Is an Infrastructure Crisis Lowering the Nation's Productivity?

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3 Is an Infrastructure Crisis Lowering the Nation's Productivity?

John A. Tatom

Has the United States allowed its public infrastructure to decline? More importantly, has such a decline lowered the nation's productivity? John A. Tatom describes and evaluates the currently popular view that the answer to these questions is yes. Supporters of this view advocate sharp increases in federal government spending on infrastructure, with the expectation of a boost in the productivity of the nation's business sector. Tatom also reviews the criticisms of this view, especially the fact that, when flaws in previous statistical studies are addressed, the perceived, positive effects of the public capital stock on business productivity vanish. Tatom summarizes the reasons for a decline in the growth of some components of the nation's infrastructure in the 1970s and early 1980s, as well as for the reversal of these trends since 1984. He shows that a slowdown of public capital formation also occurred in Europe and Japan, presumably for many of the same reasons. According to Tatom, the federal capital stock per capita has been quite steady for more than 40 years, and there has been no connection between swings in federal aid to state and local governments and the latter's capital formation. Thus, dramatic boosts in federal spending in recent years have not raised overall public capital formation, but this has not been an obstacle to advances in productivity.

23 The Determinants of Consumer Installment Credit

Sangkyun Park

The behavior of consumer credit has attracted considerable attention during the last 10 years. After growing rapidly in the mid-1980s, consumer installment credit declined in many quarters during 1991 and 1992. Changes in consumption expenditures, however, may not fully explain the wide fluctuations in the growth of consumer credit.

Sangkyun Park examines both short-term fluctuations and the long-term trends of consumer installment credit in relation to economic and institutional factors. Between 1970 and 1992, particularly significant factors explaining the growth of consumer installment credit were the emergence of home equity lines of credit, the difference between the real after-tax interest rate on consumer credit and the return on household assets, and consumers' confidence about the future. This finding suggests that the Tax Reform Act of 1986, which contributed to the emergence of home equity lines of credit and raised the real after-tax interest rate on conventional consumer credit, played a significant role in slowing down the growth of consumer installment credit in the early 1990s.
Measuring Labor Market Dynamics: Gross Flows of Workers and Jobs
Joseph A. Ritter

Gross flows—the creation and destruction of specific jobs or the movement of workers into and out of employment—are the immediate outcomes of labor market processes. Firms create and destroy jobs. Workers enter and leave employment. Usually all such developments are condensed into a single number, the net change in employment data. In this article Joseph A. Ritter investigates several measures of gross flows, which reveal some striking features of U.S. labor markets and suggest new perspectives on how the economy operates.
Is an Infrastructure Crisis Lowering the Nation’s Productivity?

The state of the nation’s public capital stock and its importance to the nation’s overall economic well-being have become the subject of widespread speculation, investigation and concern. This concern has been reinforced by a decline in the rate of growth of the public sector capital stock that began in the 1970s. This decline, some analysts argue, caused stagnation of U.S. productivity growth and a corresponding decline of the nation’s standard of living and in its international competitiveness.\textsuperscript{1} These analysts conclude that increased federal infrastructure spending is an urgent national priority with high expected returns. Their view is referred to as the infrastructure deficit hypothesis below. Candidates for the presidency in the 1992 elections lent credibility to this view and expressed strong commitment to boosting infrastructure spending.\textsuperscript{2} (The Clinton Administration’s infrastructure program, called “Rebuild America” and announced in February 1993, is described in the shaded insert on page 14.) This article reviews the claims made by proponents of the infrastructure deficit view and the evidence against it.

What is Infrastructure?

Infrastructure refers to the relatively large physical capital facilities and organizational, knowledge and technological frameworks that are fundamental to the organization of communities and their economic development. It includes legal, educational and public health systems; water treatment and distribution systems; garbage and sewage collection, treatment and disposal; public safety systems, such as fire and police protection; communications systems, public utilities and transportation systems. The federal government’s principal involvement in infrastructure formation involves the military, legislative and judicial functions. The components of infrastructure in these areas largely are not physical capital, nor is the largest physical aggregate demand, output and employment. Recent policies adopted in Japan and proposed in the European Community (EC) take this approach. See \textit{IMF} (1993, p. 34) and EC (1993) for discussions of the specific Japanese proposals of August 1992 and April 1993, and the June 1993 EC summit proposals, respectively. The discussion in each case emphasizes the conventional effects on aggregate demand and employment that some analyses suggest can arise from countercyclical fiscal stimulus programs.

\textsuperscript{1}See especially Aschauer (1989b,c) and Munnell (1990b). Aschauer has referred to the infrastructure problem as the nation’s third deficit (presumably along with federal budget and trade deficits), hence the view supported by his work is referred to as the infrastructure deficit here. Reich (1991) provides a useful summary of the view that there is an infrastructure deficit and that attention to it should be a central national priority.

\textsuperscript{2}A more traditional view of the role of public capital formation emphasizes its use a countercyclical tool for altering
The key word in describing infrastructure above is system. Infrastructure typically requires relatively large initial capital outlays to provide services potentially to all persons in a geographic area; its incremental services are relatively cheaply provided to any new household. In many cases, physical units of infrastructure capital come in relatively large and "lumpy" units, such as highways, plants and buildings.

Table 1 provides a detailed breakdown of the components of public capital at the end of 1992, measured in current prices. This measure of the capital stock, which is net of depreciation, is an estimate of the replacement cost of capital at current prices; it is prepared by the Bureau of Economic Analysis of the U.S. Department of Commerce. The constant-dollar (1987 prices) net stock is used below to compare trends in the volume, or quantity, of public capital. The collection of public sector physical plant and equipment includes a broad range of capital goods, some of which, especially when held under private ownership, are not commonly thought of as infrastructure, and some which are not related to any special function of government.

Public vs. Private Infrastructure

Much of the infrastructure in a highly developed market economy such as the United States' is privately provided and managed. Some examples include most electric and gas utilities; communications firms, such as telephone, radio, television and cable services; private educational institutions; and private providers of transportation services. Similarly, local governments have recently begun to privatize infrastructure by selling off public assets, contracting for the capital services (for example, private prisons or police), or mandating that private developers provide infrastructure capital to secure development approval. Significant private sector initiatives in areas like telecommunications, transportation and waste processing dominate U.S. infrastructure developments. Recently, mergers and joint ventures by cable companies, the Baby Bells, entertainment and other information and communication firms have accelerated the development of private communications infrastructure, especially the so-called information superhighway.

Other nations lead the way in privatizing public capital facilities, especially telecommunications and transportation, to promote efficiency and improve the quality and quantity of capital services, or simply to raise government revenue. While relatively more of these countries' infrastructure has been provided by the public sector in the past, many are currently privatizing infrastructure and shifting to private sector provision. Prominent examples include the Mexican and other telephone companies, the earlier privatization of Mexico's airlines, the privatization of infrastructure activities in Eastern European countries, and recent proposals to privatize railroads, airlines and communications systems in western Europe. The Japanese telephone company, Nippon Telephone and Telegraph (NTT), was privatized in 1985 and Japan recently began to privatize its railways.

THE INFRASTRUCTURE DEFICIT VIEW AND TRENDS IN PUBLIC CAPITAL FORMATION

According to the infrastructure deficit hypothesis, a decline in public capital formation began in the early 1970s and has reduced productivity in the nation's business sector. In addition, the hypothesis continues, the decline has reduced the rate of return to private capital formation, so that private capital formation has been reduced as well. This, in turn, has further lowered private sector productivity. Since productivity is the principal determinant of the nation's income per capita, the decline has caused, ac-
Table 1
The Composition of the Net Stock of Public Capital: 1992
(end of year, billions of dollars)

<table>
<thead>
<tr>
<th></th>
<th>Federal</th>
<th>State and local</th>
<th>Total</th>
<th>Percent of total*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nonmilitary structures</td>
<td>$247.5</td>
<td>$1,856.0</td>
<td>$2,103.5</td>
<td>(90.6%)</td>
</tr>
<tr>
<td>Highways and streets</td>
<td>16.4</td>
<td>716.6</td>
<td>733.0</td>
<td>(31.6%)</td>
</tr>
<tr>
<td>Educational buildings</td>
<td>1.2</td>
<td>327.1</td>
<td>328.3</td>
<td>(14.1%)</td>
</tr>
<tr>
<td>Other buildings</td>
<td>36.1</td>
<td>240.2</td>
<td>276.3</td>
<td>(11.9%)</td>
</tr>
<tr>
<td>Hospital buildings</td>
<td>12.2</td>
<td>51.7</td>
<td>63.9</td>
<td>(2.8%)</td>
</tr>
<tr>
<td>Water supply facilities</td>
<td>—</td>
<td>119.3</td>
<td>119.3</td>
<td>(5.1%)</td>
</tr>
<tr>
<td>Sewer systems structures</td>
<td>—</td>
<td>198.0</td>
<td>198.0</td>
<td>(8.5%)</td>
</tr>
<tr>
<td>Conservation &amp; development</td>
<td>145.1</td>
<td>36.7</td>
<td>181.8</td>
<td>(7.8%)</td>
</tr>
<tr>
<td>Industrial buildings</td>
<td>25.6</td>
<td>—</td>
<td>25.6</td>
<td>(1.1%)</td>
</tr>
<tr>
<td>Other structures</td>
<td>10.9</td>
<td>166.5</td>
<td>177.4</td>
<td>(7.6%)</td>
</tr>
<tr>
<td>Nonmilitary equipment</td>
<td>62.3</td>
<td>155.7</td>
<td>218.0</td>
<td>(9.4%)</td>
</tr>
<tr>
<td>Nonmilitary structures and equipment</td>
<td>309.8</td>
<td>2,011.6</td>
<td>2,321.4</td>
<td>(100)</td>
</tr>
<tr>
<td>Military equipment</td>
<td>420.9</td>
<td>—</td>
<td>420.9</td>
<td></td>
</tr>
<tr>
<td>Military structures</td>
<td>115.3</td>
<td>—</td>
<td>115.3</td>
<td></td>
</tr>
<tr>
<td>Total (including military)</td>
<td>846.0</td>
<td>2,011.6</td>
<td>2,857.6</td>
<td></td>
</tr>
<tr>
<td>(36.4)</td>
<td>(86.7)</td>
<td>(123.1)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Shares of the nonmilitary total are given in parentheses. Components may not add to total due to rounding.

SOURCES: Unpublished data provided by the National Income and Wealth Division (BE-54), Bureau of Economic Analysis, U.S. Department of Commerce.

According to this view, a decline in the nation's real income and international competitiveness.5

The growth of the nation's stock of public sector capital slowed sharply in the late 1960s and in the early 1970s. The infrastructure deficit view focuses on this decline in the trend growth of public capital.6 Figure 1 shows the net stock of nonmilitary fixed public sector capital measured in 1987 prices. While the capital stock has climbed steadily, its growth rate slowed in the early 1970s. Proponents of the infrastructure deficit view often measure the public capital stock relative to private sector employment and show that such capital per worker fell beginning in the mid-1970s. In their view, public capital yields services in private sector production so that, like private capital, its contribution is best assessed by measuring its quantity relative to private sector employment. Public capital is aimed at providing services to all residents, however, especially children and the aged. Thus, a broader assessment is afforded by its availability per person.

On a per capita basis, the public capital stock (Figure 2), including the federal as well as state and local governments, nearly doubled between...
Figure 1
Net Stock of Nonmilitary Public Capital
Billions of dollars (1987 prices)

NOTE: End-of-year data

Figure 2
Real Nonmilitary Government Capital Stock per Person
Thousands of dollars (1987 prices) per person

NOTE: End-of-year data.
Thus, if the previous slowing was a problem, it resumed its growth beginning in 1984. Finally, Figure 2 suggests that public capital for the slowing in overall public capital formation.

