in larger groups and deriving greater benefit from managerial coordination.[9]

The falling professional ratios observed in the Professional and Related Services* industries may reflect general trends in the delivery of professional services. The increased use of substitute, support, and supervisory personnel in the Professional and Related Services* industries may characterize work processes in professional offices throughout the economy. If so, then the professional ratio may be a biased indicator of the amount of labor committed to the output of professional work. The doubling of the U.S. professional ratio between 1950 and 1988, and the rise among the non-Professional and Related Services* industries from 3.8 to 9.7 percent, would then understate growth in the number of workers involved in the production of professional output.

By 1988, professionals had become critically important to many industries not involved in the production of professional work per se. In terms of their

Table 3 *continued*

The Professional Sector Defined Two Ways, 1950 through 1988

Professional Ratio

1970		1980		1988	
Engin/Architech*	72.4	Other Prof. Inds*	75.0	Other Prof. Inds*	72.5
Education*	59.7	Engin/Architech*	74.3	Engin/Architech*	69.2
Accounting Services*	58.5	Accounting Services*	57.4	Accounting Services*	56.4
Legal Services*	53.4	Legal Services*	54.9	Education*	53.9
Welfare & Religion	53.1	Education*	54.3	Legal Services*	49.0
Other Prof. Inds.*	47.1	Welfare & Religion*	50.7	Hospitals*	48.5
Other Health	39.3	Hospitals*	42.9	Welfare & Religion*	40.5
Hospitals	36.8	Other Health*	35.2	Office Machinery	38.8
Office Machinery	29.6	Office Machinery	31.3	Other Health*	34.8
Aircraft	26.2	Aircraft	29.8	Aircraft	33.9
Entertainment	23.6	Entertainment	28.7	Entertainment	29.6
Business Services	22.1	Petro/Coal Products	21.0	Chemicals	24.4
Petro/Coal Products	21.1	Business Services	20.8	Elec. Machinery	23.9
----------	----------	----------	----------	Communications	
Machinery	19.0			Prof. Equip/Instruments	22.6
Chemicals	18.5	Communications	19.1	Business Services	22.4
Elect. Machinery	18.4	Public Administration	19.0	Mining	22.1
Prof. Equip/Instruments	16.9	Elec. Machinery	19.0	Public Administration	20.4
Public Administration	16.5	Chemicals	18.7		
	15.1		16.2		18.0
	46.0		44.4		37.2
	21.4		24.3		39.5
	35.9		36.7		37.2
	33.4		34.9		39.5

labor inputs, the office machinery, aircraft, and entertainment industries (where professional workers accounted for 38.8, 33.9, and 29.6 percent of employees, respectively) are no longer so different from the lower half of the Professional and Related Services* group, consisting of legal services, hospitals, welfare and religion, and other health services (with professional ratios ranging from 49.0 to 34.8). As the professional ratios of certain Professional and Related Services* industries and industries outside of this group converge, their constituent enterprises can be expected to adopt more similar strategies, structures, and productive processes.

At this stage in the discussion, identifying a professional sector that displays such similarities is largely an arbitrary exercise. Using the professional ratio measure, one could adopt an absolute cutoff, say 20 percent, as a boundary line. Another approach would use a time-contextual cutoff, say 100 percent of the national ratio. The absolute boundary appeals because an industry seems to need some minimum concentration of professional, technical, and kindred workers before attaining a "professional" character. The relative approach, on the other hand, is sensitive to historical conditions and avoids anachronistic judgments.

Table 3 provides data on professional sectors, defined in two different ways, from 1950 to 1988. The first uses a 20 percent professional ratio filter; the second uses the national professional ratio for the year in question as the cutoff. For 1988, the two measures define identical professional sectors: the national ratio that year was 18.0 percent, and no industry then had a ratio between 18.0 and 20 percent. Thus the "1988 professional sector," defined in either of these two ways, included all eight members

of the Professional and Related Services* group and the ten other aforementioned industries with professional ratios above 20 percent. The sector employed nearly 40 percent of the work force in 1988; and three in eight of this 40 percent had professional, technical, or kindred occupations. The professional sector defined by the absolute 20 percent cutoff grows shorter as we look back through time: in 1950 it included just the Professional and Related Services* and the entertainment industries. The list of industries with above average ratios, however, turns out to be remarkably stable over the 1950–88 period. The group's professional ratio also remained remarkably stable, while its share of total employment essentially doubled over this thirty-eight-year period.

IV. Pace and Timing

Table 3 suggests that the pace of professionalization varied across decades as it has across industries. The number of industries with professional ratios above 20 percent increased sharply in the 1960s and 1980s, but not at all in the 1950s and 1970s. Chart 1 also shows variation in the timing of U.S. professionalization. While the chart shows the U.S. professional ratio rising continuously over the post–World War II period, the ratio jumped sharply upward in the 1950s and even more so in the 1960s; the smallest increase came in the 1970s; thus far in the 1980s, professionalization has again advanced at a rapid rate. In this chart it is the deceleration of the 1970s that stands out prominently.

Performing a shift-share analysis for each of the four decades (1950–60; 1960–70; 1970–80; 1980–88) sharpens the picture of how the U.S. professional ratio increased. The results, presented in table 4, show significant shifts in the source of professionalization. Share effects dominated the first three decades of the period under review. Between 1950 and 1980, expansion in the U.S. professional ratio came almost exclusively from the growth of highly professionalized industries. Then ratio effects predominated in the 1980s, as the initiative in expanding the U.S. professional ratio moved outside the traditional Professional and Related Services* industries.

Two factors appear to explain the shift in the 1980s in the sources of U.S. professionalization. Among the Professional and Related Services* industries, the share of total employment of the huge education industry stopped expanding. Professional ratios elsewhere in the economy meanwhile resumed their secular expansion. As these changes appear durable, industries outside the Professional and Related Services* core may continue to provide the majority of new professional employment opportunities.

Among the Professional and Related Services* industries in the 1980s, the fall-off in education is striking. The industry's professional ratio fell, which is not surprising among members of the group. But education's share of total employment also declined, which is quite unusual. Education had accounted for about half of professional and total employment in the Professional and Related Services* industries in both 1950 and 1980; between 1950 and 1980, the industry had grown at about the same rate as the group. Had education in the 1980s matched the performance of the seven remaining industries, the group would again have raised the national professional ratio by more than all other industries. But by the 1980s the baby boom generation had largely passed through its school-going years, and the demand for educational services fell. And according to U.S. Bureau of Labor Statistics projections, employment in the education industry will continue to grow more slowly than the U.S. total through the year 2000.[10]

The general economy is likely to remain the primary source of professional employment gains through the 1990s.

The professionalization of industries outside the Professional and Related Services* core meanwhile continued apace. This produced, in the decade, a doubling in the number of non-core industries with professional ratios greater than 20 percent (from five to ten). As can be seen in the professional sector listings of table 3, the commercialization of science-based technologies and the emergence of electronic data processing were the key factors pushing new industries through this 20 percent filter. In 1950, the only industry outside Professional and Related Services* with a professional ratio above 20 percent had little to do with science or computers: the professional, technical, and kindred workers employed in the entertainment industry were writers, performers, designers, and the like. But all industries thereafter added to the list, with the probable exception of government, em-

Table 4

Contribution of Share and Ratio Effects to Movements in the National Professional Ratio, 1950 through 1980

	Data for Year		Effects for Decade (Percentage points)				
Year	Total Employment (000)	Professional Ratio	Ratio	Share	Interaction	Total	Decade
All Industries							
1950	55,805	8.7					
1960	63,747	11.3	.3	2.4	−0	2.7	1950s
1970	76,754	15.1	.7	3.6	−.6	3.8	1960s
1980	99,807	16.2	.1	1.0	−0	1.1	1970s
1988	112,569	18.0	.8	0.7	.3	1.8	1980s
Professional and Related Services* Industries							
1950	4,566	63.4					
1960	7,332	58.0	−.4	2.1	−.2	1.5	1950s
1970	13,228	51.4	−.8	3.5	−.6	2.2	1960s
1980	19,291	49.5	0	1.0	−.3	.7	1970s
1988	23,655	48.9	0	.8	−.1	.7	1980s
All Other Industries							
1950	51,239	3.8					
1960	56,415	5.3	.7	.3	.1	1.2	1950s
1970	63,526	7.5	1.5	.1	−0	1.6	1960s
1980	80,516	8.2	.1	0	.3	.4	1970s
1988	88,914	9.7	.8	−.1	.4	1.1	1980s

Source: U.S. Bureau of the Census (1954a,1963a,1972a,1980,1988), and author's calculations.

ployed professional, technical, and kindred workers for expertise based primarily in science or computer skills. These industries include those commonly classified as "high tech"—the five manufacturing industries and the "high tech" portions of business services (computer and data processing services and research and development services). The list also includes mining and communications, which now are not commonly classified as high tech.[11]

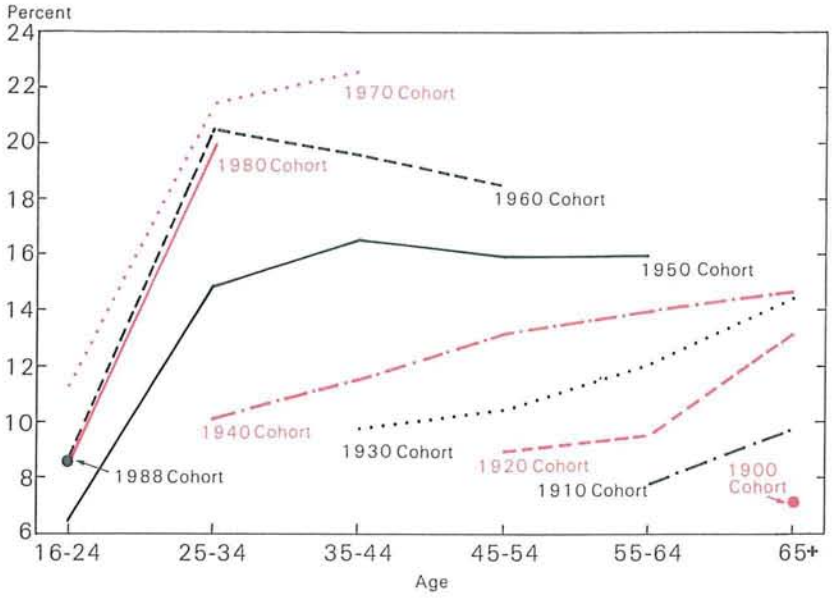
Increased employment of workers with science- and computer-based skills is also apparent in industries with professional ratios below 20 percent. The banking/credit and brokerage industries, for example, introduced sophisticated new financial engineering tools and computer applications in the 1980s. This pushed professional ratios in these two financial industries up by 4.8 and 6.1 percentage points, to 10.3 and 10.6 percent, respectively. With technical sophistication and the demand for professional labor spreading so widely, the potential seems great for continued movement of professionals beyond the traditional Professional and Related Services* core.

Evidence from the international trade arena further underlines the new significance of the highly professionalized industries not in the traditional Professional and Related Services* group. Robert Reich (1989) sees a new international division of labor developing in the 1980s, with highly developed areas like the United States providing professional goods and services and developing areas specializing in production. In a recent article, Jane Little compiled a list of U.S. exporting industries and U.S. import-competitive industries, and her results corroborate such a proposition. The manufacturing industries Little identified as most vulnerable to import competition all have low professional ratios while all five manufacturing industries in the 1988 "professional sector" are on her list of six exporters. Among the nonmanufacturing industries on the 1988 professional sector list, education, entertainment, and business services are also significant exporters.[12] To the degree that there is a new international division of labor, such as Reich described, the upward shift in the demand for professional labor outside the Professional and Related Services* industries is durable.

The general economy is therefore likely to re-

Chart 3

Professional Ratios for Generational Cohorts, by Age



Source: Table 5.

main the primary source of professional employment gains through the 1990s. The expansion of sophisticated science- and computer-based technologies into new areas, and the development of a new international division of labor, can be expected to extend further the demand for professionals beyond the traditional Professional and Related Services* industries. Meanwhile, the demand for education appears likely to remain sluggish through the decade.

V. The Constraint of Demography

The discussion above showed professional employment expanding across the industrial landscape in the 1980s, while slowing in the Professional and Related Services* core. This pattern also appeared likely to continue into the future. A review of the demographics of professionalization, however, suggests possible constraints on significant further increases in U.S. professionalization.

The professionalization process has had a distinct demographic structure, with differences within and between 10-year generational cohorts.[13] (Cohorts, for convenience, are identified by the year in which their members were 16 to 24 years of age.) Among all cohorts entering the labor force before 1950, professional ratios consistently increased with age. As illustrated in table 5 and chart 3, the concentration of professional, technical, and kindred workers in the 1940 cohort rose steadily over time, from 10.2 percent at ages 25 to 34 (in 1950) to 14.8 percent at ages 65 and over (in 1988). This pattern then changed abruptly, as the cohorts of 1950 and 1960 reached their peak professional concentrations between the ages of 25 and 44. Peaks for the 1970 and later cohorts will remain unknown until more observations become available.[14]

This shift in the pattern of cohort professionalization is closely associated with movements in the national professional ratio noted above: the tremendous increases between 1950 and 1970, and then the deceleration between 1970 and 1988. In the 1950s and 1960s as the older cohorts continued increasing their professional ratios, the younger cohorts moved quickly to their peak concentrations. Professional ratios for the 25 to 34 and 35 to 44 age groups thus showed tremendous leaps in these two decades. In the 1970s and 1980s, there were no such increases among any age group.

A second difference among cohorts has been a general increase over time in their professional ratios.

Cohorts entering the labor force would thus reach significantly higher levels of professionalization than the retiring cohorts; for any age group, professional ratios thus were generally higher than they had been a decade earlier. This upward march in cohort professionalization has consistently pushed up the national ratio. But now the end of this trend may be in sight. The 1980 and 1988 cohorts have thus far had lower age-specific professional ratios than either the 1970 or 1960 cohorts. These are the only instances in table 5 of declining professional concentrations for a given age group. The data are thin, and certainly inadequate to declare a fall in cohort professional concentrations. But it seems reasonable to sense some limit to cohort professional ratios at current levels, and thus to expect little further increase in the overall national rate.

Reinforcing this sense of limited future increases in U.S. professionalization is the maturation of the baby boom generation. The giant generation, born between 1946 and 1964, entered the work force as the cohorts of 1970 and 1980. If they repeat the pattern established by the cohorts of 1950 and 1960, they are now in their peak professional years. If baby boom ratios do decline as their members age, as was the case for the preceding two cohorts, then the unusually large size of the baby boom generation will further retard any increases in the national rate.

The cohorts following the baby boom generation are relatively small. And their peak professional concentrations may be no higher. If so, then the current economywide professional concentration of 18.0 percent is very close to its long-run equilibrium level.[15] The expanding employment opportunities beyond the Professional and Related Services* industries may thus collide with a demographic constraint.

VI. Conclusions

The years since 1950 have seen huge changes in the employment of professional, technical, and kindred workers in the United States. These occupations more than doubled their share of the work force, and their dispersion among the nation's industries widened enormously. In 1950, professionals were largely concentrated in the eight Professional and Related Services* industries, and there they dominated the work force. One could then reasonably speak of professional occupations and professional industries as one and the same. Since 1950, employment in the Professional and Related Services* industries expanded tremendously and these industries came to employ a far higher proportion of clerical and managerial workers. Professional, technical, and kindred workers also became much more common elsewhere

Table 5
Professional Ratios by Generational Cohort and Age Group

	Cohort Age					
Cohort[a]	16–24	25–34	35–44	45–54	55–64	65+
1988	8.7					
1980[b]	8.7	20.0				
1970[b]	11.5	21.5	22.7			
1960	8.8	20.5	19.6	18.5		
1950	6.5	14.9	16.6	16.0	16.0	
1940		10.2	11.6	13.3	14.1	14.8
1930			9.7	10.4	12.1	14.5
1920				9.0	9.6	13.2
1910					7.8	9.7
1900						7.2

[a]Cohorts defined by year in which their members were aged 16–24.
[b]Baby boom generation
Source: U.S. Bureau of the Census: 1954b. Table 11, "Major Occupation Group: [Employed] Persons 14 Years Old and Over, by Years of School Completed, Age, Color, and Sex, for the United States, by Regions: 1950"; 1963a. Table 6, "Age of Employed Persons, by Detailed Occupation and Sex, for the United States: 1960"; 1972a. Table 40, "Age of Employed Persons, by Detailed Occupation and Sex: 1970"; and 1980, 1988.

in the economy. Thus in the years since 1950, the core professional industries normalized their occupational structure as the rest of the economy professionalized. A new professional sector—composed of industries dependent on professional labor but employing significant proportions of supervisory, support, or substitute workers—can now be said to exist. Using a 20 percent professional ratio cutoff, the 1988 professional sector would include eighteen industries that produce a wide array of goods and services and employ nearly 40 percent of the U.S. work force.

In the 1980s, professional employment for the first time expanded more in the general economy than in the eight Professional and Related Services* industries. This pattern appears likely to continue at least through the 1990s. But demographic constraints will probably slow this expansion of professionals into new areas of employment. The large number of professionals who entered the work force in the years since 1950 facilitated the significant shifts discussed in this article. The tremendous growth of professional employment in the 1950s and 1960s—in the Professional and Related Services* industries and elsewhere in the economy—owed much to the step-up and speed-up in cohort professionalization. In the 1980s, professional employment expanded rapidly into new industries in part because then the baby boom generation was reaching its years of peak professional concentration. But the forces that raised the professional ratio in the past now appear spent. Cohorts are no longer increasing the speed at which they professionalize. The size of cohorts passing through their peak professional years will be relatively small in the future. And the peak cohort professional ratio appears stalled between 20 and 25 percent.

If opportunities for professional employment continue to emerge in nontraditional areas, as they have in the 1980s, the U.S. economy will probably not be able to exploit them as easily at it has in the past. Professionals choose their specialties at the beginning of their working careers, and thereafter find it difficult to change their skills. When large numbers of professionals are entering the labor force, those just starting out can exploit the available opportunities. But when fewer new professionals are coming onstream, as will soon be the case, we can expect the misalignments between opportunity and expertise to become more common and persistent. To adjust to changing circumstance in the future, we must either expand the supply of new professionals or shift experienced professionals between industries and professions. Both are difficult and costly operations. But if the nation forgoes the expenditure, it may miss new opportunities for professional work and remain trapped in sectors of declining demand.

The education industry played a key role in the professionalization of the U.S. labor force since 1950, and it may again play such a role in the future. The industry, higher education in particular, trains most professionals. It also provides critical services in the creation, certification, and dissemination of new professional techniques. Education thereby functions as a basic capital goods industry to professional occupations and industries. The industry had to grow dramatically first to raise and quicken cohort professionalization, and then to train the huge baby boom generation. The impending decline in the supply of new professionals could create new demands on the education industry. One response would draw the children of the nation's underprivileged groups into professional occupations. Another would facilitate professional career and industry shifts. The structure of educational initiatives to meet these requirements may well differ from models currently in place. But for the economy to adapt to changing professional opportunities, serious programs need to be developed.[16]

Appendix

The shift/share analysis begins with the identity that the number of professionals in an industry (P) equals total U.S. employment (N_{us}); multiplied by that industry's share of total U.S. employment (s); multiplied by the industry's professional ratio (PR). Thus for industry i in year t,

$$(1) \qquad P_{i,t} = N_{us,t} * s_{i,t} * PR_{i,t}.$$

As the number of professionals in the economy ($P_{us,t}$) is equal to the sum of professionals across all industries, the U.S. professional ratio ($PR_{us,t}$) can be expressed as

$$(2) \qquad PR_{us,t} = P_{us,t}/N_{us,t} = \sum_i P_{i,t}/N_{us,t}.$$

Substituting (1),

$$(3) \qquad PR_{us,t} = \sum (N_{us,t} * s_{i,t} * PR_{i,t})/N_{us,t}.$$

$$(4) \qquad = \sum (s_{i,t} * PR_{i,t}).$$

The national professional ratio, in other words, is equal to the sum of industry professional ratios, weighted by their share of the total employed labor force.

A change in the national professional ratio ($PR_{us,1} - PR_{us,0}$) can be expressed

$$(5) \qquad \sum (s_{i,1} * PR_{i,1}) - \sum (s_{i,0} * PR_{i,0}) =$$

$$(6) \qquad \sum [(s_{i,1} * PR_{i,1}) - (s_{i,0} * PR_{i,0})] =$$

$$(7) \qquad \sum [(s_{i,0} + \Delta s_i) * (PR_{i,0} + \Delta PR_i) - (s_{i,0} * PR_{i,0})] =$$

$$(8) \qquad \sum [(s_{i,0} * PR_{i,0}) + (s_{i,0} * \Delta PR_i) + (PR_{i,0} * \Delta s_i) +$$

$$(\Delta s_i * \Delta PR_i) - (s_{i,0} * PR_{i,0})] =$$

$$(9) \qquad \sum [(s_{i,0} * \Delta PR_i) + (PR_{i,0} * \Delta s_i) + (\Delta s_i * \Delta PR_i)].$$

with $\Delta s_i = s_{i,1} - s_{i,0}$; $\Delta PR_i = PR_{i,1} - PR_{i,0}$.

A change in the national professional ratio can thus be expressed as the sum, across all industries, of three industry-specific terms. The first, ($s_{i,0} * \Delta PR_i$), multiplies the change in the industry professional ratio by the initial industry employment share. It measures the effect of a change in the industry professional ratio on the national ratio and will be called the ratio effect. The second, ($PR_{i,0} * \Delta s_i$), multiplies the change in the industry employment share by the industry's initial professional ratio. It measures the consequence of a shift in the industry employment share on the national professional ratio and will be called the share effect. Finally, ($\Delta s_i * \Delta PR_i$) multiplies the incremental industry professional ratio by the incremental industry employment share. It will be called the industry interaction effect, and cannot be allocated between share and ratio effects.

Appendix Table 1

Contribution to Movements in the National Professional Ratio: Share and Ratio Effects

Industries ranked according to 1988 professional ratios.