Advocates of the infrastructure deficit view suggest that the problem arose at the federal level and that it requires a federal solution, but these conclusions are not supported by the composition of public capital and its trends. Table 1 shows that about 86 percent of the nation's public capital stock is held by state and local governments; it is these governmental units that make decisions to augment it. Figure 2 also shows that federal nonmilitary capital has been about $1,100 per person (1987 prices) since 1950. There has been essentially no upward (or downward) trend in this level, either before or after the early 1970's.

Thus, it is difficult to see that federal government holdings of capital have played a role in the slowing in overall public capital formation. Finally, Figure 2 suggests that public capital formation resumed its growth beginning in 1984. Thus, if the previous slowing was a problem, it appears to have ended almost a decade ago.

An International Comparison

Is it really true that the U.S. has fallen behind? A common criticism of U.S. infrastructure policy is that foreign countries have more infrastructure and a faster pace of infrastructure formation than the United States. Ford and Poret (1991) have examined the public capital-private productivity link for 11 major industrial countries and find that the evidence of a link is not robust. Also, criticisms of U.S. infrastructure development ignore the relatively large U.S. private sector holdings of capital that abroad, would be held by the public sector; this is especially the case in transportation, communications, and electric and gas utilities. It is not possible to construct a comprehensive and exactly comparable measure of infrastructure. Analysts would differ over the types of capital, and the various sectors to be included or excluded in constructing such a measure; moreover, it is not possible to obtain comparable detail or component measures for comparable sectors.

Table 2 provides some insight into these issues. The size of public capital formation relative to private capital formation in eight countries, including the United States, is shown for various five-year periods since 1960, where data are available. The table shows that public capital formation has generally slowed when measured relative to private capital formation or GDP in all of the countries except France. In the latest period, public capital formation continued to decline in all countries except the United States and France. Thus, the decline in U.S. public

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7Seely (1993, pp. 35-7) suggests that a comparison with the earlier infrastructure trend, especially in the 1960s and early 1970s, overstates the decline. In particular, he refers to this earlier period as the "golden age of infrastructure development in the United States." He cites the beginning of the Department of Transportation (1968), the Environmental Protection Agency (1969), and three new laws—the Solid Waste Disposal Act of 1965, the Urban Mass Transit Act of 1970 and the 1972 Water Pollution Control Act as the sources of this boom.

8See Aschauer (1989a), for example.

9Ford and Poret also note the distinction between public capital and a broader measure of infrastructure by measuring infrastructure narrowly as the public capital stock of "producers of government services," and more broadly by including public and private capital stocks in electricity, gas and water, and structures in transportation and communications. They do find some support for a link between private productivity and the broader measure in a cross-country comparison, but they reject the public capital link using the narrower measure, and find that the significant results with the broader measure are not robust.

10The capital formation data are from the Organization for Economic Co-operation and Development (OECD), except that this source contained no Japanese data; these were obtained from a national source. The countries shown are the only major industrial countries for which OECD reports data for most of the period. For example, data for Italy, the only G-7 country omitted in Table 2, are reported only for 1980-86.
capital formation is not unique and, as a share of GDP, it is small compared with the experience abroad.

Table 2 also shows that relatively more of investment (and economic activity) is determined by the public sector in Europe and Japan. In most periods shown, public capital is a larger percentage of private capital formation in all of the foreign countries (except the United Kingdom) than it is in the United States. Public capital formation has generally been a smaller share of GDP in the United States, according to these data, than in any of the other countries except the United Kingdom. While data from the 1960s are only available in a few countries, the decline in public capital formation as a share of GDP has not been smaller abroad than in the United States. Thus, it is hard to attribute any purported decline in U.S. competitiveness to a relative decline in the pace of public capital formation.

WHY HAS U.S. PUBLIC CAPITAL FORMATION DECLINED?

Two of the largest components of the nation's public capital stock (see Table 1) are highways and streets, and educational buildings. While the first is closely related to the notion of infrastructure, it is only one part of a much larger (and generally private) set of capital goods that includes automobiles, trucks, buses and trailers, which are involved in the provision of transportation services. Educational buildings (unlike the educational system, its organization, content, processes and outcomes) are less related to the infrastructure concept and also have a large private sector counterpart. These two components—highways and streets, and educational buildings—account for most of the slowing in the growth of U.S. public capital. Figure 3 shows these two components of public capital per person and total public capital per capita excluding these two
Figure 3
State and Local Net Capital Stock per Person
Thousands of dollars (1987 prices) per person

NOTE: End-of-year data

components, called “other” in the figure. Excluding these two components, there was little or no slowing in public capital formation during the 1970s and early 1980s.

Tatom (1991b) argues that there are three principal reasons for the slowing in highway and street, educational building, and total public capital formation. First, the post-World War II baby boom and associated temporary surge in population growth played a major role in the subsequent decline in growth of the educational buildings stock and in the earlier growth of highways and streets, especially surrounding cities.13 The interstate highway system, began in the mid-1950s and largely completed by 1975, also contributed to a temporary surge in public capital formation and, subsequently, gave rise to part of the apparent slowing. Second, changes in the cost of driving played an important role in accounting for the decline in road capital formation. Following sharp increases in the price of oil and gasoline in 1973-74 and again in 1979-80, the growth of passenger-miles driven per person dropped very sharply. Reductions in the growth of highway and street use reduced the growth of this form of capital.

The third factor influencing roads, highways, educational buildings and other public capital formation is the price of such capital goods. From the early 1950s to the early 1960s, the

13The decline in the growth of the stock of educational buildings reflects the fact that the share of the school-age population (ages 5 to 24) rose from about 31 percent in 1949 to about 375 percent in 1971, then fell steadily to less than 29 percent in 1990. Not surprisingly, public educational buildings per person peaked in 1974. The subsequent decline in public educational buildings per person was smaller than the decline in its private educational counterpart. The slowing in highway and street capital formation was similarly not unusual when compared with private capital formation associated with road transportation; see Tatom (1993).
prices of public capital goods fell relative to the prices of private capital goods. Consistent with the law of demand, the quantity of public capital grew much faster than that of private capital goods over the period. Since then, and especially since the late 1960s, the relative price of public capital goods has climbed sharply; not surprisingly, the demand for, and quantity of, public capital has declined relative to private capital.14

Two of the three factors depressing public capital formation began to reverse in the 1980s. The relative price of gasoline generally declined after 1980, falling dramatically in 1986, boosting road travel and the demand for highway and street capital. The share of the school-age population has nearly bottomed out as well. For example, the population ages 5 to 19 rose from 52.4 million in 1986 to 53.2 million in 1991 (the latest year available), after declining from a peak of 60.3 million in 1971.15 Not surprisingly, school districts have responded to the recent baby “boomlet” by building new schools. From 1983 to 1992, the stock of state and local highways and streets and educational buildings per person declined at a 0.2 percent rate, much slower than their 0.9 percent rate of decline from 1975 to 1983.

These two changes have resulted in a resumption of growth in the overall stock of public capital per person since 1983. During the 1975-83 period, the total stock rose at only a 1.1 percent rate, so the per capita total public stock rose at only a 0.1 percent rate. The only period of decline in the per capita total occurred from the end of 1980 to the end of 1983, when it fell at a 0.1 percent rate. From 1983 to 1992, the growth rate of the total public capital stock accelerated to a 1.7 percent rate and that of the per capita stock rose to a 0.7 percent rate. If there was an infrastructure deficit as measured by declining public capital per person, it ended in 1983.

Did Reduced Federal Funding Play a Role?

While the closer look above at the composition of public capital and its trends shows that federal government capital formation plays a minor role in public capital acquisition and the overall trend, the federal government does play a role in financing some state and local government capital formation. This financing role could account for some of the earlier slowing in public capital formation. Tatom (1993) shows, however, that changes in federal financing do not account for the past state and local slowing. The argument there uses data on overall federal grants-in-aid to state and local governments and the latter’s public capital formation relative to GDP. The total grant is the relevant gauge of federal assistance for infrastructure development because of the fungibility of funds within state and local government budgets.16 These data are plotted in Figure 4. Most of the post-1968 decline in the share of public investment in GDP occurred before the share of federal grants to state and local governments in GDP peaked in 1978.17 The share of public investment showed a further slight decline from 1978 to its 1984 level of about 2 percent of GDP, but it rose to about 2.2 percent of GDP in 1985 through 1991, despite a further decline in federal grants until 1989.

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14In Tatom (1991b), the relative price of public capital to private capital is measured by the implicit price deflators for public nonmilitary investment and for private nonresidential fixed investment. It declined about 13 percent from 1954 to 1960, then rose about 36 percent from 1960 to 1989. As a result of the latter movement, in part, the quantity of constant-dollar net stock of nonmilitary public capital fell from about 58 percent of the constant-dollar net stock of nonresidential private capital in 1964 to about 42 percent in 1989.

15See Council of Economic Advisers (1993), p. 381. The number of persons ages 20 to 24 continued to decline after 1986, falling 1.6 million from 1986 to 1991, so that the total for both groups may not have reached its trough in 1991.

16Federal grants to state and local governments include funding for other programs besides capital outlays. Indeed, such grants are nearly four times as large as federal grants for state and local government spending on infrastructure capital. About 60 percent of federal infrastructure spending occurs through such grants. Also, see Moore (1992) for more detailed analysis of the growth of federal spending for infrastructure since 1989.

17The share of federal grants for major public physical capital investment in GDP rose from about 0.2 percent in fiscal 1948-56 to 0.8 or 0.9 percent in 1976-80, then declined to 0.5 percent in 1987-92, according to the U.S. Office of Management and Budget (1993, p. 378). This pattern essentially mirrors, at a lower level, the pattern of total federal grants to state and local governments.
Since 1989, federal grants to state and local governments have ballooned, rising from 2.2 percent of GDP in the federal government’s 1989 fiscal year to 2.8 percent in the 1992 fiscal year. These expenditures rose from $116 billion in fiscal 1989 to $167.8 billion in fiscal 1992 (a 44.7 percent increase); had their share in GDP not risen, such spending would have climbed to only $130.7 billion. Despite this $37.1 billion extra boost in funds available to state and local governments, there has been no change in public sector investment as a share of GDP.

Table 3 shows federal outlays aimed directly for public capital in selected years; it also shows GDP in each year to facilitate assessments of the growth of nominal expenditures. The table shows that federal outlays aimed at state and local capital formation are much larger than direct federal outlays. The table also shows that recent growth has outstripped overall growth in the nation’s GDP. From 1989 to 1993, federal outlays grew 47.4 percent, more than twice as much as the 21.6 percent rise in GDP over the same period. Over the same period, grants to state and local governments for major public capital projects rose 39.6 percent, still nearly twice the percentage increase in GDP. Despite this surge, public investment as a percent of GDP changed little after 1989. The overall boost in federal government funding was apparently offset by reduced funding at the state and local levels.