Rank No.	Industry	1950 Total Employment (000)	1950 Employment Share (percent)	1950 Profes-sional Ratio	1988 Total Employment (000)	1988 Employment Share (percent)	1988 Profes-sional Ratio	Effects			
								Ratio	Share	Inter-action	Total
1	Other Prof. Inds.*	69	.12	77.3	397	.35	72.5	0	.2	0	.2
2	Engin./Architech*	83	.15	71.1	777	.69	69.2	0	.4	0	.4
3	Accounting Services*	102	.18	71.8	753	.67	56.4	0	.3	−.1	.2
4	Education*	2,077	3.72	71.7	9,849	8.75	53.9	−.7	3.6	−.9	2.1
5	Legal Services*	226	.40	60.6	1,127	1.00	49.0	0	.4	−.1	.2
6	Hospitals*	984	1.76	44.5	4,429	3.93	48.5	.1	1.0	.1	1.1
7	Welfare & Religion*	400	.72	61.3	1,963	1.74	40.5	−.1	.6	−.2	.3
8	Office Machinery	106	.19	7.6	851	.76	38.8	.1	0	.2	.3
9	Other Health*	625	1.12	64.3	4,360	3.87	34.8	−.3	1.8	−.8	.6
10	Aircraft	257	.46	15.4	884	.79	33.9	.1	.1	.1	.2
11	Entertainment	557	1.00	25.2	1,326	1.18	29.6	0	0	0	.1
12	Chem. & Allied Prods.	655	1.17	11.8	1,214	1.08	24.4	.1	0	0	.1
13	Electrical Machinery	771	1.38	9.2	2,244	1.99	23.9	.2	.1	.1	.3
14	Communications	641	1.15	4.8	1,652	1.47	23.2	.2	0	.1	.3
15	Prof. Equip./Instrs.	197	.35	9.3	588	.52	22.6	0	0	0	.1
16	Business Services	353	.63	16.4	4,877	4.33	22.4	0	.6	.2	.9
17	Mining	928	1.66	3.5	778	.69	22.1	.3	0	−.2	.1
18	Public Admini.	2,491	4.46	11.7	6,379	5.67	20.4	.4	.1	.1	.6
19	Misc. Manufacturing	577	1.03	3.7	823	.73	16.8	.1	0	0	.1
20	Petrol. & Coal Prods.	284	.51	14.0	167	.15	16.2	0	−.1	0	0
21	Printing & Publishing	868	1.56	9.5	1,898	1.69	16.1	.1	0	0	.1
22	Util. & Sanitation	779	1.40	7.7	1,498	1.33	16.0	.1	0	0	.1
23	Non-Profit Org.	185	.33	10.2	471	.42	15.7	0	0	0	0
24	Tobacco	92	.17	1.1	56	.05	14.3	0	0	0	0
25	Other Transp. Serv.	850	1.52	3.8	1,741	1.55	11.4	.1	0	0	.1
26	Brokerage	87	.16	7.2	668	.59	10.6	0	0	0	.1
27	Other Trans. Manuf.	216	.39	5.7	449	.40	10.5	0	0	0	0
28	Banking & Credit	516	.93	3.7	2,778	2.47	10.3	.1	.1	.1	.2
29	Machinery	1,178	2.11	6.7	1,640	1.46	10.3	.1	0	0	0
30	Motors	863	1.55	4.2	1,115	.99	9.8	.1	0	0	0
31	Insurance	751	1.35	3.7	2,256	2.00	8.7	.1	0	0	.1
32	Paper	464	.83	3.4	733	.65	8.7	0	0	0	0
33	Stone/Clay/Glass	459	.82	4.0	618	.55	8.3	0	0	0	0
34	Rubber & Plastics	236	.42	5.4	754	.67	8.2	0	0	0	0
35	Other Personal Servs.	1,324	2.37	6.3	1,883	1.67	7.0	0	0	0	0
36	Ferrous Metals	947	1.70	3.8	486	.43	6.4	0	0	0	0
37	Leather	378	.68	1.0	142	.13	6.3	0	0	0	0
38	Fabricated Metals	831	1.49	4.8	1,231	1.09	6.3	0	0	0	0
39	Textiles	1,233	2.21	1.4	720	.64	6.1	.1	0	−.1	0
40	Non-Ferrous Metals	216	.39	5.3	284	.25	6.0	0	0	0	0
41	Railroads	1,382	2.48	1.6	345	.31	5.5	.1	0	−.1	0
42	Furniture	323	.58	1.6	640	.57	5.3	0	0	0	0
43	Food	1,380	2.47	2.6	1,714	1.52	5.0	.1	0	0	0
44	Wholesale Trade	1,947	3.49	2.5	4,181	3.71	4.0	.1	0	0	.1
45	Agric./Forestry/Fish.	7,017	12.57	.6	3,016	2.68	3.9	.4	−.1	−.3	0
46	Construction	3,398	6.09	3.7	6,856	6.09	3.2	0	0	0	0
47	Other Repair	285	.51	1.3	611	.54	2.9	0	0	0	0
48	Lumber	851	1.53	.9	717	.64	2.8	0	0	0	0
49	Real Estate	529	.95	1.5	2,080	1.85	2.8	0	0	0	0
50	Retail Trade	8,442	15.13	1.9	18,960	16.84	2.6	.1	0	0	.1
51	Priv. Hsehld. Servs.	1,662	2.98	.7	1,106	.98	2.3	0	0	0	0
52	Hotel	531	.95	2.0	1,509	1.34	2.3	0	0	0	0
53	Trucking	696	1.25	.7	1,783	1.58	2.2	0	0	0	0
54	Apparel	1,072	1.92	1.0	1,200	1.07	1.9	0	0	0	0
55	Auto Service	657	1.18	.5	992	.88	1.3	0	0	0	0
All Industries		55,805		8.7	112,569	100.0	18.0	2.4	8.9	−2.0	9.3
Prof. & Relatd. Serv.* Inds.		4,566	8.18	63.4	23,655	21.0	48.9	−1.2	8.2	−2.0	5.1
All Other Industries:		51,239	91.82	3.8	88,914	79.0	9.7	3.5	.7	0	4.2

Notes: 780,000 employed persons not allocated by Bureau of the Census in 1950 are assigned to the all other industries group.

Professional and Related Services Industry

Source: U.S. Bureau of the Census 1954a and 1988.

Appendix Table 2

Professional Ratios by Industry, 1950 through 1988

Percent, in descending order according to 1988 professional ratio

no.	industry	1950	1960	1970	1980	1988
1	Other Professional Industries*	77.3	66.0	47.1	75.0	72.5
2	Engineering/Architecture*	71.1	71.4	72.4	74.3	69.2
3	Accounting Services*	71.8	65.8	58.5	57.4	56.4
4	Education*	71.7	67.3	59.7	54.3	53.9
5	Legal Services*	60.6	58.2	53.4	54.9	49.0
6	Hospitals*	44.5	40.2	36.8	42.9	48.5
7	Welfare & Religion*	61.3	53.0	53.1	50.7	40.5
8	Office Machinery	7.6	17.4	29.6	31.3	38.8
9	Other Health*	64.3	54.4	39.3	35.2	34.8
10	Aircraft	15.4	22.3	26.2	29.8	33.9
11	Entertainment	25.2	19.5	23.6	28.7	29.6
12	Chemicals & Allied Products	11.8	15.6	18.5	18.7	24.4
13	Electrical Machinery	9.2	15.2	18.4	19.0	23.9
14	Communications	4.8	10.7	14.7	19.1	23.2
15	Prof. Equipment/Instruments	9.3	16.2	16.9	12.8	22.6
16	Business Services	16.4	17.6	22.1	20.8	22.4
17	Mining	3.5	7.4	11.0	12.6	22.1
18	Public Administration	11.7	13.7	16.5	19.0	20.4
19	Misc. Manufacturing	3.7	3.3	6.3	16.3	16.8
20	Petroleum & Coal Products	14.0	15.1	21.1	21.0	16.2
21	Printing & Publishing	9.5	9.2	12.6	13.7	16.1
22	Utilities & Sanitation	7.7	8.1	10.6	14.0	16.0
23	Non-Profit Organizations	10.2	12.9	14.5	9.6	15.7
24	Tobacco	1.1	2.2	5.1	8.8	14.3
25	Other Transport. Services	3.8	4.8	8.3	8.4	11.4
26	Brokerage	7.2	7.8	6.5	4.6	10.6
27	Other Transport. Manufacturing	5.7	6.1	8.7	5.6	10.5
28	Banking & Credit	3.7	3.3	5.5	5.5	10.3
29	Machinery	6.7	9.4	10.6	10.8	10.3
30	Motors	4.2	6.8	8.1	11.0	9.8
31	Insurance	3.7	3.9	6.0	7.5	8.7
32	Paper	3.4	5.1	6.8	8.7	8.7
33	Stone/Clay/Glass	4.0	3.5	6.7	6.7	8.3
34	Rubber & Plastics	5.4	5.8	7.3	9.6	8.2
35	Other Personal Services	6.3	5.6	3.0	6.0	7.0
36	Ferrous Metals	3.8	5.0	6.3	5.9	6.4
37	Leather	1.0	.9	1.9	1.1	6.3
38	Fabricated Metals	4.8	9.5	10.9	7.1	6.3
39	Textiles	1.4	1.9	3.3	4.4	6.1
40	Non-Ferrous Metals	5.3	7.4	8.3	10.1	6.0
41	Railroads	1.6	1.9	2.8	3.5	5.5
42	Furniture	1.6	2.0	2.9	4.0	5.3
43	Food	2.6	2.5	4.5	4.9	5.0
44	Wholesale Trade	2.5	3.0	4.3	3.8	4.0
45	Agriculture/Forestry/Fishing	.6	1.3	2.9	3.6	5.3
46	Construction	3.7	4.7	4.5	3.4	3.2
47	Other Repair	1.3	1.3	4.2	2.6	2.9
48	Lumber	.9	1.3	2.2	2.5	2.8
49	Real Estate	1.5	1.2	3.8	1.8	2.8
50	Retail Trade	1.9	1.7	2.2	1.6	2.6
51	Private Household Services	.7	.3	1.5	.9	2.3
52	Hotel	2.0	2.1	3.0	3.1	2.3
53	Trucking	.7	.7	1.1	1.6	2.2
54	Apparel	1.0	1.1	1.9	1.7	1.9
55	Auto Service	.5	.6	1.2	.3	1.3
National Professional Ratio:		8.7	11.3	15.1	16.2	18.0

Professional and Related Services Industry

Sources: U.S. Bureau of the Census 1954a, 1963a, 1972a, 1980, and 1988.

[1] Managers of professionals focus on housekeeping, intermediation, and career and organizational strategy rather than direct supervision.

[2] As this study uses Bureau of the Census data, it also uses its industrial classification scheme. The major difference between the Census approach and the Standard Industrial Classification is the treatment of government, with the Census listing various public activities within the appropriate nongovernment category. The Census, for example, classifies public education under services; public welfare agencies under services (beginning in 1960); and the U.S. post office under transportation and public utilities (after 1980). See the box on sources and definitions for the treatment of such changes.

[3] Chart 2 and the two appendix tables provide industry detail below the 1-digit level where two conditions apply. First, industries are broken out where greater definition reveals significant variation in professionalization. Second, an industry is included only if data are available for all five years used in this study—1950, 1960, 1970, 1980, and 1988.

[4] Accounting services joined the Professional and Related Services group in the 1960 Census. For some reason the Census Bureau also classified nonprofit and membership organizations within Professional and Related Services. This industry, however, never registered more than a moderate level of professionalization according to our measure—the professional ratio. For the remainder of this paper, references to the "Professional and Related Services" industries will thus exclude the nonprofit and membership organization industry. All such references will be marked with an asterisk—"Professional and Related Services*"—to signal our difference from Bureau of the Census usage.

[5] Since 1950, hospitals have focused increasingly on the provision of professional-intensive acute care services. They have transferred convalescent and chronic care services to other facilities, which the Census Bureau classified under the "other health" rubric. Specialization on the part of hospitals thus resulted in an increased professional ratio for that industry and a sharp drop for other health services. Taking both industries together, however, health care as a whole showed a typical 10.5 point drop in its professional ratio, from 52.2 percent to 41.7 percent.

[6] Interactions between ratio and industry effects were large and on balance accounted for a 2.0 percentage point drop in the national professional ratio. The entire interaction effect originated among the Professional and Related Services* industries, whose professional ratios sharply fell while their shares of total employment rose significantly. (The interaction effect, for each industry, is the product of the change in its professional ratio multiplied by the change in its employment share.)

Interactions between ratio and industry effects outside the Professional and Related Services* industries were quite small, accounting for just a 0.01 gain in the national professional ratio. This indicates a lack of association, elsewhere in the economy, between changes in industry professional ratios (which were all positive, with the exception of construction), and changes in industry employment shares. The positive share effect, on the other hand, indicates an association between initial professional ratios and subsequent growth in employment shares.

[7] Commercial research, development, and testing labs; computer and data processing services; and business and management consulting, components of the large and heterogeneous business services "industry," are in effect providers of professional services and had even higher 1988 professional concentrations than office machinery. The analysis does not break out business services because the published Census volumes did not provide such detail prior to the Census of 1980.

[8] Successful efforts to leverage professional skills or a general increase in paperwork may underlie this rise in clerical personnel. Among the factors that may account for the substantial variation in clerical worker employment among the eight Professional and Related Services* industries are different patterns of office automation, the rise of alternate payment systems in medical care, and the shift of certain medical services out of hospitals.

[9] The shares of managers reported in the text are lower than those given in the Current Population Survey due to our reclassification of accountants, personnel and labor relations specialists, and certain other "management-related" occupations from "executive, administrative, and managerial" to "professional, technical, and kindred" occupations.

The only occupational shift of any significance, other than among managers and clericals, was the dramatic drop in service worker employment in hospitals, and the concomitantly large jump in this group in other health services. This reflects the transfer of service-intensive services out of the former and into the latter "industry," as discussed in note 4. For health care as a whole, the fraction of employees in service worker occupations rose slightly, from 26.0 percent to 28.4 percent.

[10] Personick (1987), p. 43, table 6, "Employment by Selected Industry, 1972, 1979, 1986, and Projected to 2000."

[11] The Massachusetts Department of Employment and Training, for example, classifies as "high tech" S.I.C. industries 281, 282, 283, (from chemicals and allied products); 351, (from non-electrical machinery); 357, (office machinery, also from non-electrical machinery); 361, 362, 366, 367, (from electronic and electrical equipment); 372, 376, (aircraft and space vehicles); 381, 382, 383, 384, 386, (from instruments); 737, 739, (from business services); 891 (engineering and architectural services); and 892 (noncommercial educational and scientific research).

[12] Little (1989) lists as "import-vulnerable" manufacturing industries: apparel, lumber, paper, leather, primary metals, and miscellaneous manufacturing. Her "export-oriented" manufacturers are: chemicals (PS), rubber and plastics, non-electrical machinery (office equipment-PS); electric and electronic equipment (PS), transportation equipment (aircraft-PS); and instruments (PS). For the trade balances of nonmanufacturing industries, see U.S. Bureau of Economic Analysis 1989, Table F, "Other Private Services, Unaffiliated," p. 57.

[13] In each cohort, the 16-to-24-year-old age group displayed the smallest professional concentrations, as those who would later hold professional, technical, or kindred positions were either in school, in casual employment, or just in other lines of work when younger. Cohort professional ratios rose after they reached age 65 perhaps because professionals tend to live longer, because their efforts were more rewarding and less taxing than other employments, or because Social Security replacement ratios were less generous for the generally better-paid professional workers.

[14] The 1950 cohort reached its peak professional concentration between the ages of 35 and 44 and thereafter stabilized at a slightly lower level; the professional ratio for the 1960 cohort peaked between the ages of 25 and 34, and thereafter fell for two decades; the 1970 cohort reached its highest professional concentration between the ages of 35 and 44, slightly above its level at ages 25 to 34, and this is the most recent reading for this generational cohort.

[15] Given the large underprivileged populations in the United States, the potential supply of professional labor is clearly greater than levels currently achieved. Tapping this resource may require substantial institutional change and income redistribution. Barring such actions, the nation may simply be unable to increase its supply of professional labor much further. As underprivileged populations will comprise an increasing proportion of the nation's work force, the national professional ratio may indeed decline in the absence of such institutional change and income redistribution.

[16] For some ideas emerging from a somewhat different context, see Spring (1989).

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Taking Charge: Should New England Increase Its Reliance on User Charges?

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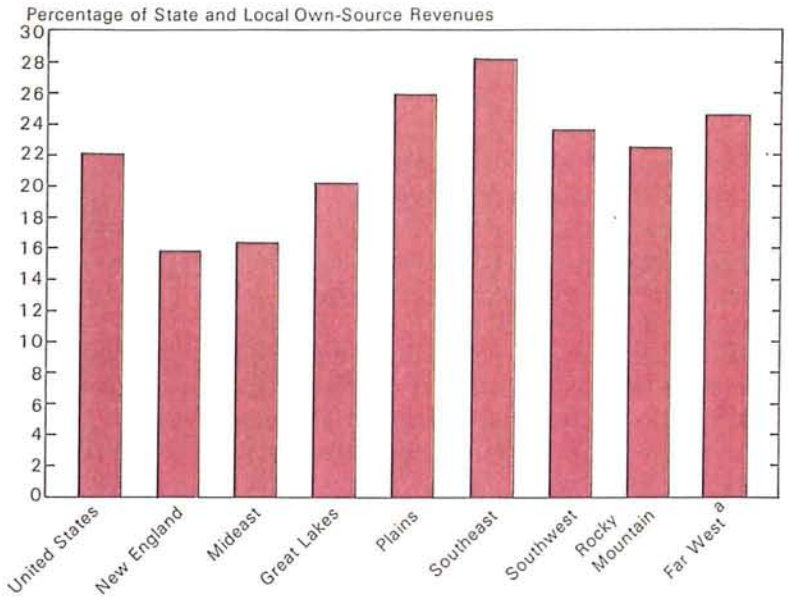
Last year was difficult for New England's state and local governments. Each state government was forced to borrow, raise taxes, cut spending, or tap reserves in order to balance its budget for fiscal year 1990. All of the region's states except Maine and New Hampshire have slowed the rate of growth in their fiscal assistance to cities and towns.[1] This slow growth in state aid comes at a time when the inflation-adjusted value of federal aid to local governments is declining; public school enrollment is rising; and municipalities are grappling with such problems as hazardous waste disposal, underfunded pension liabilities, homelessness, and deteriorating public infrastructure.

In order to relieve their fiscal stress, the region's state and local governments have been casting their nets for sources of additional revenue. One potential source receiving considerable attention is higher user charges. A user charge is a payment for a specific publicly provided service, such as electricity, garbage collection, or higher education. The size of the payment varies directly with the amount of service rendered to the payor. By contrast, most taxes are payments for government services in general and do not necessarily reflect the quantity of services received by the taxpayer. (As discussed in the accompanying box, some revenue sources are difficult to classify as either user charges or taxes.)

New England relies less on user charges for its state and local revenues than any other region of the country (chart 1). As a result, some policymakers maintain that increases in user charges would correct an "imbalance" in the region's revenue mix. However, the national mix of state and local revenues is not necessarily the best mix for the states of New England. The degree to which a state should rely on user charges depends on the priorities of its policymakers among competing principles of taxation, the conditions under which each principle favors user charges over taxes, and the extent to which these conditions exist within the state. Since each state has its own distinctive

Chart 1

The Role of User Charges in State and Local Own-Source Revenues, Fiscal Year 1986



[a]Far West excludes Alaska and Hawaii. U.S. total includes Alaska and Hawaii.
Note: See footnote 3 for definition of state and local own-source revenue. User charges include current charges, utility revenue, and liquor store revenue.
Source: U.S. Bureau of the Census, *Government Finances 1985-86.*

values and traits, the role of user charges in financing state and local government should vary across states.

This article explores the conditions under which user charges compare favorably to taxes according to the principles of efficiency, equity, and exportability.

The national mix of state and local revenues is not necessarily the best mix for the states of New England.

Section I briefly explains these principles. Sections II and III discuss five conditions under which user charges compare favorably to taxes according to at least one of these principles. Where possible, evidence is presented concerning the extent to which these conditions are less common in New England than in other regions of the country. Section IV draws policy conclusions.

The article finds that, given conditions peculiar to New England, the region's low dependence on user charges makes sense in terms of all three principles. Moreover, in several instances where New England states do rely heavily on user charges to finance a particular public service, circumstances favor user charge financing.

I. What Makes a Revenue System Efficient, Equitable, and Exportable?

Efficiency, equity, and exportability are three widely recognized criteria of a good state and local revenue system. An efficient revenue system helps governments and private firms to produce what people want most at the least possible cost. An equitable revenue system distributes the burden of financing government fairly. The definition of fairness depends on which of the two basic principles of tax equity is adopted. According to the "benefit principle," the burden of financing government should be distributed in proportion to the benefits received from government. According to the "ability to pay principle," tax policymakers should take into account each household's personal circumstances in

Sorting Out User Charges and Taxes

The line separating user charges from taxes is indistinct.[2] Three categories of revenues identified by the U.S. Bureau of the Census—"current charges," "utility revenue," and "liquor store revenue"—clearly should be considered user charges. The Census Bureau defines current charges as "amounts received from the public for performance of specific services benefiting the person charged, and from sales of commodities and services . . . ." (U.S. Bureau of the Census 1987). The largest categories of current charges finance hospital care, higher education, and sewerage. These charges, mostly imposed by local governments, account for 14 percent of all state and local own-source revenue (table 1).[3] Charges imposed by publicly operated utilities, owned primarily by local governments, account for approximately 8 percent. Government-owned liquor stores, operated mostly by state governments, account for only 0.6 percent, although in New Hampshire they account for 8.3 percent.

Some analysts contend that taxes on motor fuels are in effect user charges because most of the revenue they generate is earmarked for the construction and maintenance of roads and bridges. Financing these expenditures entirely with tolls would entail enormous administrative costs and would create intolerable traffic congestion. Consequently, state and local governments generally opt for the more tractable alternative of taxing the consumption of motor fuel, a complement of road usage. Because of this complementary relationship, the burden of motor fuel taxes is distributed among drivers roughly in proportion to the number of miles driven. State and local motor fuel taxes, levied primarily by state governments, account for 3 percent of all state and local own-source revenue.

"Special assessments," imposed primarily by local governments, are also sometimes classified as user charges. These assessments, only 0.4 percent of all state and local own-source revenue, are "compulsory contributions collected from owners of property benefited by special public improvements . . . to defray the cost of such improvements" (U.S Bureau of the Census 1987). While such assessments are not based on actual usage of the improved facility, the relationship between usage and assessment is often close. For example, municipalities sometimes cover the cost of repaving a small street lined with owner-occupied homes by imposing a special assessment on the owners of the homes, reasoning that these homeowners are the principal users of the improved street.

Thus, user charges account for between 22 and 25 percent of nationwide state and local revenues, depending on the characterization of motor fuel taxes and special assessments. The comparable range for New England is between 16 percent and 18 percent.

License taxes are sometimes considered a form of user charge. These taxes are payments required for the privilege of engaging in a particular regulated activity, such as driving, marrying, hunting, fishing, and selling liquor, or owning property incident to such activity, such as a rifle or an automobile. In contrast to current charges and utility revenues, they are collected almost exclusively by state governments. In 1986 they accounted for 3 percent of all state and local own-source revenue.

Mushkin and Bird (1972) characterize license taxes as charges for regulatory services that benefit the licensed individual, such as enforcement of traffic, hunting, and fishing laws. However, rarely does a license tax paid reflect the amount of licensed activity undertaken. Moreover, the regulation of such activity often benefits the general public at least as much as license holders. Consequently, license taxes are not considered as user charges in this article.

Table 1
The Importance of User Charges and Related Revenue Sources in the Mix of State and Local Own-Source Revenues, by Region, Fiscal Year 1986

	Percentage of Total State and Local Own-Source Revenues							
	User Charges				Revenue Sources Related to User Charges			
	Current Charges (1)	Utility Revenue (2)	Liquor Store Revenue (3)	Total User Charges [(1)+(2)+(3)] (4)	Special Assessments (5)	Motor Fuels Taxes (6)	License Taxes (7)	Other Revenues (8)
New England	10.3	4.7	.8	15.8	.1	2.5	2.1	79.4
Connecticut	8.0	3.3	0	11.4	.3	2.9	2.5	83.0
Maine	11.6	1.9	2.0	15.6	0	4.0	3.6	76.7
Massachusetts	10.7	6.6	0	17.3	.1	1.9	1.3	79.3
New Hampshire	12.1	1.5	8.3	22.0	0	3.6	4.2	70.3
Rhode Island	11.6	2.1	0	13.7	.2	2.2	1.6	82.3
Vermont	13.3	6.0	2.5	21.8	0	3.2	3.5	71.5
Mideast	10.7	5.2	.6	16.4	.2	1.5	2.4	79.5
Great Lakes	14.7	4.7	.8	20.2	.3	2.9	2.8	73.7
Plains	16.3	9.1	.7	26.0	.8	2.9	3.1	67.2
Southeast	16.9	10.6	.7	28.2	.2	3.4	2.9	65.2
Southwest	13.9	9.8	0	23.7	.5	2.8	4.6	68.5
Rocky Mountain	14.8	6.7	1.0	22.5	.9	2.9	2.4	71.4
Far West[a]	14.5	9.7	.4	24.6	.6	1.9	1.8	71.0
United States	14.0	7.6	.6	22.2	.4	2.5	2.7	72.3

[a]Excludes Alaska and Hawaii. United States total includes Alaska and Hawaii.
Note: See footnote 3 for definition of state and local own-source revenues.
Source: U.S. Bureau of the Census. *Government Finances 1985–86.*

determining its share of financing government. The latter principle is generally thought to imply that, as a household's income increases, the portion of its income paid in taxes and charges should increase, too. A tax or user charge that distributes its burden in this manner is a "progressive" tax. By comparison, under a "regressive" tax or charge, payments as a proportion of income decline with income.

An "exportable" state and local revenue system imposes a significant proportion of its burden on residents of other states. The more a state can export the burden of its taxes and charges to nonresidents, the larger the volume of public services that it can provide at a given cost to its residents. Consequently, it is in the interest of each state to export as much of its revenue burden as possible.

Efficiency, equity, and exportability are potentially incompatible. A revenue system that promotes efficiency may be regressive, or a system that exports a large proportion of its burden may stimulate an inefficiently high level of public spending. Consequently, tax policymakers must establish priorities among these partially competing objectives in order to choose rationally among alternative revenue structures.