Such a substitution in funding is not unusual. Earlier attempts by the federal government to boost specific state and local spending components have met with such substitutions. Thus, such substitution effects. The CBO (1986) provides strong evidence of such substitutability. Also, see CBO (1988), Gramlich (1978) and Jondrow and Levy (1984) for discussions of this phenomenon.
Table 3
Federal Outlays for Major Public Physical Capital: Selected Years (billions of dollars)

<table>
<thead>
<tr>
<th>Year</th>
<th>Nondefense</th>
<th>Grants to state and local government</th>
<th>Total</th>
<th>GDP*</th>
</tr>
</thead>
<tbody>
<tr>
<td>1960</td>
<td>$1.9</td>
<td>$3.3</td>
<td>$5.2</td>
<td>$513.4</td>
</tr>
<tr>
<td>1970</td>
<td>2.5</td>
<td>7.1</td>
<td>9.6</td>
<td>1010.7</td>
</tr>
<tr>
<td>1980</td>
<td>8.1</td>
<td>22.5</td>
<td>30.6</td>
<td>2644.5</td>
</tr>
<tr>
<td>1985</td>
<td>11.7</td>
<td>24.9</td>
<td>36.6</td>
<td>3970.9</td>
</tr>
<tr>
<td>1989</td>
<td>13.9</td>
<td>24.5</td>
<td>38.4</td>
<td>5175.8</td>
</tr>
<tr>
<td>1990</td>
<td>15.5</td>
<td>25.3</td>
<td>40.8</td>
<td>5482.9</td>
</tr>
<tr>
<td>1991</td>
<td>16.3</td>
<td>26.5</td>
<td>42.8</td>
<td>5671.5</td>
</tr>
<tr>
<td>1992</td>
<td>20.3</td>
<td>29.3</td>
<td>49.6</td>
<td>5940.8</td>
</tr>
<tr>
<td>1993</td>
<td>22.4</td>
<td>34.2</td>
<td>56.6</td>
<td>6294.6</td>
</tr>
<tr>
<td>1994</td>
<td>22.9</td>
<td>38.7</td>
<td>61.6</td>
<td>NA</td>
</tr>
</tbody>
</table>

*GDP and budget data here are for fiscal years.


it is difficult to ensure that targeted assistance programs, such as those for public capital formation, will result in net increases in spending. New federal funding for state and local government capital spending may well finance projects that would have been done in any case; in turn, the savings these federal grants generate are used to fund more pressing current expenses instead of new capital formation.

**THE QUESTIONABLE EVIDENCE FOR THE PUBLIC CAPITAL-PRIVATE PRODUCTIVITY HYPOTHESIS**

The principal damage attributed to the infrastructure deficit, according to proponents of this view, is that it led to the stagnation of private sector productivity beginning at nearly the same time as the slowing in public capital formation. Statistical estimates by Aschauer (1989c) and Munnell (1990b) indicate that the public capital stock has an unusually large effect on private sector output, given the use of fixed amounts of private sector resources.20 Criticisms of these estimates have arisen for several reasons outlined below.

**The Benefits of Public Capital Are Not Necessarily Reflected in Business Output**

Both Aaron (1990) and Musgrave (1990) criticize the Aschauer (1990) discussion for ignoring the fact that most of the services of public capital have no effect on measured national output, not to mention measured business sector output or, even more to the point, business sector productivity. Similarly, Aaron insists that “the argument that public sector investments contribute massively to measured national output is not strengthened by arguing that such investments contribute to items that do not appear in measured output” (p. 59). Even in the case of investments in airports or highways to reduce congestion costs, there are other benefits to the public besides increased efficiency of work and, therefore, greater business output. Time savings due to reduced congestion could result in increased work time and business output, but this

20Ratner (1983) had obtained this result earlier, although his estimate was somewhat smaller. Holtz-Eakin (1988) also obtained similar results, although later (1992 and 1993) he presented more detailed analysis for cross-section and time-series results that rejected the hypothesis.
would not necessarily boost their ratio, or business sector productivity.\textsuperscript{21}

**Public and Private Capital Are Substitutes**

Proponents of the link between private productivity and public capital tend to ignore substitutability in public and private capital services.\textsuperscript{22} Increased highway stocks, for example, could raise the rate of return to trucking firms, but these gains come, in part, at the expense of lower social and business returns to public and private capital in water, rail and air transport. Public projects involving locks and dams, airports or roads produce services that are likely to be substitutes for each other and for private capital services as well. The presence of such a substitutability relation reduces the expected returns from public capital formation and leads to offsetting reductions in the other components of the public capital stock and in the private stock. More importantly, these substitutions offset, in part, any gain in private output directly associated with a rise in one component of public capital.

Over the period 1929 to 1991, the growth rates (continuously compounded) of the end-of-year public and business sector capital (measured by the constant-dollar net stock of fixed nonresidential private capital) stocks have a contemporaneous correlation coefficient of $-0.287$, which is statistically significant at a 95 percent confidence level. Even within the government total there is no evidence of complementarity, as the growth rates for the federal stock and the state and local stock have a correlation coefficient of $-0.143$; this negative relationship is not statistically significant at the 95 percent level, however.

**Estimates of the Size of the Public Capital Stock Effect**

The Aschauer/Munnell estimates have been widely criticized as being implausible because of their sheer magnitude. Aaron (1990) focuses on their implausible real rate of return estimates for components of the capital stock. The real rate of return (ignoring nonmarket benefits) to private (public) capital equals what is called the marginal private sector product, or the contribution to private sector output of an additional unit of private (public) capital. Aaron points out that Aschauer's estimates imply a real rate of return to some components of public capital that is about five times that of private capital (146 percent vs. 21 to 29 percent). Such estimates imply that moving a dollar of private investment spending to such public investment would boost output by more than $1.15 per year.

More recently, Aschauer (1993) has scaled back his estimate of the effect of public capital on private sector output. He now assumes that this marginal product of public capital is the same as that of the marginal product of private capital.\textsuperscript{23} As a result, he has also scaled back his earlier claim that the slowdown in public capital formation accounted for all of the slowing in

\textsuperscript{21}Tatom (1993) suggests that reduced congestion and travel cost could lower real wages, leading to a lower level of marginal and average productivity of labor. The latter effect requires that the marginal and average productivity of labor are proportional and that employment rises. Output, employment and the typical consumer's standard of living all rise in this analysis, but private sector productivity does not.

\textsuperscript{22}Aschauer (1989b) claims that public and private capital are complements, although he finds evidence that public capital formation crowds out private capital formation, dollar for dollar. Aschauer's estimates using data on capital stocks, however, indicates that the stocks are complements. The apparent inconsistency in these results is not explained. Eisner (1991) tests the relationship of private capital investment to public capital investment using Munnell's data (1980a, 1980b) in an accelerator model. He finds evidence that public and private capital are not related, although a negative public capital formation coefficient ($-0.07$) found in the time-series data for 48 states suggest a substitute relationship and this effect is only marginally not statistically significant ($t = -7.75$) at a 5 percent level. Erenburg (1993) reports results supporting the complementarity hypothesis, although the statistical significance of the result is not indicated. The Erenburg result arises for private equipment, but not for private structures.

\textsuperscript{23}If government decisionmakers maximize the value of the nation's resources, the opportunity cost of public capital would be the private rate of return on private capital adjusted upward up to reflect capital income taxation. Then the marginal benefit of public capital would be equal to the marginal product of private capital services. In practice, however, the cost of capital used in public decisions tends to be lower than it is for the private sector; thus, it is more likely that the marginal product of public capital is lower than that of private capital. See the discussion of the theory and practice of cost-benefit analysis in Musgrave and Musgrave (1989). Moreover, even if it were the case that the public sector decisionmaker equates the public cost of capital to the marginal benefit of public capital, the latter is composed of marginal nonmarket benefits plus any marginal private sector product of public capital. Thus, to the extent that government capital yields direct services to consumers, the marginal private sector product of public capital will be less than the marginal private sector product of private capital. When public decisionmakers pursue private benefits of their own, there is an additional incentive to "overinvest" in public capital by using a lower cost of public capital than otherwise.
The Shifting Policy Perspective on Public Capital Formation

Aaron (1990) has pointed out that one of the peculiarities of the infrastructure debate is how readily the evidence supporting the infrastructure view was accepted, despite the implausibility of the estimates. He argues that such evidence is welcome relief to those analysts who are “sick and tired—with good reason, in my view—of continuous and unsupported allegations that everything the government does is wasteful or harmful” (p. 62). He also points out how welcome the kind of results in Aschauer and Munnell are to groups who stand to gain from expanded infrastructure spending.

The two leading candidates for president in the 1992 election proposed increased federal infrastructure spending as critical priorities. For example, the Clinton campaign planned to boost federal infrastructure spending by $20 billion each year from 1993 to 1997 as part of a $50 billion per year program to “put America back to work—the most dramatic economic growth program since World War II.” The centerpiece of this growth program, called “Rebuild America,” included the extra $20 billion per year to rebuild America and develop the world’s best communication, transportation and environmental systems. Despite the public attention to the problem of the nation’s physical infrastructure, the proposed program represents a smaller overall boost in spending than the rhetoric might suggest. More importantly, the plan also contains a major shift toward technology developments (instead of physical capital formation) that are traditionally the province of the private sector.

The table shows the Clinton Administration’s path of planned new spending for Rebuild America from 1994 to 1998. Note that the proposed additional spending in each year does not reach $20 billion until 1998, and only then by including tax incentives for private capital. More importantly, most of the nearly $70 billion of increased “investment” in 1994-98 are not for public capital and infrastructure. Only about $27 billion of this total is for traditional public infrastructure spending in transportation, environmental, rural and community development (which also include funds for some housing stock rehabilitation programs). While this total excludes public housing and spending for new technology development (including short-haul aircraft research, high-performance computing, information highways, alternative fuels, vehicles and research on natural gas, and fusion energy), it includes items that would result in little new physical capital formation, such as spending for smart cars/smart highway research, alcohol-related safety programs, and community development banks.

Proposed spending from 1994-98 also shows a significant change in the composition of federal programs. The current administration plans to devote an increasing share of spending to innovative activities. The emphasis in infrastructure spending has shifted to information networks and the technologies of the future, which are largely private sector activities in the United States. The technologies for fast computing, information highways and fiber-optic networks already exist and innovations are being implemented in the U.S. private sector (for example, through the use of existing super computers, the Internet system, private phone systems, and satellite communication centers, respectively). Expansion of fiber-optic networks and the introduction of information highway systems by the Baby Bells represent continuing efforts to extend the use of the processes. There is even a pri-

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1See Clinton and Gore (1992).
2The figures in the table are from Clinton (1993). Data from the Administration’s budget released on April 8, 1993, differ slightly. Aschauer apparently agrees with the shift in emphasis or broadened view of infrastructure described here. According to the Washington Post (1992), “Aschauer stresses that not all public investment will produce a big long-term return. For example, he opposes pork barrel highway projects, but strongly supports government investment on advanced technologies, such as ‘intelligent highways.’ ”
The Clinton Budget Plan: Rebuild America Public Capital Formation (billions of dollars)¹

<table>
<thead>
<tr>
<th>Year</th>
<th>Rebuild America: total increase in public investment</th>
<th>Total, excluding energy, housing and technology²</th>
<th>Technology</th>
</tr>
</thead>
<tbody>
<tr>
<td>1994</td>
<td>$2.2 ($4.0)</td>
<td>$1.2 ($1.3)</td>
<td>$0.7 ($1.9)</td>
</tr>
<tr>
<td>1995</td>
<td>7.2 (10.1)</td>
<td>4.1 (4.4)</td>
<td>2.3 (3.8)</td>
</tr>
<tr>
<td>1996</td>
<td>11.2 (14.8)</td>
<td>6.0 (6.8)</td>
<td>3.4 (5.2)</td>
</tr>
<tr>
<td>1997</td>
<td>14.1 (18.6)</td>
<td>7.4 (8.6)</td>
<td>4.2 (6.2)</td>
</tr>
<tr>
<td>1998</td>
<td>16.0 (21.4)</td>
<td>8.2 (9.9)</td>
<td>4.5 (6.7)</td>
</tr>
<tr>
<td>1994-98</td>
<td>50.7 (68.9)</td>
<td>26.9 (31.1)</td>
<td>15.1 (23.7)</td>
</tr>
</tbody>
</table>

¹Numbers in parentheses are total investment outlays including tax incentives.
²Includes transportation, environmental, rural and community development.

NOTE: Numbers do not add to total due to rounding.

SOURCE: Clinton, A Vision of Change for America.

vately owned and funded high-speed rail system in the planning stage in Texas.

One indicator of the shift to competition with private sector activities is indicated in the table. Revitalizing technology, about one-third of Rebuild America, includes substantial sums for research and development in mainstream private sector activities. Most of the energy outlays and a substantial fraction of transportation, environmental and community development outlays are for similar projects. Ironically, as Butler (1992) shows, there is no evidence that total R&D, or public R&D, investments slowed in the late 1970s and 1980s, especially to the extent of the slowing in physical public capital.