II. Two Good Reasons for New England's Low Dependence on User Charges

At least two conditions favoring taxes over user charges are more common in New England than in other regions of the country. First, New England spends a relatively large portion of its state and local revenues on public welfare and on "collective" services. Second, New Englanders have a relatively strong incentive to rely on sources of state and local revenue that are deductible from federal taxable income.

User Charges, Public Welfare, and Collective Services

The degree to which a publicly provided service should be financed with user charges depends in part on whether its primary purpose is redistribution and on whether it is "private," "mixed," or "collective." User charges are obviously poorly suited to finance services targeted on economically disadvantaged households. To finance such services wholly or mostly with user charges would defeat their very purpose. As explained below, user charges are better suited than taxes to finance services that are private in nature. Mixed services are best financed with a combination of user charges and taxes. Collective services must be financed wholly with taxes.

What are private services, mixed services, and collective services? A private service possesses two distinguishing characteristics. First, it is "rival" in consumption, that is, the consumption of it by one person interferes with the consumption of it by other people. For example, if A uses a public tennis court for an hour, no one else can use that tennis court until the hour has passed. Second, a private service is excludable, that is, the provider of the service can deny it to those who fail to pay for it. For example, city officials can deny access to a public tennis court to those who fail to pay a fee in advance.

By contrast, a collective service is not rival and is usually not excludable. The consumption of it by one person does not diminish the capacity of others to consume it. For example, most members of a community benefit simultaneously from a mosquito abatement program. Moreover, once such a program is initiated, most or all members of a community benefit from it, whether or not they pay for it.[4]

A mixed service has both private and collective attributes. When a household consumes a mixed service, it satisfies some of its own needs or wants while simultaneously generating benefits for other households ("externalities"). For example, when a city removes trash from a specific address, it enables residents at that address to live in a cleaner, healthier environment. At the same time, it reduces the exposure of the whole neighborhood to filth, germs, and unpleasant odors.[5]

Efficiency considerations. In competitive markets, prices guide buyers and sellers to the most efficient level of production of each private good and service. User charges can similarly help households, businesses, and public officials to achieve the most efficient level of each publicly provided private service, as long as two conditions hold.

First, as a government increases its production of a private service, the value to its residents of additional units of production must become progressively smaller. For example, most households consider some level of water supply to be a necessary minimum for drinking, cooking, and washing. Above this minimum, they use water for less vital purposes, such as watering lawns, filling swimming pools, and washing cars. Thus, the benefit of each additional gallon of water, or water's "marginal benefit," declines with volume.

Second, the cost of expanding output of the service must increase with volume. For example, suppose that as a town's water works increases output, it must install more powerful pumps, replace parts more frequently, alter the construction of its buildings to ensure safety, and use more sophisticated monitoring and control devices. As a result, the cost of producing each additional gallon of water, or the "marginal" cost of production, increases with volume.[6]

User charge financing is not inherently more efficient than taxation if public production includes mixed services or collective services.

If these two conditions hold, then, as production and consumption of a public service increase, its marginal benefit falls and its marginal cost rises. Total economic welfare increases as long as each additional unit of service generates more benefit than cost. If benefits accrue only to consumers of the service, economic welfare is maximized at the point where the marginal benefit to consumers and the marginal cost to producers are equal. Beyond that point, additional production generates more cost than benefit, diminishing total economic welfare.

A governmental agency can discover this welfare-maximizing point by setting price equal to marginal cost at each level of production. Consumers will purchase additional output as long as the resulting marginal benefit exceeds price. They will stop expanding consumption at the level at which marginal

benefit, price, and therefore marginal cost, are equal. In this manner, marginal cost pricing can guide public agencies to an efficient level of production.

By contrast, when a publicly produced private service is financed through taxation, officials lack the feedback from consumers needed to determine the optimal level of production. Each household perceives the cost to itself of consuming an additional unit of the service to be close to zero, since the total cost is spread among all taxpayers. Consequently, in the absence of constraints imposed on production by public officials, too much of the service is consumed. Officials must therefore guess the level of production that maximizes economic welfare.

However, user charge financing is not inherently more efficient than taxation if public production includes mixed services or collective services. Consumers of a mixed service have little incentive to take into account the externalities that they generate. They compare the price of the service with the marginal benefit to themselves of additional consumption. Consequently, if the price of the mixed service is set equal to marginal cost, the amount of it consumed will be suboptimal. The total benefits from additional consumption, including externalities, will exceed the cost of additional production.

For example, suppose that municipal sanitation departments removed trash only on request for a fee. It is unlikely that households would take into account all of the external benefits generated by this service in deciding how frequently to have their trash removed. Consequently, most cities and towns subsidize trash removal or pay for it entirely out of tax revenue in order to ensure that trash is removed at a socially optimal frequency.

A collective service must be financed exclusively with taxes. Once a government provides a collective service to one household, most or all households served by that government benefit from the service, no matter who pays for it. For example, most residents of a community benefit from mosquito abatement programs and the maintenance of public buildings. Since everyone has an incentive to let someone else pay for these expenses, no one pays for them voluntarily.

Equity considerations. As pointed out in section I, according to the "benefit" principle of equity the burden of financing government should be distributed in proportion to the benefits received from government. By this standard, user charges usually get high marks because, by definition, they link payment for a particular public service to the amount of service consumed. If the service is private in nature, payments made are, indeed, proportional to benefits received. However, when mixed goods are financed with user charges, those enjoying external benefits do not pay for them.

In the case of some mixed goods, taxation may conform as closely to the benefit principle as user charge financing. For example, good public schools enhance property values as well as educate their pupils. Consequently, financing public education with property taxes may conform as closely to the benefit principle as sole reliance on tuition. The most equitable formula according to the benefit principle may be some combination of taxes and tuition.

User charges may play such a small role in New England because of its high priority on collective services and redistributional programs.

The importance of collective services and redistributional programs in New England's mix of public spending. If the suitability and feasibility of user charge financing depend in part on the nature of the public service to be financed, then New England's low dependence on user charges may in part reflect its mix of state and local spending. Specifically, user charges may play such a small role in New England because its states and municipalities place a high priority on collective services, which can not be financed with user charges, and redistributional programs, which should not be financed with user charges.

Evidence concerning this hypothesis is presented in table 2 and charts 2a and 2b. Table 2 classifies state and local spending categories into those consisting mostly of collective services, private services, and mixed services. The spending categories are those used by the U.S. Bureau of the Census in its official statistics on governmental finances.

This classification is necessarily arbitrary to some degree. Many of the spending categories include a wide range of services, some collective, some private, and some mixed. Moreover, the degree to which a specific service generates externalities is difficult to

Table 2
Collective Services, Private Services, and Mixed Services: A Classification of Categories of State and Local Spending

Categories Consisting Primarily of:		
(1)	(2)	(3)
Collective Services	Private Services	Mixed Services
Public Health	Hospitals	Elementary and Secondary Education
Police Protection	Electric Power	Higher Education
Fire Protection	Water Supply	Employment Security Administration
Correction	Gas Supply	Veterans' Services
Protective Inspection and Regulation	Liquor Stores	Highways
Financial Administration	Public Welfare	Air Transportation
Judicial and Legal		Parking Facilities
General Public Buildings		Water Transport and Terminals
Other Government Administration		Transit Subsidies
Interest on General Debt		Natural Resources
		Parks and Recreation
		Housing and Community Development
		Sewerage
		Sanitation other than Sewerage

Note: Insurance Trust Fund Expenditures are excluded from these lists. For reasons, see footnote 3.
Source: Author's classifications and U.S. Bureau of the Census, *Government Finances 1985–86.*

evaluate in many cases. In columns 1 and 2, the author has attempted to identify only those expenditure categories that are, respectively, most clearly collective and private in nature.

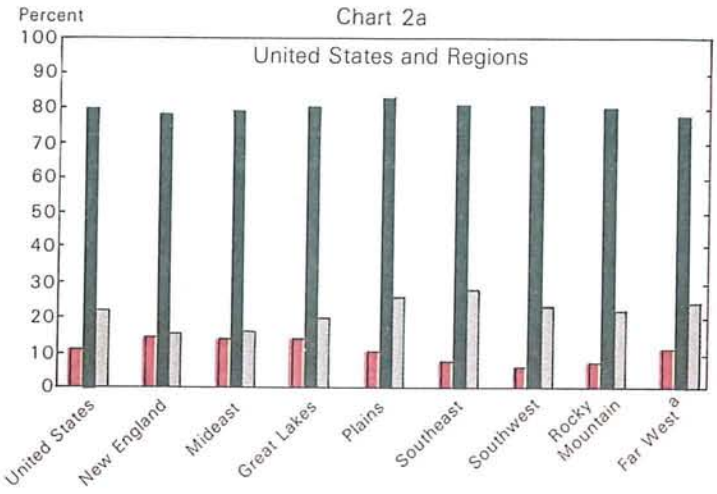
According to chart 2a, collective expenditure categories account for a larger fraction of state and local spending in New England than in any other region of the country. The same is true for public welfare, the only spending category characterized here as primarily redistributional in nature.[7] Within New England, collective categories receive especially high priority in Connecticut and Rhode Island, while public welfare is heavily emphasized in Maine, Massachusetts, New Hampshire, and Rhode Island (chart 2b). Nationwide, the more a state emphasizes public welfare and collective services in its spending mix, the less it relies on user charges and the more it relies on taxes.[8] Thus, New England's state and local spending priorities vindicate and may partially account for its low dependence on user charges.

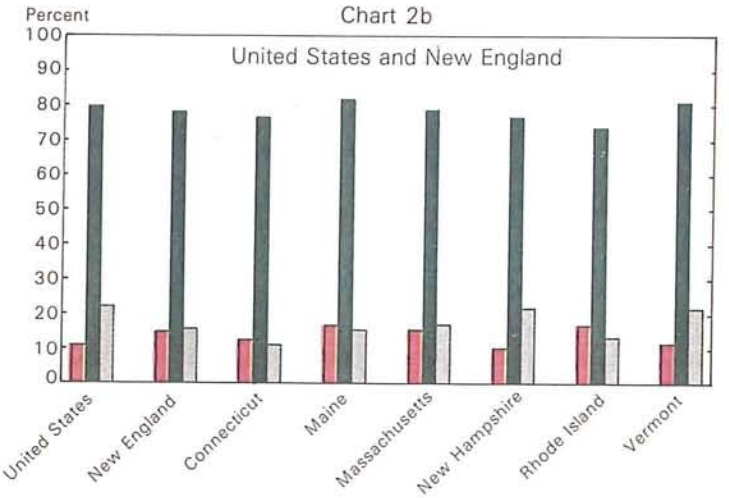
New England's emphasis on collective services largely reflects the high interest per capita it pays on its general debt (classified here as a collective service) and its low per capita spending on three large categories of private and mixed services: electric power, higher education, and hospital care (see appendix table 1). Moreover, user charge financing is poorly suited to the types of public hospital care that New England does offer. These types are generally not covered by health insurance; New England care is more oriented toward hospices, psychiatric care, and care of the mentally retarded. If these services were financed out of user charges, only people in the highest income brackets could afford them. Largely as a result, New England states generally do not rely heavily on user charges to finance their public hospitals (appendix table 2). By contrast, states that do depend heavily on user charges for this purpose, such as Nebraska, Kentucky, Mississippi, and Wyoming, provide extensive general hospital care. Because most general hospital services are covered by insurance, most patients can afford them even when their cost is not heavily subsidized with tax revenues.

Federal Tax Disincentives to User Charge Financing

States and municipalities have an incentive to rely on sources of revenue that are deductible from federal taxable income. Currently, households filing itemized federal returns can deduct state and local personal income taxes and property taxes. (Prior to 1987 they could deduct state and local general sales

State and Local Spending on Welfare and on Private and Mixed Services and State and Local User Charges by Region, Fiscal Year 1986





[a] Far West excludes Alaska and Hawaii. U.S. total includes Alaska and Hawaii.
Source: Author's calculations and U.S. Bureau of the Census, *Government Finances 1985-86.*

Spending on public welfare as a percentage of total state and local spending (excluding spending from insurance trust funds).

Spending on private and mixed services as a percentage of total state and local spending (excluding spending from insurance trust funds).

User charges as a percentage of total state and local own-source revenues. User charges include current charges, utility revenue, and liquor store revenue. See footnote 3 for a definition of total own-source revenues.

taxes as well.) On the whole, New England's states, cities, and towns have a relatively strong incentive to rely on deductible taxes.

By relying on deductible taxes, state and local governments can "export" a portion of their revenue burden to residents of other states. To the extent that the loss in federal revenue resulting from the deductibility of state and local taxes is offset by federal tax increases, these increases are borne by federal taxpayers nationwide. Similarly, if the federal revenue forgone through deductibility augments the federal deficit, the costs in higher interest rates or inflationary potential are shared throughout the nation. Consequently, by relying on deductible taxes, a state or municipality can lower the effective revenue burden borne by its residents.

The incentive for a state or municipality to rely on deductible taxes depends on the average federal tax saving of its residents per dollar of deductible taxes. This tax saving, in turn, depends on the fraction of deductible taxes that is actually deducted and the average tax saving per deducted tax dollar. For example, in calendar year 1985, 56 percent of all deductible taxes levied by Massachusetts were actually deducted by residents of the Commonwealth, and each deducted tax dollar saved Massachusetts itemizers an average of $0.27. Consequently, deductibility reduced the burden of the Commonwealth's deductible tax dollars by an average of (.56) × ($0.27), or $0.15 per dollar. Put another way, the average net burden of each deductible tax dollar was $0.85 (see appendix table 3). The net burden of each dollar collected from nondeductible sources was one dollar.

In 1985 the average net burden of a deductible tax dollar was lower than the national average in every New England state except Maine (appendix table 3). Because New Englanders enjoy high incomes relative to the national average, they are subject to high marginal tax rates. Consequently, they enjoy large federal tax savings per deducted state and local tax dollar. Their high incomes also encourage itemization. This propensity is reinforced by the large percentage of their household spending allocated to deductible items, such as mortgage interest, income taxes, and property taxes. Thus, in the interest of exportability, New England's state and local governments should rely less heavily on nondeductible sources of revenue, including user charges.

How much deductibility of state and local taxes has actually influenced the revenue mix of New England and of other regions is unclear. Nationwide, states with a relatively strong federal tax incentive to rely on deductible taxes in fact tend to rely on them more than other states do.[9] However, some economists have argued that this correlation is spurious, reflecting other underlying factors.[10] Within New England, New Hampshire, and Vermont rely lightly on deductible taxes, even though both states have a relatively strong federal tax incentive to levy them (appendix table 3).

III. Other Considerations in Choosing between User Charges and Taxes

Even if a state or local government has a strong federal tax incentive to rely on deductible taxes, it may nevertheless rely heavily on user charges to finance some of its private and mixed services. Financing such a service with user charges is most equitable and efficient when 1) the service is not a necessity, 2) a large portion of the service is consumed by nonresidents, and 3) the cost of providing the service varies widely among the neighborhoods or communities served by the state or local government. Given currently available data, it is not possible to evaluate the degree to which the private and mixed services provided by each state exhibit these three characteristics. Nevertheless, the extent to which these conditions hold is an important consideration in deciding how to finance a particular public service.

User Charges and Necessities

User charges generally finance services considered to be necessities, such as gas and electricity, water supply, sewerage, trash removal, and hospital care. Because they are necessities, their importance in a household's budget decreases as its income increases. Consequently, most user charges are regressive.

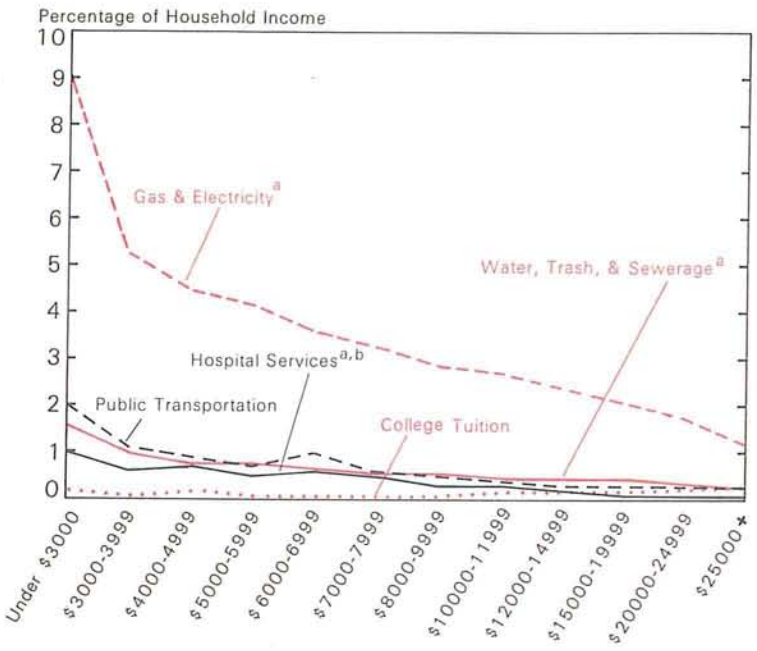
Many user charges are no more regressive, or even less regressive, than certain forms of taxation.

A survey conducted by the U.S. Bureau of Labor Statistics in 1972 and 1973 (U.S. Bureau of Labor Statistics 1978) confirms this regressive pattern (chart 3).[11] The only charge reported in the survey whose burden is not regressively distributed is tuition for public higher education, the third largest category of state and local user charges nationwide.

While most major charges are regressive, many of them are no more regressive, or even less regressive, than certain forms of taxation. Consequently, before rejecting higher user charges in favor of higher taxes, states and municipalities should consider the distributional characteristics of the tax alternatives at their disposal. According to Phares (1980), the most regressive taxes are selective sales taxes, such as excise taxes on liquor, tobacco products, and motor fuels; general sales taxes; and license taxes.[12] New

Chart 3

Household Outlays on Selected Services Often Financed by State and Local User Charges, by Income Class, 1972-73



[a] Publicly provided and privately provided services combined because of limitations of available data.
[b] Billed, not covered by insurance.

Note: The personal income deflator, as reported in the National Income Product Accounts, averaged 48.1 in 1972 and 1973 (1982=100). In the second quarter of 1989, this deflator equalled 129.8. Consequently, in order to inflate the income brackets used in this chart, the lower and upper boundary of each should be multiplied by 2.7 (129.8/48.1). For example, in 1989:2 dollars, the $3,000-3,999 bracket would be $8,100-10,797.

Source: U.S. Bureau of Labor Statistics, *Consumer Expenditure Survey 1972-1973*; U.S. Bureau of Economic Analysis, *National Income and Product Accounts*, and unpublished data.

England relies less heavily on these taxes for its state and local revenue than any other region. Partially as a result, several of the region's six state governments have responded to their budgetary problems by recently increasing one or more of these types of taxes (Gold 1989). The region's state and local tax policymakers should keep in mind that these taxes have the same undesirable distributional characteristics as many user charges. If their choice comes down to higher user charges, higher taxes on consumption, or higher license taxes, higher user charges may be the fairest of the three.

Taxes, User Charges, and Subsidization across Sites

Other things equal, user charges are more efficient and more equitable than taxes in financing services whose marginal cost varies greatly over space. Unlike user charges, taxes cannot discriminate among customers according to their location. Consequently, taxpayers at low-cost locations subsidize taxpayers at high-cost locations. Such "cross-subsidization" is unfair and stimulates excessive consumption by customers at high-cost sites.

For example, the marginal cost of sewerage varies inversely with population density because the more spread out the population served, the more feet of sewer pipe are required per customer. Consequently, in jurisdictions exhibiting a great deal of variation in density, taxpayers inhabiting high-density locations often must subsidize the cost of providing these services to taxpayers at low-density locations. Through "hook-up" fees and other public pricing schemes, user charges can be designed to force the latter to pay more for their sewer services than the the former, thereby reducing inequitable and inefficient cross-subsidization (Downing and DiLorenzo 1981 and Fisher 1987). Differential pricing can also reduce cross-subsidization in the provision of electricity, water, and natural gas.

Concern about cross-subsidization may explain why the percentage of a state's spending on sewerage that is financed by user charges depends partly on the extent to which sewerage is the responsibility of state agencies, county governments, and special districts (see the appendix).[13] Because states, most counties, and most special districts contain more than one municipality, the variation in population density within these three types of jurisdictions tends to be greater than the variation within a city or town.

Consequently, the probability of cross-subsidization among households is especially high if a state, county, or special district relies heavily on taxation to finance sewerage. In New England, where reliance on user charges to finance sewerage is extremely light (appendix table 2), sewerage is almost exclusively a municipal function.[14]

User Charges and Consumption by Nonresidents

When a state or local government finances a service through taxation, residents often subsidize the consumption of the service by nonresidents. This subsidization unfairly burdens residents and induces an inefficiently high level of consumption by nonresidents. If the service is private or mixed, then governments can reduce this inequity and inefficiency by charging for the service. By imposing user charges, they can also often export more of their revenue burden to nonresidents than by levying taxes.[15]

In several of the instances in which New England states rely heavily on user charges to finance a particular service, nonresidents consume a large proportion of the service. For example, a large proportion of the students enrolled in the public universities and colleges of New Hampshire and Vermont are nonresidents. These two states rely more heavily on tuition and fees to finance public higher education than any other state in the nation (appendix table 2). Nationwide, the larger the proportion of students enrolled in a state's institutions of higher learning that are nonresidents, the more the state relies on tuition and fees to finance those institutions (see the appendix). This relationship reflects the fact that all states charge nonresidents higher tuition than residents, mostly to compensate for the fact that their parents pay taxes to the state in which they live, not to the state in which their children attend college.

The heavy volume of interstate traffic borne by the highways of Maine, Massachusetts, and New Hampshire justifies and may partially explain these states' relatively heavy reliance on tolls to pay for their roads and bridges (appendix table 2). Massachusetts' highways are heavily used by motorists traversing the Northeast corridor. (Other states along the Northeast corridor, such as New York, New Jersey, Delaware, and Maryland, also rely heavily on tolls to pay for their roads and bridges.) The highways in New Hampshire's southeast corner bear a large volume of traffic traveling between Maine and other northeastern states. Moreover, tourism is an important industry to Maine, Massachusetts, and New Hampshire. Similarly, Massachusetts' heavy reliance on user charges to finance its airports may be justified by the large number of nonresidents that use Logan International Airport, the Commonwealth's only major air facility.

IV. Policy Implications

The U.S. Advisory Commission on Intergovernmental Relations (1979) has urged states and municipalities to strive for balance in their mix of revenues. The Commission has actually stipulated the percentage of total revenues that each tax should raise in an ideal state and local revenue system. Yet, a "balanced" system is not necessarily an efficient or equitable one.[16] Consequently, New England's state and local governments should not increase their user charges solely in order to bring the composition of their state and local revenues into greater conformity with the nationwide pattern. Indeed, this article has documented conditions in New England that partially explain and justify the relatively small role played by user charges in the region's mix of state and local revenues.

Conditions in New England partially explain and justify the relatively small role played by user charges in the region's mix of revenues.

Even if a uniform, ideal ratio of user charges to total revenues could be established, it would be a moving, elusive target. The importance of user charges in a state's revenue mix depends in part on its rate of economic growth. Growth in user charge revenues is less sensitive to business conditions than growth in tax revenues because the largest categories of user charges generally finance public services that are considered to be necessities, for which demand changes more slowly than income. Consequently, when a state's economic growth exceeds that of the national economy, the importance of user charges in its mix of state and local revenues declines relative to the nationwide average, in the absence of offsetting

policy changes. Partially for this reason, between 1977 and 1986 the share of New England's state and local revenues accounted for by user charges grew much more slowly than the comparable share nationwide.[17] However, in the absence of policy changes, this trend will probably reverse itself with slower economic growth in New England.

To the extent that increases in user charges play a role in solving New England's fiscal problems, the principles of efficiency and benefit taxation suggest that such increases should be confined to services that are primarily private in nature, such as electric power, water supply, and hospital care. Other state and local services with a smaller but still significant private dimension include higher education, primary and secondary education, public transportation, air transportation, highways, parks and recreation, housing, and sanitation (including sewerage).