The CBO (1991) discusses the federal role in spending on research and development, pointing out that returns to academic and basic research (about one-fourth of federal R&D spending) has significant positive effects on private productivity but that (except in health and agriculture) there is no consistent evidence of significant returns from federally applied R&D. Similarly, Griliches (1988) rejects a role for R&D movements in explaining the slowdown in private productivity growth. CBO (1991) refers to the fact that production function estimates find no consistent, positive effects of federal contract R&D expenditures on productivity as a "major puzzle."

The CBO argues that public R&D could crowd out private R&D, but that this interaction probably has only small overall importance.³ In research on new technology, however, government funding can crowd out private R&D because the returns to new technology are not as easily captured by private entrepreneurs when the technology is funded by the government. In addition, government investment crowds out private activity by competing for scarce specialized research resources. The potential for the public sector to further technological innovation is open to serious doubt.⁴ While public sector R&D investments may be productive, the evidence for a larger or smaller effect of public physical capital on business output does not have any bearing on the purported effects on private output or productivity of public sector spending on research and development.

³Butler (1992) reviews trends in R&D expenditures in the United States, Japan and Germany.
⁴See Cato Institute (1993), Gilder (1993) and Rodgers (1993) for discussions of the private sector's dominance in invention and innovation of new high-technology infrastructure.
private sector productivity growth after 1970. Now, "a non-negligible portion, perhaps around 10 percent, of the productivity slump, perhaps due to the lesser rate of public capital accumulation" (1993, p. 13). The most recent estimate is based on an assumption, however, not on statistical evidence. Nevertheless, Aschauer suggests that there is "a strong causal relationship between public capital investment and productivity and output" and that "the time-series results suggest that, at the aggregate level, there is underprovision of public capital" (1993, p. 22).

Munnell (1992) has also agreed with critics who contend that "the numbers emerging from the aggregate time-series studies are not credible." Nevertheless, she concludes that an "even-handed reading of the evidence—including the growing body of cross-sectional results—suggests that public infrastructure is a productive input which may have large payoffs." Eisner (1991) uses Munnell's (1990a, b) data to show that the time-series evidence for the 48 states in Munnell's sample rejects the infrastructure productivity hypothesis. The evidence for the variation in gross state product (not private sector output) across states shows that states with larger output have more public capital. Eisner indicates that this is consistent with an alternative hypothesis that richer states buy more public capital, as well as with the hypothesis in question—that states with more public capital produce more output. 25

The Spurious Regression Problem

The time-series estimates that show a positive and statistically significant effect of the public capital stock on private sector output do so because of a statistical fallacy called "spurious regression." For example, if two wholly unrelated measures have similar time trends, then they can exhibit an apparent, statistically significant relationship between them when no economic relationship, in fact, exists. In the infrastructure case, the spurious regression problem can be observed in the relationship of private productivity—business output per hour—and the stock of infrastructure per hour. Both showed relatively strong upward trends from the late 1940s to the early 1970s and then each trend declined sharply (see Figure 5).

Since the early 1980s, the evidence on the levels of private output and public capital per hour is considerably weaker. In particular, private productivity accelerated sharply, rising at a 1.7 percent annual rate from 1982 to 1988; meanwhile, the growth of the stock of public capital per hour actually slowed further, falling at a 1.5 percent annual rate from 1982 to 1988, down from 0.5 percent rate of increase from 1971 to 1982. 26 The public capital stock per hour then began to rise, growing at a 1.7 percent rate to 1991, while private productivity growth slowed to a 0.3 percent rate. Thus, the two measures were negatively related from 1982 to 1991. In 1992 both measures accelerated.

The spurious regression problem in Figure 5 is easily illustrated using simple correlations. The level of business output per hour and of public capital per hour are strongly and positively correlated from 1947 to 1992; the correlation coefficient is 0.95, consistent with a strong, but potentially spurious, relationship. The correlation between the growth rates of

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24Munnell also cites Peterson's (1990) argument that a relatively high voter-passage rate for infrastructure-related bond issues indicates an undersupply of public capital. Of course, voter revelations of expected net benefits from public spending could reflect either direct, nonmarket benefits, contributions to business output, or some combination of the two. Peterson found that about 80 percent of bond proposals were accepted from 1984 to 1989 by margins exceeding 66 percent on average. He argues that a "median voter" model would suggest approval rates and margins closer to 50 percent if the voters consider the stock of public capital to be about the amount desired. Tatomi (1993) cites a recent approval rate higher than 50 percent (62 percent) as evidence for the reverse, that the public does not accept unanimously or indiscriminately capital projects offered by government officials. Recent polling results on infrastructure demand are also reported that suggest that such spending is a low priority compared with private capital formation or reducing the federal deficit, among other priorities. Therefore, it appears that voters get about what they want, just as Tiebout (1956) argued.

25Others have found conflicting evidence using cross-sectional data. For example, Holtz-Eakin (1992) provides cross-sectional evidence that rejects the infrastructure productivity hypothesis. More importantly, he explains that the existence of a cross-sectional effect does not support an aggregate national effect because the former would imply an interregional substitution of output, as private resources migrate from other regions. Eberts (1986), (1990a), (1990b) and Garcia-Mila and McGuire (1992) find evidence for a cross-sectional effect of public capital on output, although the latter study is supportive only for highways and education, and the effects are relatively small.

26While the capital stock per person rebounded after 1983, the capital stock per hour did not begin to rise until later. This reflects the faster growth of the labor force than of the population until the end of 1988.
the two series, however, is not statistically significant. The correlation coefficient for the growth rates (1948 to 1992) of 0.15 is well below the critical value of 0.29 at a 95 percent confidence level. Thus, simple correlation analysis rejects the hypothesis that a contemporaneous rise or fall in the amount of public capital per hour raises or lowers business sector productivity.

Studies of the link between public capital and private sector output do not use such a limited two-variable comparison. Instead, they attempt to control for other factors that determine aggregate private sector production, such as private sector hours \(h\) and the flow of private capital services \(k\). The basic statistical model used by Aschauer, Munnell and others is a production function estimate of the form:

\[
\ln \frac{Q}{K} = \ln A + \alpha \ln \left(\frac{h}{K}\right) + \delta \ln \left(\frac{KG}{K}\right) + rt + \varepsilon
\]

where \(Q\) is business sector output in period \(t\), \(KG\) and \(K\) are the public and private capital stocks, respectively, and \(\varepsilon\) is a normally and independently distributed random disturbance term. The scale parameter \(A\), the rate of disembodied technological change, \(r\), and the output elasticities, \(\alpha\) and \(\delta\), are estimated using ordinary least squares regression. The critical parameter for the public capital-private productivity hypothesis is \(\delta\), which is hypothesized to be positive.

Estimation of such an equation requires that all of the variables entering equation (1) must have certain statistical properties for the esti-
mate to be a meaningful long-run relationship. In particular, the estimation of the parameters in equation (1) requires that the error term have a distribution with a mean of zero and constant variance. Thus, the linear combination of variables that equals $\epsilon$ also must have such a distribution. This requirement is satisfied if each of the variables entering equation (1) is stationary, which means each must have a tendency to revert to its own fixed mean. In this case, each measure is said to be integrated of degree zero, I(0). Alternatively, each series can be integrated of a common degree, typically one I(1), meaning that each must be stationary when differenced once or, in general, differenced the number times indicated by the degree of integration.\footnote{If all the variables in an equation are integrated of the same degree, they are potentially cointegrated, regardless of the degree. Lynde and Richmond (1993) use the measure \textit{ln KG} in level estimates like equation (1) to test the public capital stock effect for two periods, 1948-89 and 1958-89. In both periods \textit{ln KG} is I(2) according to tests by the author, although Lynde and Richmond do not note this problem. Moreover, the method they use to address potentially spurious regressions, employing what are called Phillips-Hansen estimators, does not remove the possibility of spurious outcomes when the included variables are integrated of mixed order with one or more variables that are I(2), or are integrated of even a higher order.}

In the latter case, a linear combination of the variables entering equation (1) can be stationary if the variables are cointegrated.

The spurious regression problem in estimates of equation (1) arises from the fact that for the post-World War II periods used in studies of the public capital stock effect, the public capital stock variable and the term involving it in equation (1) are integrated of order two, or I(2), which means that either measure must be differenced twice to be stationary. The dependent variable in the production function is integrated of order one and \textit{ln(h/k)} is also I(2) for the period studied in Tatom (1991). Taken together, these properties imply that a linear combination of the levels of the variables, like the linear combination equal to $\epsilon$ in equation (1), cannot be stationary, as required by statistical theory. An estimate of such an equation can result in the appearance of statistically significant relationships when, in fact, the variables are not related.\footnote{A cointegration test which avoids this issue is used in Tatom (1991a). In this test, the public capital stock has a negative but statistically insignificant effect on business sector output and productivity.}

There are well-known statistical methods for assessing whether the spurious regression problem is present and for removing its influence on statistical results. In this case, simply first-differencing the data and including a time trend in the estimate eliminates the problem because the growth rates of the two I(2) variables are trend-stationary. First-differencing the data means that the effect is estimated using data on changes (growth rates) in private sector productivity and the public capital stock, along with growth rates of other factors influencing the level of private sector productivity. First-differencing earlier production function estimates that include the public capital stock yields estimates of the public capital effect that are not statistically significantly different from zero.\footnote{Some of the studies that have noted this fragility include Aaron (1991), Holtz-Eakin (1988, 1992, 1993), Hulten and Schwab (1991), Jorgenson (1991), Rubin (1991) and Tatom (1991a). Finn (1993) uses the same method as Lynde and Richmond and tests various components of the public capital stock. Her evidence supports the view that only the highway component of the public capital stock is statistically significant. Her preferred measures using highway and street capital in place of public capital suffer from the same lack of stationarity for the growth rates of highway capital or of the ratio of public highway to private capital. Thus, her results are also spurious. This is not surprising since the time-series plots of public capital—in total, per capita, or per unit of private capital—mirror those of highway capital. The cointegration test like that reported in Tatom (1991a) for the first-difference version of an equation like equation (1) rejects the statistical significance of the highway stock.}

In KG
in a levels estimate, they will remain so in first differences. Munnell (1992) recognizes the problems posed by nonstationarity and recommends testing for cointegration; Tatm (1991a) provides such a test and rejects the hypothesis.31

**An Alternative View: Reverse Causality**

There is an alternative view that suggests a positive link between private productivity and the stock of public capital per worker. Eisner (1991) suggests the fact that regions with relatively high productivity have relatively higher infrastructure, and simply may reflect an effect of income on the demand for and quantity of public capital.

A statistical test of whether higher productivity causes more public sector capital formation, or the reverse is true, employs “Granger causality.” In these tests, causality means a statistically significant temporal relation in which changes in one measure temporally are followed by statistically significant movements in the other measure. It is possible, in principle, for each measure to “cause” the other, for neither to cause the others, or for only one measure to cause the other.

Tatm (1993) provides a test of Granger causality for the productivity-public capital formation link.32 The test uses annual data (1949 to 1991) for the public capital stock or public sector investment and for the private sector's total factor productivity, the latter being output per unit of a weighted-average bundle of both private capital and labor resources. The results indicate that neither the growth rate of the public capital stock nor the level of public sector investment cause total factor productivity growth. On the contrary, the growth of private sector productivity causes both measures of public capital formation.

One of the advantages of this approach is that it explicitly looks for statistically significant relationships between public capital formation and subsequent private sector productivity growth, and the reverse, between productivity growth and subsequent changes in public capital formation. The use of longer periods for observing expected effects allows for lags in the effect of one measure on the other. Nonetheless, this approach finds only the reverse relationship to be statistically significant.