Increases in charges for these services would impose considerable hardship on many low- and middle-income households. Consequently, should such increases be implemented, policymakers should consider mitigating this hardship with progressive tax reforms or increased funding for redistributional programs. For example, as Massachusetts decides whether to enact recently proposed increases in tuition at its public colleges and universities (Flint 1989), it might consider a simultaneous expansion of scholarships for students from low- and middle-income families.

Each state should design fiscal solutions tailored to its own circumstances and priorities among competing tax policy goals.

However New England's state and local governments ultimately deal with their fiscal troubles, their choices should not be dominated by a preoccupation with balance among revenue sources or conformity to nationwide norms. Each state should design solutions tailored to its own circumstances and priorities among competing tax policy goals. Policymakers should not be concerned if, as a result, the composition of their state and local revenues differs from the nationwide pattern.

Appendix

I. Determinants of Reliance on User Charges for Financing Sewerage

As discussed in the text, one significant determinant of the extent to which a state relies on user charges to finance sewerage is the percentage of its spending on sewerage accounted for by state government, county governments, and special districts. The strength of the relationship between these two variables is demonstrated in the following equation, estimated by ordinary-least-squares regression analysis:

$$\underset{}{\text{USERSEW}} = \underset{(0.121)^{**}}{0.288} \times \text{GOVSEW} - \underset{(0.0012)^{*}}{0.0021} \times \text{TAXCAP} + .746$$

$R^2 = 0.149$
Numbers in parentheses are standard errors.
* Significant at the 0.1 level.
** Significant at the 0.05 level.
N = 50

USERSEW = the percentage of spending on sewerage by governments within a state financed with user charges, in FY1986.

GOVSEW = the percentage of spending on sewerage by governments within a state accounted for by state government, county governments, and special districts, FY1986.

TAXCAP = a state's "tax capacity" in FY1986, as measured by the U.S. Advisory Commission on Intergovernmental Relations (1988) with its "representative tax system" approach. According to this approach, a state's tax capacity is the amount of revenues per capita that the state and its local governments would have raised in 1986 from a representative state and local tax system.

II. Interstate Differences in Reliance on User Charges to Finance Higher Education

As discussed in the text, the degree to which a state relies on user charges to finance public higher education is strongly and negatively correlated with the percentage of students in its public colleges and universities who are residents. This percentage is not currently available. Two

proxies were used instead. One is the percentage of freshmen in all of a state's institutions of higher learning, private as well as public, who are nonresidents, as measured by the U.S. Department of Education (1988). The major problem with this proxy is the inclusion of students at private universities. The other proxy is the percentage of students at each state's largest public university who are residents, as estimated by the College Entrance Examination Board (1988). The major problem with this statistic is its exclusion of all public institutions of higher learning other than the state's largest university. Both proxies are significantly correlated with a state's reliance on user charges to finance higher education, as indicated by the following two equations, both estimated by ordinary-least-squares regression analysis:

$$USERED = -0.319 \times COLL + 0.486$$
$$(0.068)^{\#\#}$$
$$R^2 = 0.315$$
$$N = 50$$
$$USERED = -0.191 \times LARGEST + 0.379$$
$$(0.055)^{\#}$$
$$R^2 = 0.198$$
$$N = 50$$

Numbers in parentheses are standard errors.
Significant at the 0.001 level
Significant at the 0.0001 level

USERED = the percentage of spending by a state and its local governments on higher education that is financed with user charges, in FY1986.

COLL = the percentage of freshman at all institutions within a state, private as well as public, that are residents, in 1987.

LARGEST = the percentage of students at the state's largest public university that are residents.

When tax capacity was entered into the above equations as an additional independent variable, its coefficient was found to be statistically insignificant.

III. Reliance on User Charges for Hospital Care

As alluded to in the text, the degree to which a state relies on user charges to finance public hospitals depends on the type of hospital care that it provides. Specifically, the larger the proportion of spending on hospital care devoted to general hospitals, the greater the reliance on user charges to finance hospital care. Data indicating the mix of each state's outlays for hospital care are not readily available. However, the American Hospital Association (1988) provides state-by-state estimates of hospital beds provided by registered, short-term, general community hospitals that are operated by state and local governments. (Registered, short-term, general community hospitals account for most of the beds provided by general hospitals and is the only category for which separate data on state and local governmental facilities exist.) The positive correlation between this per capita measure and a state's reliance on user charges to finance hospital care is indicated in the following equation, estimated by ordinary-least-squares regression analysis:

$$USERHOSP = 0.094 \times BEDSPC + 0.513$$
$$(0.043)^{**}$$
$$R^2 = 0.091$$
$$N=50$$

** Significant at the 0.05 level.

USERHOSP = the proportion of a state's spending on hospital care financed with user charges, FY 1986.

BEDSPC = the number of hospital beds provided by state and local, registered, short-term, community general hospitals per 1,000 population, 1987. (Sources: author's calculations, U.S. Bureau of the Census 1989, and American Hospital Association 1988.)

The coefficient on tax capacity is statistically insignificant when entered into the equation as an independent variable.

Appendix Table 1
Per Capita State and Local Spending on Selected Categories, New England and the United States, Fiscal Year 1986

	Dollars per Capita Spending on:							
State	Higher Education	Rank	Hospitals	Rank	Electric Power	Rank	Interest on General Debt	Rank
New England	$171.89		$127.14		$ 76.90		$190.95	
Connecticut	149.56	(48)	131.57	(24)	45.97	(33)	214.36	(12)
Maine	202.26	(38)	67.43	(45)	9.63	(42)	144.32	(29)
Massachusetts	157.16	(47)	163.44	(15)	127.95	(15)	177.00	(18)
New Hampshire	167.25	(46)	39.09	(49)	7.40	(43)	181.64	(15)
Rhode Island	210.76	(33)	110.53	(31)	4.10	(47)	272.11	(4)
Vermont	335.19	(8)	36.47	(50)	117.93	(17)	176.10	(19)
United States	234.51		157.89		116.90		153.74	

Source: U.S. Bureau of the Census, *Government Finances 1985–86*, and unpublished data.

Appendix Table 2

Composition of State and Local User Charges and Ratio of State and Local User Charges to Total Spending, by Expenditure Category, by Region, Fiscal Year 1986

State	Air Transportation				All Education			
	Percent of All User Charges	Rank	Ratio of User Charges to Spending	Rank	Percent of All User Charges	Rank	Ratio of User Charges to Spending	Rank
New England	2.6		1.183		21.2		0.105	
Connecticut	0.2	(48)	0.352	(44)	21.7	(26)	0.086	(45)
Maine	2.3	(18)	0.804	(16)	30.5	(4)	0.112	(32)
Massachusetts	4.3	(8)	1.512	(1)	15.2	(41)	0.088	(44)
New Hampshire	0.1	(49)	0.200	(50)	29.7	(8)	0.177	(4)
Rhode Island	1.1	(32)	0.509	(36)	29.8	(6)	0.108	(33)
Vermont	0.9	(39)	0.247	(49)	44.6	(1)	0.220	(1)
Mideast	3.5		1.100		16.6		0.083	
Great Lakes	1.9		0.563		27.6		0.138	
Plains	2.1		0.648		21.6		0.146	
Southwest	2.0		0.856		15.6		0.118	
Southeast	3.5		0.736		20.8		0.115	
Rocky Mountain	3.4		0.759		24.6		0.134	
Far West	2.9		0.919		13.4		0.097	
United States	2.7		0.811		18.6		0.113	

State	Higher Education				Elementary, Secondary, & Other Education			
	Percent of All User Charges	Rank	Ratio of User Charges to Spending	Rank	Percent of All User Charges	Rank	Ratio of User Charges to Spending	Rank
New England	17.3		0.392		3.9		0.025	
Connecticut	16.6	(28)	0.328	(32)	5.1	(9)	0.025	(32)
Maine	25.6	(7)	0.379	(16)	4.9	(12)	0.024	(36)
Massachusetts	11.8	(40)	0.343	(26)	3.4	(32)	0.025	(34)
New Hampshire	25.5	(8)	0.642	(1)	4.2	(22)	0.033	(20)
Rhode Island	26.2	(5)	0.379	(17)	3.6	(29)	0.018	(44)
Vermont	41.8	(1)	0.606	(2)	2.8	(40)	0.021	(41)
Mideast	13.2		0.340		3.3		0.021	
Great Lakes	22.5		0.399		5.1		0.036	
Plains	16.5		0.384		5.1		0.049	
Southwest	12.0		0.328		3.6		0.037	
Southeast	16.9		0.321		3.8		0.031	
Rocky Mountain	20.4		0.388		4.2		0.032	
Far West	11.4		0.263		2.0		0.021	
United States	14.9		0.337		3.7		0.030	

Note: Far West excludes Alaska and Hawaii. U.S. average includes Alaska and Hawaii.

Appendix Table 2 *continued*

Composition of State and Local User Charges and Ratio of State and Local User Charges to Total Spending, by Expenditure Category, by Region, Fiscal Year 1986

State	Hospitals				Highways			
	Percent of All User Charges	Rank	Ratio of User Charges to Spending	Rank	Percent of All User Charges	Rank	Ratio of User Charges to Spending	Rank
New England	14.1		0.432		4.0		0.083	
Connecticut	13.8	(33)	0.310	(44)	4.0	(10)	0.054	(17)
Maine	11.1	(38)	0.493	(35)	7.8	(4)	0.096	(5)
Massachusetts	16.2	(26)	0.454	(38)	3.9	(11)	0.124	(4)
New Hampshire	1.2	(50)	0.133	(49)	5.0	(7)	0.091	(6)
Rhode Island	30.5	(5)	0.844	(5)	2.5	(15)	0.044	(19)
Vermont	0.8	(51)	0.109	(51)	0.3	(39)	0.005	(43)
Mideast	10.4		0.291		7.6		0.168	
Great Lakes	18.7		0.660		2.1		0.050	
Plains	19.5		0.681		0.8		0.017	
Southwest	24.7		0.549		1.1		0.015	
Southeast	14.9		0.744		0.7		0.031	
Rocky Mountain	17.1		0.694		0.7		0.014	
Far West	16.6		0.685		0.9		0.041	
United States	17.9		0.600		2.3		0.059	

State	Housing & Community Development				Parks & Recreation			
	Percent of All User Charges	Rank	Ratio of User Charges to Spending	Rank	Percent of All User Charges	Rank	Ratio of User Charges to Spending	Rank
New England	4.7		0.222		1.7		0.206	
Connecticut	4.8	(5)	0.209	(20)	3.5	(3)	0.342	(8)
Maine	2.5	(9)	0.126	(42)	1.5	(24)	0.227	(22)
Massachusetts	5.6	(3)	0.241	(17)	1.2	(34)	0.141	(46)
New Hampshire	2.4	(12)	0.172	(31)	1.6	(23)	0.372	(4)
Rhode Island	5.3	(4)	0.255	(12)	1.1	(39)	0.112	(49)
Vermont	1.6	(20)	0.191	(24)	1.5	(28)	0.337	(9)
Mideast	4.2		0.260		2.1		0.211	
Great Lakes	1.3		0.153		2.1		0.234	
Plains	1.0		0.176		1.5		0.219	
Southwest	1.2		0.184		1.4		0.175	
Southeast	0.8		0.223		1.3		0.224	
Rocky Mountain	0.9		0.167		2.1		0.217	
Far West	0.9		0.098		1.9		0.226	
United States	1.7		0.195		1.7		0.217	

Appendix Table 2 *continued*

Composition of State and Local User Charges and Ratio of State and Local User Charges to Total Spending, by Expenditure Category, by Region, Fiscal Year 1986

State	Sewerage				Sanitation Other than Sewerage			
	Percent of All User Charges	Rank	Ratio of User Charges to Spending	Rank	Percent of All User Charges	Rank	Ratio of User Charges to Spending	Rank
New England	5.4		0.388		0.6		0.122	
Connecticut	5.5	(29)	0.281	(50)	1.3	(27)	0.165	(40)
Maine	8.7	(10)	0.555	(33)	0.5	(44)	0.106	(46)
Massachusetts	5.2	(32)	0.443	(43)	0.5	(45)	0.104	(47)
New Hampshire	4.9	(37)	0.414	(44)	0.7	(42)	0.153	(42)
Rhode Island	5.6	(28)	0.308	(48)	0.3	(48)	0.056	(51)
Vermont	3.1	(46)	0.270	(51)	0.2	(50)	0.093	(48)
Mideast	7.9		0.560		1.5		0.172	
Great Lakes	8.6		0.586		0.9		0.248	
Plains	4.8		0.572		1.2		0.538	
Southwest	4.7		0.588		2.4		0.739	
Southeast	6.9		0.737		3.1		0.500	
Rocky Mountain	6.7		0.657		1.9		0.697	
Far West	7.2		0.814		2.3		0.858	
United States	6.6		0.628		1.9		0.419	