**CONCLUSIONS**

The role of public capital formation and of the federal government in its provision have been the subject of widespread discussion and concern in recent years. This concern has been prompted by the infrastructure deficit hypothesis, which argues that there has been a sharp decline in public capital formation and that this decline lowered U.S. private sector productivity growth.

This article questions the infrastructure hypothesis. Trends in U.S. public capital formation indicate that the federal government’s role...
in public capital formation has been quite limited; only a small fraction of the nation's public, nonmilitary capital stock is held by the federal government and the per capita federal capital stock has been roughly constant throughout the post-World War II period.

There was a slowing in the growth of state and local government highways, roads and educational buildings relative to population growth in the 1970s and early 1980s. The demographic and energy-price changes that gave rise to reductions in the growth of demand for these goods, however, began to reverse in the early 1980s. Thus, if there was a deficit indicated by the trend in public capital formation, it seems to have begun to disappear almost a decade ago.

The purported link between public capital and private sector productivity has been widely criticized for distorting the role of public capital, yielding implausible estimates of the private sector productivity gains that could arise from public capital formation, and reversing the connection between the two. The fundamental problem with earlier estimates is that they resulted from spurious or unrelated movements in the quantity of public capital and business sector output and productivity. While both private sector productivity and the public capital stock per hour have risen over time, their movements have not been closely related. Indeed, in the 1980s the two measures generally moved inversely with one another. Of special note is the rebound in private sector productivity growth until 1988, which was accompanied by an accelerated decline in the stock of public capital per hour. The bottom line here is that no one has produced evidence that an increase in the nation's public capital stock will boost private sector output or productivity, within the year or even some future period. Quite simply, when the hypothesis has been explicitly tested this way, the evidence strongly rejects it.

REFERENCES


Organization for Economic Co-operation and Development. *National Accounts, Detailed Tables, Volume II.*


The Determinants of Consumer Installment Credit

Consumers consider various economic factors in making their borrowing decisions. Thus, to interpret the movement of consumer credit accurately, one needs to identify the economic factors that influence consumer borrowing and understand the ways those variables affect consumers' decisions. This article studies consumers' borrowing behavior by investigating both long-term trends and short-term fluctuations of consumer credit in relation to economic and institutional factors, including the Tax Reform Act of 1986, which phased out tax deductions for interest expense on consumer debt.

The focus is on consumer installment credit, which includes major categories of consumer loans such as automobile and credit card loans. The behavior of consumer credit has attracted considerable attention during the last 10 years. Many analysts argue that consumers accumulated excessive debt in the 1980s and became reluctant to use credit in the early 1990s. In fact, after growing rapidly in the mid-1980s, consumer installment credit declined in many quarters during 1991 and 1992. The decline of consumer installment credit in the early 1990s is particularly interesting because it occurred despite low interest rates. The decline during the early 1990s after a period of rapid growth may not be fully explained by changed consumption expenditures. Thus, it appears that consumers have changed the pattern of financing their purchases.

The change in consumer installment credit is the difference between the extension of new credit and the repayment of the principal of existing debt. This article examines the variables that may affect the proportion of consumption that is financed by debt and the rate at which consumers repay existing debt principal.

Growth of Consumer Installment Credit

Consumer installment credit covers most short- and intermediate-term credit extended to individuals for which repayment is scheduled in two or more installments, excluding loans secured by real estate. Consumer installment credit, which totaled about $760 billion at the end of 1992, consists of three main categories: automobile credit, revolving credit and other credit. Revolving credit is mainly credit card.

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1 Data on consumer installment credit are collected and published by the Federal Reserve Board of Governors in their G19 release.

2 There is also noninstallment consumer credit, which consists mostly of short-term credit such as charge card balances that need to be paid in full within the billing cycle. This credit category totaled $52 billion at the end of 1992. Because it reflects more of delayed settlements than credit extension and accounts for a relatively small portion of consumer credit, noninstallment credit is not discussed here.
loans, and the category other credit includes
loans to finance purchases of mobile homes,
home appliances and furniture, and personal
loans. Major lenders are commercial banks,
finance companies, credit unions, savings insti-
tutions, retailers and gasoline companies.

The economic importance of consumer install-
ment credit may be illustrated by examining it
in relation to other components of the house-
hold balance sheet. Table 1 shows the balance
sheet of the household sector for selected years
between 1960 and 1992. Two main components
of household liabilities are home mortgages and
consumer installment credit. Consumer install-
ment credit emerged as a main financing tool
for households after World War II and has
been a major component of the household
balance sheet since the early 1950s. Between
1960 and 1992, consumer installment credit
held fairly stable at about 20 percent of total
liabilities.

Although its long-term trend can be described
as a steady increase in line with other compo-
nents of the household balance sheet, consumer
installment credit grew at uneven rates over
short time spans. Particularly notable are rapid
growth in the mid-1980s and stagnation in the
early 1990s. In most quarters of the years be-
tween 1984 and 1986, the annualized growth
rate of consumer installment credit was sub-
stantially more than 10 percent. Between 1991
and 1992, however, the outstanding amount
of consumer installment credit declined in
many quarters. In particular, automobile credit
decreased in all but one quarter of the two
years.

To investigate the possibility that the financ-
ing pattern of consumers has changed over
time, we need to examine the behavior of con-
sumer installment credit in relation to consump-
tion. The outstanding amounts of consumer
credit and consumption expenditures are not
directly comparable because the former is a
stock, a value at a point in time, whereas the
latter is a flow, a rate per unit of time. For pur-
poses of comparability, the change in consumer
installment credit, which is a flow, is compared
with consumption expenditures. Figure 1 shows
the ratio of the change in each category of con-
sumer installment credit to the consumption
expenditures on the relevant category of goods,
which is referred to as the credit ratio.3 For
total credit, consumption expenditures on dura-
ble goods are used as the denominator because
consumers obtain credit mostly to finance the
purchase of big-ticket items such as automo-
bles, furniture and home appliances. The
denominator for the automobile credit ratio is
consumption expenditures on automobiles. For
the revolving credit ratio, consumption expendi-
tures on all items but automobiles are used as
the denominator because consumers use credit
cards for a wide variety of purposes but gener-
ally not for the purchase of automobiles. For
the other credit ratio, expenditures on durable
goods other than automobiles serve as the
denominator.

A high or low credit ratio may be interpreted
as fast or slow credit growth relative to con-
sumption. Thus, fluctuations of the credit ratio
reflect changes in the financing pattern of con-
sumers, that is, changes in the proportion of
debt-financed consumption, in the rate of repay-
ment of existing debt, or in both. In other
words, substantial changes in the credit ratio
suggest that factors other than consumption
have affected consumer borrowing.4

In Figure 1, the total credit ratio shows no
apparent long-term trend but exhibits wide
short-term fluctuations. Excluding the early
1990s, the automobile credit ratio fluctuates
around 0.13 and has no apparent long-term
trend. For revolving credit, the credit ratio
shows an upward trend, reflecting the increased
use of credit cards during the last two decades.

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3Data are quarterly and seasonally adjusted. The Federal
Reserve Board's data on consumer installment credit show
several breaks that may arise from modified classifications.
For example, securitized consumer loans were added to
the data in January 1989. To alleviate such problems, the
quarterly changes are linearly interpolated when obvious
breaks are found. The interpolated data points are 1971:1,

4The correlation coefficients between credit ratios and rele-
vant consumption expenditures confirm that credit ratios
were unrelated to the cyclical behavior of consumption be-
tween 1970 and 1992. The correlation coefficients were
−0.133 for total credit, −0.098 for automobile credit, 0.533
for revolving credit and −0.482 for other credit. Time
trends in credit ratios, which were upward for revolving
credit and downward for other credit, can explain the sig-
ificant magnitudes of the coefficients for revolving and
other credit. On the other hand, the correlation coefficients
between credit ratios and changes in consumer installment
credit were all greater than 0.8 for the four categories of
credit.
Table 1
Balance Sheet of the Household Sector
(in billions of 1982-84 dollars)\(^1\)

<table>
<thead>
<tr>
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<tr>
<td>TOTAL ASSETS</td>
<td>6,921.8</td>
<td>9,886.3</td>
<td>13,472.7</td>
<td>15,118.8</td>
<td>17,321.6</td>
<td>18,425.2</td>
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<td>Tangible assets</td>
<td>2,466.3</td>
<td>3,515.1</td>
<td>5,707.5</td>
<td>6,136.8</td>
<td>6,685.8</td>
<td>6,790.7</td>
</tr>
<tr>
<td>(35.6%)</td>
<td>(35.6%)</td>
<td>(42.4%)</td>
<td>(40.6%)</td>
<td>(38.6%)</td>
<td>(36.9%)</td>
<td></td>
</tr>
<tr>
<td>Owner-occupied real estate</td>
<td>1,649.4</td>
<td>2,235.6</td>
<td>3,992.0</td>
<td>4,321.6</td>
<td>4,574.6</td>
<td>4,752.0</td>
</tr>
<tr>
<td>(23.8%)</td>
<td>(22.6%)</td>
<td>(29.6%)</td>
<td>(28.6%)</td>
<td>(26.4%)</td>
<td>(25.8%)</td>
<td></td>
</tr>
<tr>
<td>Nonprofit tangible assets</td>
<td>162.7</td>
<td>319.6</td>
<td>484.5</td>
<td>522.3</td>
<td>544.9</td>
<td>448.9</td>
</tr>
<tr>
<td>(2.4%)</td>
<td>(3.2%)</td>
<td>(3.6%)</td>
<td>(3.5%)</td>
<td>(3.1%)</td>
<td>(2.4%)</td>
<td></td>
</tr>
<tr>
<td>Consumer durables</td>
<td>654.3</td>
<td>959.9</td>
<td>1,231.0</td>
<td>1,292.8</td>
<td>1,566.2</td>
<td>1,589.8</td>
</tr>
<tr>
<td>(9.5%)</td>
<td>(9.7%)</td>
<td>(9.1%)</td>
<td>(8.6%)</td>
<td>(9.0%)</td>
<td>(8.6%)</td>
<td></td>
</tr>
<tr>
<td>Financial assets</td>
<td>4,455.4</td>
<td>6,371.2</td>
<td>7,765.2</td>
<td>8,982.0</td>
<td>10,635.9</td>
<td>11,634.5</td>
</tr>
<tr>
<td>(64.4%)</td>
<td>(64.4%)</td>
<td>(57.6%)</td>
<td>(59.4%)</td>
<td>(61.4%)</td>
<td>(63.1%)</td>
<td></td>
</tr>
<tr>
<td>TOTAL LIABILITIES</td>
<td>743.0</td>
<td>1,216.2</td>
<td>1,760.8</td>
<td>2,161.3</td>
<td>2,935.7</td>
<td>2,930.2</td>
</tr>
<tr>
<td>Home mortgages</td>
<td>452.2</td>
<td>705.1</td>
<td>1,099.2</td>
<td>1,281.4</td>
<td>1,851.1</td>
<td>1,957.6</td>
</tr>
<tr>
<td>(60.9%)</td>
<td>(58.0%)</td>
<td>(62.4%)</td>
<td>(59.3%)</td>
<td>(65.3%)</td>
<td>(66.8%)</td>
<td></td>
</tr>
<tr>
<td>Installment consumer credit</td>
<td>152.2</td>
<td>272.0</td>
<td>366.6</td>
<td>489.1</td>
<td>576.0</td>
<td>539.1</td>
</tr>
<tr>
<td>(20.5%)</td>
<td>(22.4%)</td>
<td>(20.8%)</td>
<td>(22.6%)</td>
<td>(20.3%)</td>
<td>(18.4%)</td>
<td></td>
</tr>
<tr>
<td>Other liabilities</td>
<td>138.6</td>
<td>239.1</td>
<td>295.9</td>
<td>390.8</td>
<td>406.5</td>
<td>433.4</td>
</tr>
<tr>
<td>(18.7%)</td>
<td>(19.7%)</td>
<td>(16.8%)</td>
<td>(18.1%)</td>
<td>(14.4%)</td>
<td>(14.8%)</td>
<td></td>
</tr>
<tr>
<td>NET WORTH</td>
<td>6,178.8</td>
<td>8,670.1</td>
<td>11,711.9</td>
<td>12,957.5</td>
<td>14,486.0</td>
<td>15,495.0</td>
</tr>
</tbody>
</table>

\(^1\)Includes personal trusts and nonprofit organizations. Dollars are deflated by consumer price index. Numbers in parentheses are percent of total assets for asset items and percent of total liabilities for liability items.

SOURCE: Board of Governors.

In contrast, the other credit ratio appears to have declined over time.

Short-term fluctuations in the credit ratios are much more notable. Between 1970 and 1992, the total credit ratio ranged from -0.07 to 0.26. The movement of the total credit ratio generally confirms that consumers borrowed aggressively in the mid-1980s but became reluctant to borrow in early years of the 1990s. The changed borrowing behavior is particularly evident for automobile credit; the automobile credit ratio plunged in 1991 after peaking in the mid-1980s.\(^5\) A reason for the wider fluctuation of automobile credit may be that consumers consider the economic environment more seriously when they obtain larger loans.

\(^5\)Eugeni (1993) suggests that an increase in auto leases partly explains the slow growth of consumer credit in recent periods. The credit ratio, however, is not seriously affected by auto leasing. The Bureau of Economic Analysis, which publishes the data on consumption expenditures, classifies rental and leasing expenses under expenditures on services as opposed to goods. The credit extension involving leasing is classified under business credit.

ECONOMIC AND INSTITUTIONAL FACTORS

The main economic decisions of consumers are to allocate available resources to various types of consumption and to construct a desirable personal financial structure. The resources available to consumers include existing wealth, current income and future income. Consumers allocate these resources between current consumption and future consumption. By distributing resources prudently over time, consumers can avoid excessive consumption and prevent future financial hardships. Changes in the economic environment also require a restructuring in consumer balance sheets. A well-managed

Accordingly, an increase in leasing reduces consumption expenditures on durable goods as well as consumer credit.
Figure 1a
Total Credit Ratio

Figure 1b
Automobile Credit Ratio

1 Change in total consumer installment credit/consumption expenditures on durable goods

1 Change in automobile credit/consumption expenditures on automobiles
Figure 1c
Revolving Credit Ratio

Figure 1d
Other Credit Ratio

1Change in revolving credit/consumption expenditures other than automobiles

1Change in other credit/consumption expenditures on durable goods other than automobiles
household balance sheet can increase the net worth and liquidity of the household.

The change in outstanding consumer credit in a given period is the difference between acquisition of new credit and repayment of existing credit. Acquisition of new credit, which is a decision to use future income for current purchases, reflects various factors such as the level and type of consumption, characteristics of consumers, the relative cost of resources, as well as macroeconomic conditions. The relative cost of resources along with macroeconomic conditions may also affect repayment of existing credit, which is an act of transferring current income to wealth. The variables affecting the acquisition and repayment of loans should explain changes in consumer credit.

Acquisition of new credit would tend to increase with consumption, especially with expenditures on durable goods. As shown in Figure 1, however, consumption alone is not enough to explain the growth of consumer credit. This section focuses on other factors that may influence the financing pattern of consumers and thereby affect credit growth. An examination of those factors helps clarify the relationship between credit growth and the economic environment and sheds light on the unusually fast growth of consumer credit in the mid-1980s and the particularly slow credit growth in the early 1990s.

Other factors considered here are the growth of home equity lines of credit, demographic characteristics, income distribution, interest expense on consumer installment credit, consumer confidence, the debt burden of households, and measures of banks' willingness to lend. Tax deductibility may play an important role as well. It is considered as a part of the discussion of home equity lines of credit and interest expense.

Consumers can select among various credit instruments to satisfy a given borrowing need. Because home equity lines of credit can serve as close substitutes for consumer installment credit, any discussion of consumer credit must take into account the growth of home equity lines of credit. Demographic characteristics and income distribution may influence the long-term trend of consumer borrowing by affecting the income profile of typical consumers. Interest rates will influence the use of consumer installment credit. Consumer confidence may indicate the consumers' anticipation of future income, which is an important consideration in making borrowing decisions. The size of debt burden may also affect the borrowing decision. The supply of credit shall also be considered. If lenders are reluctant to lend, consumers cannot borrow as much as they want.

**Home Equity Lines of Credit**

Home equity lines of credit deserve particular attention because they can serve as close substitutes for consumer installment credit and are offered at a lower rate, especially on an after-tax basis. Home equity lines of credit, which became widely available in the mid-1980s, emerged as an important financing tool for households. Once they open a line of credit, households can conveniently obtain extra credit and flexibly repay the outstanding amount. The flexibility of home equity lines of credit allows households to easily substitute this credit for conventional consumer loans. Home equity lines of credit, which are secured, are offered at comparatively low interest rates, generally at 1.5 percentage points above the prime rate. Furthermore, home equity lines of credit are treated as home mortgages for tax purposes and, hence, the interest expense is fully tax deductible in most cases. Consequently, home equity lines of credit have been more attractive than conventional consumer credit since the Tax Reform Act of 1986 phased out tax deductions for interest expense on conventional consumer credit.

Home equity lines of credit at commercial banks and S&Ls almost tripled between 1987

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6Home equity lines of credit are generally classified under home mortgages.
7See Canner and Luckett (1989).
8Interest expense on consumer loans was 100 percent tax deductible before 1987. The deductibility decreased to 65 percent in 1987, 40 percent in 1988, 20 percent in 1989, 10 percent in 1990 and 0 percent thereafter.
and 1991, from $32 billion to $86 billion. The surge of home equity lines of credit, however, may have occurred at the expense of conventional consumer loans. The 1988 Survey of Consumer Attitudes shows that the major reasons for drawing on home equity lines of credit include the repayment of other debts and the purchase of automobiles. In addition, the surge of home equity lines of credit coincided with the phase-out of tax deductions for interest expense on consumer installment credit.

After the initial surge, home equity lines of credit stagnated in 1992. The stagnation might be explained by active refinancing of home mortgages in recent years, another way of extracting home equity. Canner and Luckett report that nearly 60 percent of those who refinanced their residential mortgages increased their mortgage debt. It is obvious that some consumers have substituted home equity for consumer installment credit by using home equity lines of credit in the late 1980s and early 1990s, and also mortgage refinancing in the early 1990s. This finding suggests a significant effect of the phase-out of tax deductions for interest expense on conventional consumer debt. The phase-out of tax deductions certainly appears to have contributed to the slowing in the growth of consumer credit in the late 1980s and the early 1990s by accelerating the substitution of consumer installment credit with loans secured by residential properties.

**Demographic Characteristics**

Borrowing decisions differ across consumers. Therefore, the aggregate outcome depends on the demographic composition of consumers. The age of consumers may be important. According to the permanent income hypothesis, consumers maximize lifetime utility by using credit to create a pattern of consumption over their lifetimes that is smoother than the pattern of income. Because younger individuals in general have accumulated little wealth and have low current incomes relative to their future incomes, they are more likely to finance current consumption with future income.

Table 2 shows the percentage distribution of U.S. population by age between 1960 and 1990. The population may roughly be classified into the following three groups: (1) those who do not make independent financial decisions—younger than 20 years of age; (2) those who make independent financial decisions and rely heavily on future income—between 20 and 34 years of age; and (3) those who make independent financial decisions and primarily rely on current income and existing wealth—35 years of age and older. During the 30-year period, both the percentages of the 20-34 group and the 35 and older group generally increased, but the increase was larger for the 20-34 group. Thus, the net long-run effect is likely to be increased consumer borrowing. The increase in the 20-34 group was particularly marked from 1970 to 1980, which seems to be consistent with heavy borrowing in the mid-1980s. Furthermore, the stabilizing of the 20-34 group, along with continued growth in the 35 and older group, suggest that age distribution may have contributed to a slowing in consumer credit during the late 1980s and early 1990s.

**Income Distribution**

The distribution of income also influences the aggregate borrowing behavior of consumers. Middle-income individuals, who do not have large current income but may expect stable future income, may on average actively borrow to finance current consumption. On the other hand, high-income individuals generally have less need to borrow, and low-income individuals without stable employment may be afraid to borrow, unable to borrow, or both. Hendricks

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9In 1988 about 85 percent of home equity lines of credit was held by commercial banks and savings institutions (Canner and Luckett, 1989). The Call Report data (Consolidated Reports of Condition and Income) of the Federal Reserve Board have included home equity lines of credit since 1987:4 for commercial banks and since 1988:4 for S&Ls. For the period between 1987:4 and 1988:3, home equity lines of credit at S&Ls were estimated. The credit at S&Ls was assumed to have grown at the same rate as that at commercial banks.


11See Canner and Luckett (1989). The study looks at the relationship between consumer characteristics and borrowing behavior using survey data.
and others report the highest ratios of installment debt to income for middle-income families. Kennickell and Shack-Marquez also show that the proportion of families carrying credit cards and other consumer debt is the largest for middle-income families. Consequently, a shift in the distribution of income toward middle-income families might be associated with more consumer borrowing for a given amount of consumption.

Table 3 shows that the proportion of middle-income households (annual income between $25,000 and $49,999 in 1989 dollars) gradually decreased from 38.8 percent to 33.2 percent between 1970 and 1989. Median income increased slightly during the period, but the slight increase does not appear to be enough to explain the changed income distribution. With other things constant, the decreased proportion of middle-income households should have reduced consumer borrowing. Figure 1 does not show either an upward or downward long-term trend in consumers' borrowing behavior. It is possible that the long-term effects of age distribution and income distribution have roughly offset each other.

13See Hendricks and others (1973).
14See Kennickell and Shack-Marquez (1992).

### Interest Rates

The price of credit is expected to have an effect on consumers' borrowing decisions. Higher interest rates on consumer credit mean larger sacrifice of future income for a given level of current consumption financed by future income. Thus, higher interest rates on consumer credit will discourage current consumption in general and have an even larger effect on the use of consumer credit for current purchases. Consumers with heavy borrowing needs are more likely to defer purchases. Therefore, the proportion of debt-financed consumption should be lower. A high cost of carrying debt will also induce households to repay existing debt faster. Hence, in addition to slowing consumption, increases in interest rates reduce the proportion of consumption financed with debt and increase the repayment rate, causing growth of consumer credit to slow relative to consumption.