State	Total Utility				Utility: Water Supply			
	Percent of All User Charges	Rank	Ratio of User Charges to Spending	Rank	Percent of All User Charges	Rank	Ratio of User Charges to Spending	Rank
New England	30.0		0.092		9.3		0.889	
Connecticut	29.2	(22)	0.111	(7)	10.9	(19)	0.785	(33)
Maine	12.3	(47)	0.160	(4)	8.6	(31)	0.766	(36)
Massachusetts	38.1	(10)	0.080	(11)	9.4	(26)	0.944	(8)
New Hampshire	7.0	(51)	0.288	(1)	5.4	(47)	0.828	(24)
Rhode Island	15.6	(45)	0.213	(3)	11.4	(14)	1.094	(2)
Vermont	27.5	(25)	0.049	(21)	6.6	(40)	0.856	(21)
Mideast	31.4		0.072		7.7		0.844	
Great Lakes	23.1		0.041		10.6		0.900	
Plains	34.9		0.025		6.7		0.848	
Southwest	37.7		0.014		10.2		0.734	
Southeast	41.4		0.025		13.1		0.815	
Rocky Mountain	29.8		0.016		11.5		0.719	
Far West	39.4		0.018		13.1		0.838	
United States	34.4		0.035		10.4		0.819	

Appendix Table 2 *continued*

Composition of State and Local User Charges and Ratio of State and Local User Charges to Total Spending, by Expenditure Category, by Region, Fiscal Year 1986

State	Utility: Electric Power				Utility: Gas Supply			
	Percent of All User Charges	Rank	Ratio of User Charges to Spending	Rank	Percent of All User Charges	Rank	Ratio of User Charges to Spending	Rank
New England	16.4		0.828		0.9		1.109	
Connecticut	14.9	(24)	0.958	(28)	1.0	(26)	1.283	(1)
Maine	3.2	(41)	0.997	(25)	0.0	(35)	—	
Massachusetts	22.3	(8)	0.796	(38)	1.3	(23)	1.070	(6)
New Hampshire	1.6	(45)	0.915	(32)	0.0	(35)	—	
Rhode Island	1.5	(46)	1.120	(5)	0.0	(35)	—	
Vermont	20.6	(11)	0.852	(36)	0.0	(35)	—	
Mideast	7.6		1.003		2.4		0.950	
Great Lakes	7.6		0.991		2.3		1.019	
Plains	24.0		0.927		3.4		1.004	
Southwest	22.4		0.771		4.4		0.945	
Southeast	25.0		0.734		2.5		1.017	
Rocky Mountain	15.0		0.444		2.6		1.043	
Far West	23.2		0.914		0.6		1.015	
United States	17.9		0.811		2.6		1.000	

State	Utility: Transit System				Liquor Stores			
	Percent of All User Charges	Rank	Ratio of User Charges to Spending	Rank	Percent of All User Charges	Rank	Ratio of User Charges to Spending	Rank
New England	3.4		0.173		4.8		1.162	
Connecticut	2.4	(11)	0.190	(36)	0.0	(23)	—	
Maine	0.5	(29)	0.439	(1)	13.0	(4)	1.019	(21)
Massachusetts	5.2	(6)	0.167	(40)	0.0	(23)	—	
New Hampshire	0.0	(49)	—		37.9	(1)	1.236	(7)
Rhode Island	2.7	(10)	0.202	(34)	0.0	(23)	—	
Vermont	0.3	(36)	0.432	(2)	11.3	(5)	1.038	(20)
Mideast	13.7		0.355		3.5		1.058	
Great Lakes	2.6		0.284		4.0		1.140	
Plains	0.8		0.248		2.6		1.164	
Southwest	0.7		0.211		2.6		—	
Southeast	0.8		0.206		0.0		1.180	
Rocky Mountain	0.7		0.161		4.4		1.270	
Far West	2.6		0.276		1.5		1.296	
United States	3.5		0.302		2.6		1.156	

Source: Author's calculations and U.S. Bureau of the Census, unpublished data.

Appendix Table 3

Size and Burden of Deductible Household Taxes, New England and United States

State	FY 1986 Deductible Household Taxes as a Percentage of Total Household Taxes	1985 Average Net Burden of a Deductible Tax Dollar Paid by Households ($)
New England	54.1	.857
Connecticut	51.4	.850
Maine	56.7	.894
Massachusetts	57.5	.849
New Hampshire	39.8	.841
Rhode Island	54.6	.860
Vermont	46.3	.845
United States	48.1	.866

Source: Author's calculations; National Bureau of Economic Research Tax Simulation Model; and Robert Tannenwald, "Rating Massachusetts' Tax Competitiveness," *New England Economic Review*, November/December 1987.

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[1] Division of Local Services, Massachusetts Department of Revenue, unpublished data, and phone interviews with budget officials of other New England states.

[2] For further discussion of the distinction between a tax and a user charge, see U.S. Advisory Commission on Intergovernmental Relations (1987), Bird (1976), Mushkin and Bird (1972), and Fisher (1987).

[3] For the purposes of this article, own-source revenues are defined as taxes, charges, interest, special assessments, other and unallocable general revenues, utility revenue, and liquor store revenue. Federal aid and insurance trust fund revenues are excluded. Insurance trust fund revenues are excluded because they are not available for general purposes and their composition is partially constrained by federal law.

The U.S. Bureau of the Census does not classify utility revenue and liquor store revenue as "general own-source revenues." However, in so doing, the Census Bureau does not mean to imply that these revenue sources are unavailable for general purposes. Telephone interview with Ms. Donna Hirsch, Governments Division, U.S. Bureau of the Census, September 25, 1989. See also U.S. Bureau of the Census (1987).

[4] See Musgrave (1959, 1984) for further discussion of the distinction between private and collective goods.

[5] The consumption of some mixed goods and services imposes costs on others, that is, generates "negative" externalities. For example, the smoke from burning cigarettes poses a health threat to occupants of a crowded room. This article assumes that on net the externalities created by the consumption of publicly provided mixed services are positive.

[6] As pointed out by Downing and DiLorenzo (1981), the provision of water supply often entails decreasing rather than increasing costs.

[7] The Census Bureau defines public welfare very broadly to include all "support of and assistance to needy persons contingent upon their need." It includes all cash payments to such persons, vendor payments on their behalf made to private purveyors, and assistance in kind, such as services provided by publicly operated hospitals (U.S. Bureau of the Census 1987).

[8] The correlation coefficient between these two variables in 1986 is 0.75, significant at the .0001 level. Total spending excludes expenditures out of insurance trust funds.

[9] The simple correlation coefficient between the average net burden of a deductible tax dollar in state calendar year 1985 and the fraction of the state's household tax revenues accounted for by deductible taxes in state fiscal year 1986 is 0.56, significant at the .0001 level.

[10] For more on the dispute concerning the effect of deductibility on state and local revenue mix, see Feldstein and Metcalf (1986), Holtz-Eakin and Rosen (1987), and Kenyon (1986).

[11] The U.S. Bureau of Labor Statistics' more recent surveys do not go into sufficient detail to evaluate the distributional characteristics of major state and local user charges.

[12] The property tax was once considered by most economists to be regressive. However, the tax's distributional characteristics have always been difficult to evaluate because its burden can be shifted away from owners of taxable property to renters, to employees, to consumers, or, through behavior responses in capital markets, to all owners of capital. A number of prominent economists now believe that the property tax is proportional or progressive. See Aaron (1975) and Mieszkowski (1972).

Many states and municipalities mitigate the regressivity of their general sales taxes by excluding necessities, such as food and clothing. Massachusetts is a case in point. See U.S. Advisory Commission on Intergovernmental Relations (1987), Reschovsky (1987), and Reschovsky, Sass, and Tannenwald (1988).

[13] One might posit that this strong correlation simply reflects a strong correlation between the percentage of spending on sewerage financed through user charges and the importance of special districts in providing sewerage. Special districts are arguably more likely to impose user charges rather than taxes because they generally provide only one service. As a result, taxes, payments for public services in general, may seem a less appropriate means of raising revenues for special districts. However, empirical evidence does not support this hypothesis. The percentage of spending on sewerage provided by special districts is not significantly correlated with the percentage of spending on sewerage financed with user charges.

[14] See Holland and McCarney (1983) and Holland (1984) for a detailed analysis of differences between Massachusetts and other states in terms of reliance on user charges to finance specific services.

[15] The opposite may be true if nonresidents engage intensively in private transactions that are simple to tax, such as renting hotel rooms, dining in restaurants, purchasing retail goods, or purchasing seasonal housing. Under these circumstances, states and municipalities get nonresidents to help finance the provision of public services by levying room occupancy taxes, meal taxes, and retail sales taxes and property taxes. Such taxes are the only effective means to force nonresidents to share in the financing of collective services.

[16] Ladd and Wiest (1987) document in considerable detail how preoccupation with balance in state and local revenue systems can detract from attainment of important tax policy goals, such as efficiency, fairness, and competitiveness.

[17] In FY 1977, user charges accounted for 16.6 percent of the nation's state and local own-source revenues. By 1986, this percentage had risen to 22.2 percent. By comparison, in FY 1977, user charges accounted for 14.9 percent of New England's own-source revenues. By FY 1986 this percentage had risen to only 15.8 percent.

The growing gap between New England and the rest of the nation in dependence on user charges is attributable to trends at the state level. Between FY 1977 and FY 1986, the percentage of state own-source revenues accounted for by user charges rose from 9.5 percent to 11.9 percent. By comparison, in New England this

percentage fell from 13.2 percent to 10.7 percent. At the local level, the percentage of own-source revenues accounted for by user charges grew in both New England and the nation by about 8 percentage points (U.S. Bureau of the Census 1979, 1987). Most local governments around the nation were induced by the property tax revolt of the late 1970s and early 1980s to substitute user charges for property taxes. The political pressures inducing this substitution overwhelmed the effect of business conditions on the ratio of user charges to total own-source revenues at the local level.

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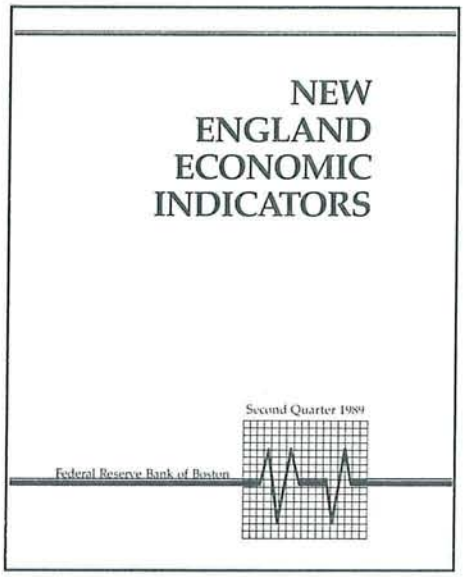

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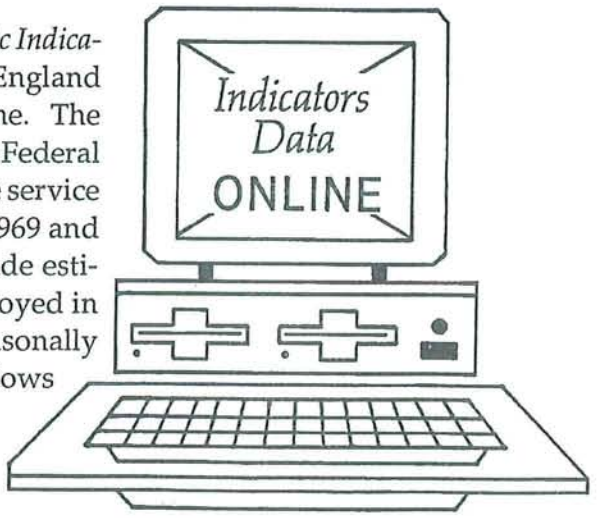

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