To illustrate the effect of interest rates on consumer installment credit, this study compares interest rates on 48-month new car loans and the automobile credit ratio, instead of the total credit ratio, because it is difficult to obtain an interest rate applicable to consumer install-
Table 3

Percent Distribution of Household Income
(in thousands of 1989 dollars)

<table>
<thead>
<tr>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 10.0</td>
<td>16.8%</td>
<td>16.8%</td>
<td>17.4%</td>
<td>17.2%</td>
<td>15.6%</td>
</tr>
<tr>
<td>10.0-14.9</td>
<td>8.9</td>
<td>10.4</td>
<td>10.1</td>
<td>10.2</td>
<td>9.7</td>
</tr>
<tr>
<td>15.0-24.9</td>
<td>18.7</td>
<td>19.1</td>
<td>19.8</td>
<td>19.0</td>
<td>17.9</td>
</tr>
<tr>
<td>25.0-34.9</td>
<td>19.2</td>
<td>17.7</td>
<td>17.0</td>
<td>16.3</td>
<td>15.9</td>
</tr>
<tr>
<td>35.0-49.9</td>
<td>19.6</td>
<td>18.7</td>
<td>18.2</td>
<td>17.2</td>
<td>17.3</td>
</tr>
<tr>
<td>50.0-74.9</td>
<td>12.0</td>
<td>12.5</td>
<td>12.2</td>
<td>13.3</td>
<td>14.5</td>
</tr>
<tr>
<td>75.0 or more</td>
<td>4.8</td>
<td>4.8</td>
<td>5.4</td>
<td>6.8</td>
<td>9.0</td>
</tr>
<tr>
<td>Less than 25</td>
<td>44.4</td>
<td>46.3</td>
<td>47.3</td>
<td>46.4</td>
<td>43.2</td>
</tr>
<tr>
<td>25-49.9</td>
<td>38.8</td>
<td>36.4</td>
<td>35.2</td>
<td>33.5</td>
<td>33.2</td>
</tr>
<tr>
<td>50 or more</td>
<td>16.8</td>
<td>17.3</td>
<td>17.6</td>
<td>20.1</td>
<td>23.5</td>
</tr>
<tr>
<td>Median Income</td>
<td>$27.9</td>
<td>$27.2</td>
<td>$26.7</td>
<td>$27.2</td>
<td>$28.9</td>
</tr>
</tbody>
</table>


ment credit in general.\textsuperscript{15} Figure 2 shows the real after-tax interest rate on automobile credit along with the automobile credit ratio.\textsuperscript{16} The real after-tax rate is more relevant than the nominal interest rate. Because future income tends to rise with the rate of inflation, the interest rate net of inflation more accurately reflects the price of present consumption in terms of future income. Despite lower nominal interest rates, the real after-tax interest rate on automobile credit stayed high in the early 1990s because of low rates of inflation and the phase-out of tax deductions for interest expense on consumer loans.

In Figure 2, the automobile credit ratio generally exhibits a negative relationship with the interest rate except for years between 1983 and 1986, when both the credit ratio and the interest rate were high. One possibility is that consumers, who had experienced high inflation in the early 1980s, mistakenly expected high inflation and, hence, underestimated the real interest rate in those years. The figure shows very high real after-tax interest rates in the early 1990s, when the credit ratio was very low. Thus, when the effects of tax deductibility and inflation are incorporated, the movement of interest rates is consistent with the slow credit growth of the early 1990s.

Relative Interest Rates

When consumers have more than one financing alternative, they will choose the least costly method. A financing alternative available to

\textsuperscript{15}Data on the interest rate on automobile credit are available from the first quarter of 1972. No appropriate measure of the interest rate is available for other credit, which consists of various types of loans. The interest rate on credit card loans is available, but the demand for credit card loans is known to have been unusually insensitive to the interest rate. Thus, revolving credit is not a good candidate for this analysis.

\textsuperscript{16}Real after-tax interest rate = nominal interest rate – expected rate of inflation – tax deduction. The four-quarter average (the current and next three quarters) of the annualized rate of change in the consumer price index is used as the measure of expected inflation. The assumption here is that consumers on average forecast the rate of inflation accurately. Tax deduction is the nominal interest rate multiplied by the proportion of tax-deductible interest expense multiplied by the marginal federal income tax rate for four-person, median-income families. The data source of the marginal federal income tax rate is the Department of the Treasury (1991); the tax rate for 1992 is assumed to be the same as in 1991. State income taxes, which vary, are not considered. The incorporation of state income taxes would make the tax deduction more significant and, hence, raise the real after-tax interest rate of recent periods.
households is to draw down their wealth. Because bank deposits offer financial flexibility, many households with large bank accounts may still want to finance their automobile purchases with loans even though the interest rate on automobile loans is higher than the return on deposits. When there is a large gap between the interest rate on household liabilities and the return on household financial assets, however, households may use their assets to finance consumption instead of incurring more debt. Furthermore, the high cost of carrying liabilities relative to the return on assets prompts the repayment of existing debt. Thus, the relative interest rates on assets and liabilities can have an effect on the growth of consumer installment credit.

Assuming that the returns on major household assets, such as certificates of deposits and money market shares, are closely tied to the Treasury bill rate, we can estimate the spread between the interest rate on consumer credit and the return on household financial assets using the Treasury bill rate as a proxy for the return on household assets. Figure 3 shows the relationship between the spread of after-tax interest rates on automobile loans over three-month Treasury bills on an after-tax basis and the automobile credit ratio. The phase-out of tax deductions widens this spread as much as it raises after-tax interest rates on automobile loans because the Tax Reform Act of 1986 had little effect on the after-tax return on household assets. The spread and credit ratio tended to move in opposite directions for the most part. The spread can partly explain the rapid credit growth in the mid-1980s, unlike the real after-tax interest rate, and well explains the slowdown of credit growth in the early 1990s. This analysis suggests that the interest rate spread

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Figure 2
Real After-Tax Interest Rate on Automobile Credit

Interest Rate

Credit Ratio

Credit ratio

Interest rate

1972 74 76 78 80 82 84 86 88 90 1992

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17Spread = [interest rate on automobile loans - (interest rate on automobile loans x marginal tax rate x tax deductibility)] - [three-month Treasury bill rate - (three-month Treasury bill rate x marginal tax rate)]. In this calculation, all interest income of households is assumed to have been subjected to income tax throughout the period.
significantly affects consumer borrowing behavior and also confirms the importance of the Tax Reform Act of 1986.

Confidence in the Economy

The purchase of goods on credit is an act of financing current consumption with anticipated future income. Because future income is uncertain, consumers’ borrowing decisions depend on their confidence in the future. In particular, confidence about future income may significantly affect the financing decisions of the consumers who rely heavily on future income. When confidence is low, those consumers are discouraged from purchasing goods in the current period. If those heavy credit users defer consumption, consumer borrowing in aggregate will be smaller per unit of consumption. In addition, consumers in general may wish to consume less and reduce the level of debt to prepare for an uncertain future. Therefore, the repayment rate of existing debt tends to be higher.

Measures of consumers’ confidence are designed to capture consumers’ subjective feelings about economic conditions that might influence their spending decisions. Those feelings can have an impact on consumer borrowing, regardless of their accuracy. What is more relevant for consumers making their decisions might be the perception about future income rather than the actual future income. Figure 4 compares the Conference Board’s index of consumer confidence and the total credit ratio. The two variables show a strong tendency to move together. The only exception is the period between 1987 and 1989, when the credit ratio declined despite

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18 According to the panel study of Hendricks and others (1973), families that are more optimistic about financial progress borrow more. In addition, the index of past and future financial progress is more highly correlated with borrowing than it is with consumption expenditures. These results suggest that households borrow more per unit of consumption when they are optimistic about the future.

19 Weinberg (1993) discusses the validity of consumer confidence indices and concludes that their usefulness as a forecasting tool is limited.
very high levels of consumer confidence. This measure of consumer confidence is consistent with high credit ratios between 1984 and 1986 and low ratios between 1990 and 1992. Overall, it appears that consumers' perception about the economy significantly influences their borrowing behavior.

**Debt Burden of Households**

Many analysts have cited the large debt burden of households as a factor contributing to the slowdown of consumer installment credit in the early 1990s. A heavy debt burden means that consumers have already used a large portion of future income and, hence, have less future income available for consumption. Then they are likely to consume less in the current period and repay debt faster in an effort to smooth out consumption.

Figure 5 shows that the stock of consumer installment credit as a percentage of disposable personal income increased rapidly through most of the 1980s. That the debt/income ratio peaked toward the end of the 1980s might appear to be consistent with the slowdown of credit growth in the early 1990s. A careful comparison of the debt/income ratio with the total credit ratio, however, does not convincingly support the economic relationship between the two variables. Since 1970, the debt/income ratio generally lagged behind the credit ratio, indicating that changes in the debt/income ratio may have been a result rather than a cause of movements of the credit ratio. Thus, Figure 5 shows more of an accounting relationship than economic causality; the debt burden increased as a result of heavy borrowing in previous periods.

An alternative measure of the debt burden is debt service payments, which are principal and interest payments on household debt. A possible advantage of this measure over the debt/income ratio is the incorporation of the effects of interest rate changes. Figure 5 also shows the estimated debt service payments of households as a share of disposable personal income. The

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**Footnote:**

20Debt service payments have been estimated by the Board of Governors based on the methodology suggested by Paquette (1986).
Figure 5a
Ratio of Consumer Installment Credit to Annual Disposable Personal Income

Figure 5b
Ratio of Debt Service Payments to Annual Disposable Personal Income
estimate includes mortgage payments, as well as payments on consumer credit. The debt service burden shows a similar pattern of movements to the debt/income ratio, especially during the 1980s and 1990s. Consequently, it is difficult to draw any conclusions about the effect of debt burdens on financing patterns because the two measures are so closely intertwined.

Willingness of Lenders to Lend

The factors considered thus far have dealt mainly with the demand for consumer installment credit. Supply conditions may also affect the quantity of consumer installment credit. Tightening of lending standards by financial institutions may force many consumers with heavy credit needs to defer consumption and many others to find other financing means. Hence, the reluctance of lenders to extend credit may result in slow growth of consumption and even slower growth of consumer credit.

Figure 6 plots an index based on a survey of banks' willingness to make consumer installment loans along with the total credit ratio. Positive index values indicate that banks on average were more willing to lend during the period, whereas negative values mean that banks were less willing to lend. During the period examined, the credit ratio generally followed the index with a lag of a few quarters. In terms of the direction of changes, the relationship between the two variables appears to have been

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21The index is derived from the Senior Loan Officer Opinion Survey of Bank Lending Practices. In the survey, the participating banks (60 major banks) indicate the change in their willingness to lend during the last three months by selecting one of the following five willingness categories: much more willing, somewhat more willing, basically unchanged, somewhat less willing and much less willing. In constructing the index, a number is assigned to each category (2, 1, 0, -1 and -2). The index is the weighted average of the assigned numbers multiplied by 100.
Table 4

Is the Factor Consistent with the Financing Pattern of Consumers?

<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>Home equity lines of credit</td>
<td>NA</td>
<td>NA</td>
<td>Yes</td>
</tr>
<tr>
<td>Real after-tax interest rate</td>
<td>NA</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Interest rate spread</td>
<td>Somewhat</td>
<td>Somewhat</td>
<td>Yes</td>
</tr>
<tr>
<td>Consumer confidence index</td>
<td>Yes</td>
<td>Somewhat</td>
<td>Yes</td>
</tr>
<tr>
<td>Debt burden</td>
<td>No</td>
<td>No</td>
<td>Somewhat</td>
</tr>
<tr>
<td>Willingness to lend</td>
<td>Somewhat</td>
<td>No</td>
<td>Yes</td>
</tr>
</tbody>
</table>

systematic throughout the period examined. High values for the index were closely in line with the credit ratio during the mid-1980s. In the early 1990s, however, the relationship became questionable because of a large gap between the two variables, though the direction of changes remained consistent.

**SUMMARY**

This article has examined consumers' borrowing behavior between 1970 and 1992, with particular emphasis on consumer installment credit. Consumption expenditures do not fully explain consumer borrowing because consumers vary their financing pattern (the proportion of debt-financed consumption and the repayment rate of existing debt) in response to economic and institutional changes.

Although showing no apparent long-term trend, the ratio of the change in consumer installment credit to consumption expenditures fluctuated widely since 1970, indicating that the financing pattern of consumers is volatile in the short run. In particular, consumer installment credit declined in the early 1990s after increasing rapidly during the second half of the 1980s. Short-term borrowing behavior can be affected by many economic and institutional factors, such as the emergence of a new borrowing instrument, the cost of consumer credit, the cost of consumer credit relative to the return on household financial assets, confidence in the economy, the debt burden of households and the supply condition of consumer credit. This article has examined the relationship between these factors and the ratio of the change in consumer installment credit to consumption expenditures.

Table 4 summarizes the qualitative results. The movements of most of the economic variables are found to have been fairly consistent with the behavior of consumer installment credit during the period examined. Overall, the growth of consumer installment credit relative to consumption expenditures is particularly well explained by the difference between the cost of consumer credit and the return on household financial assets (interest rate spread) and the consumer confidence index. In explaining the heavy borrowing of the mid-1980s, the high willingness of banks to lend appears significant. The small interest rate spread, high levels of the consumer confidence index and the high proportion of young adults also help explain the heavy borrowing. The slow growth of consumer installment credit in the early 1990s is fairly well explained by high real after-tax interest rates, large interest rate spreads, low levels of the consumer confidence index and the emergence of home equity lines of credit. The phase-out of the tax deductions for interest expense on consumer credit appears to have played a significant role in slowing the growth of consumer installment credit after 1986. The change in tax law induced households to substitute household financial assets and home equity lines of credit for consumer installment credit.

**REFERENCES**


Measuring Labor Market Dynamics: Gross Flows of Workers and Jobs

GROSS FLOWS—THE CREATION and destruction of specific jobs or the movement of workers into and out of employment—are the immediate outcomes of labor market processes. When a firm closes a plant, it destroys jobs. When it opens a plant, it creates jobs. When an adult leaves a job to return to school full time or take care of a child, there is a flow from the pool of those employed to the pool of those not in the labor force. If the job itself is not destroyed, another person may move from unemployment to employment to fill it. If a construction worker’s job ends with the first snowfall, that is a job destroyed. Simultaneously, the worker may move from employed to unemployed or leave the labor force. On the other hand, he or she may move immediately into another job, perhaps one created in anticipation of the Christmas boom in retail sales, one that will be destroyed in January. Taking a wider view, an observer of the U.S. economy might notice that since the trough of the most recent recession, prominent employers have laid off thousands of workers—jobs destroyed—but more diffuse (and thus less visible) job creation has nevertheless raised overall employment by more than 3 million.

Standard measures of labor market developments condense all of these events into a single number, the net change in employment. Useful as they are, these statistics hide an interesting and potentially informative (though difficult to measure) dimension of labor market developments: the gross numbers of jobs created and destroyed and the gross movements of individuals into and out of employment. An employment increase of 10,000 by one of the usual measures may mean 10,000 hires and no job separations, or it may mean 500,000 hires and 490,000 separations. Clearly, the nature of economic forces underlying these two scenarios may be radically different. The first portrays an economy with stable, perhaps rigid, labor markets, while the second conveys a picture with much more activity. The U.S. economy turns out to be much more like the second scenario, with surprisingly high levels of job destruction and creation, particularly during recession and recovery periods, respectively.

This article introduces the ideas behind measurement of gross labor market flows, presents several such measures, including a new one, and outlines some of the ways these data may influence economists’ views of macroeconomic events. The article first examines three sources of information on gross labor market flows. These are (1) establishment-level data assembled by Steven Davis and John Haltiwanger from the Census Bureau’s Survey of Manufactures, (2) industry employment data from the Bureau of Labor Statistics’ (BLS) Current Employment Statistics (CES) program (often called the estab-
lishment survey, though information on individual establishments is not available from this source) and (3) household data extracted from the Current Population Survey (CPS). To prevent confusion with the establishment-level data from the Survey of Manufactures, the second data source (CES) will subsequently be termed industry data.

The Survey of Manufactures and industry data look at gross flows from the standpoint of employers, that is, from the demand side of the market. Measured gross job creation is the sum of increases in employment at those firms/industries that experience increases. Measured job destruction instead sums decreases. The household data measure gross flows from the supply side of the labor market as the sum of individuals' movements into employment (gross job finding) and the sum of their movements out of employment (gross job separation).

After describing the gross flow data, the article turns to a discussion of ambiguities that can arise because of the interval between surveys or the choice of measurement unit (household, establishment or industry). The last two sections in the article note differences and similarities among the different gross flow measures and some implications of looking at labor market data in this way, especially the hypothesis that business cycles are driven by sectoral shifts.

MANUFACTURING ESTABLISHMENT DATA

Davis and Haltiwanger (1990, 1992) have assembled and analyzed gross flow data from the Annual Survey of Manufactures undertaken by the Census Bureau. In 1977 the Survey of Manufactures covered approximately 19 percent of manufacturing establishments (including all establishments above a certain size) and 76 percent of manufacturing employment.¹

Davis and Haltiwanger's series for gross job creation and destruction rates are defined as the sum of the absolute values of employment changes in establishments with increasing and decreasing employment, respectively, divided by total employment in sample establishments:

\[ JC_t = \frac{1}{E_t} \sum_{i=1}^{N_t} \delta_i^{(+)} \Delta E_{it} \]

\[ JD_t = \frac{1}{E_t} \sum_{i=1}^{N_t} \delta_i^{(-)} (-\Delta E_{it}) \]

where \( E_t \) is total employment in sample establishments, \( E_{it} \) is employment in establishment \( i \), \( N_t \) is the number of establishments in the sample, \( \delta_i^{(+)} = 1 \) if \( \Delta E_{it} > 0 \) and 0 otherwise, and \( \delta_i^{(-)} = 1 \) if \( \Delta E_{it} < 0 \) and 0 otherwise.²

The series for job creation and destruction as calculated by Davis and Haltiwanger are shown in Figure 1.³ Davis and Haltiwanger draw attention to several features of these time series. First, the magnitude of job creation and destruction is dramatic. Job creation and destruction average 5.4 percent and 5.6 percent, respectively, at a quarterly rate over the 1973–86 period. Second, there is a clear negative correlation between creation and destruction during recessions. Third, job destruction accounts for much more of the movement in employment during recessions than does job creation. Fourth, at no time is either job creation or job destruction near zero; simultaneous creation and destruction is the rule without exception.

Limitations of the Manufacturing Establishment Data

Though establishment-level data have important advantages for measuring gross flows, this data source also suffers from serious limitations. The most obvious is that it is restricted to manufacturing, which accounted for only about 17 percent of employment in 1992 (down from 26 percent at the start of the Davis and Haltiwanger sample in 1972). Second, these data are available only with a substantial lag, and the raw data are not publicly available.

In principle an establishment could incorrectly report employment levels in a quarter, thus generating spurious job creation or destruction.

¹Davis and Haltiwanger (1990), p. 128. An establishment is defined as a single physical location. Thus, one firm may comprise several establishments.
²To compensate for the stratified sampling design, establishments are weighted by the inverse of their sampling probabilities. For a description of how births and deaths of establishments are handled, see Davis and Haltiwanger (1990).
³These series are updated versions of the POS and NEG series used in Davis and Haltiwanger (1990). The data were kindly provided by John Haltiwanger.
INDUSTRY DATA

A second approach to measuring gross job creation and destruction, developed for this article, is similar to Davis and Haltiwanger's, but uses a breakdown of employment by industry based on the monthly BLS Current Employment Statistics (CES) survey. While there are disadvantages to basing gross flow measures on industry-level data (particularly the netting of job creation and destruction within industries), this approach offers several significant advantages: (1) industry coverage can be quite comprehensive; (2) the data are publicly available; and (3) the data are available monthly without a major publication lag.

The raw data are employment levels in several hundred industries in the private nonfarm sector of the economy. The CES sample currently covers more than 370,000 establishments, including all firms with more than 250 employees and a subset of smaller firms. These data are benchmarked annually using yet more comprehensive information. The CES sample excludes agricultural workers, unpaid family workers, domestic workers in private homes, and self-employed persons (all of whom are included in the household data described in the next section). To focus on job creation and destruction driven primarily by market forces, the data used for this paper also exclude government workers, though the CES sample includes them. People who hold jobs at more than one establishment will be counted more than once. Though the data are collected from individual establishments, only industry totals are publicly available.

In a month t when there is no change in the industrial classification (most months), the

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*4 A detailed description of the CES program can be found in the BLS Handbook of Methods. Each issue of Employment and Earnings contains an abbreviated description in the "Explanatory Notes" section.
gross job creation and destruction rates are defined analogously to Davis and Haltiwanger's measures:

\[
JC_i = \frac{1}{E_i} \sum_{t=1}^{N_t} \delta_i^{t-1} \Delta E_i
\]

\[
JD_i = \frac{1}{E_i} \sum_{t=1}^{N_t} \delta_i^{t-1} (-\Delta E_i)
\]

where \( E_i \) is total employment in these industries and \( E_i \) is employment in industry \( i \). The construction of job creation and destruction series using CES data is complicated by the evolving classification of industries. At various times the standard industrial classification (SIC) used by BLS to allocate employment among industries is revised. In general, the revision results in a finer breakdown of industries already included, but sometimes it adds coverage of entirely new industries. The job creation and destruction series are constructed so that the breadth of industrial coverage does not change from the first period to the last. A finer breakdown within a larger industry is exploited, however. An adjustment at the “birth” of a new three- or four-digit industry accounts for the fact that the start of data on the industry does not indicate job creation, but reclassification. Since new three- and four-digit industries are generally created to subdivide growing industries, this procedure tends to limit the extent of netting of job creation and destruction within industries. The procedure followed in periods when a finer breakdown of an industry appears in the data is described in the appendix.

Figure 2 shows rates of job creation and destruction using a base of two-digit industries for which data are available since 1947. Almost all of these are manufacturing industries, so this series is dominated by manufacturing, which has been a declining share of total employment for several decades. Since the breadth of industrial coverage increases substantially in 1958 and 1972, Figure 3 shows results of the same calculations on industries for which data are available in 1972. Neither Figure 2 nor Figure 3 is affected in a substantial way by excluding government from the base of industries. The data plotted in Figures 2 and 3 are seasonally adjusted using the X-11 procedure and further smoothed using a five-month centered moving average.

The industries in the 1972 base are a comprehensive cross-section of the nonfarm business sector. In January 1972, employment was 59.2 million for all private nonfarm payrolls, only 23.5 million (39.7 percent of the total) for the 1947 base of industries, but 57.8 million (97.6 percent) for the 1972 base. By June 1993, total employment was 91.3 million for all private nonfarm payrolls, 23.3 million (25.5 percent) in the 1947 base and 87.3 million (95.6 percent) for the 1972 base.

One notable aspect of Figures 2 and 3 is that job creation rates are substantially higher during the 1980s using the 1972 base than using the 1947 base, whereas job destruction rates do not differ much between the two bases. This is largely because many of the industries that are excluded from the 1947 base are those which experienced rapid growth during the 1980s relative to other industries. Most segments of construction, transportation, communications, utilities, trade, insurance, real estate and services (including medical) that are included in the 1972 base are not in the 1947 base.

These gross flow measures based on industry data also show a pronounced cyclical pattern. Job destruction still dominates cyclical movements in total employment, though creation appears more cyclical in the industry measures than in the Davis and Haltiwanger measure.

The most recent recession was marked by unusually small changes in job creation and destruction rates (see Figure 3). The job destruction rate rose and fell, but by far less than in recent recessions. This surprising fact is discussed more extensively later in this article. The job

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5For example, starting with 1958 data, the industrial machinery and equipment (SIC 35) category is broken down into engines and turbines (SIC 351), construction and related machinery (SIC 353) and so on. In 1972, industry 353 was itself subdivided into construction machinery (SIC 3531) and mining machinery (SIC 3532). Also in 1972, the remainder of industry 35 was further subdivided by addition of farm and garden machinery (SIC 352), general industrial machinery (SIC 356), and miscellaneous industrial and commercial machinery (SIC 359).
Figure 2
Rates of Gross Job Creation and Destruction, 1947 Base
Seasonally adjusted, centered 5-month moving average

Shaded areas represent recessions.

Figure 3
Rates of Gross Job Creation and Destruction, 1972 Base
Seasonally adjusted, centered 5-month moving average

Shaded areas represent recessions.
creation rate showed no sharp increase around the time of the trough as it did in previous recessions. Shortly before the trough of the 1990-91 recession the job creation rate reached its lowest level since the 1950s. The earlier low points were the result of sharp downward swings, however, while the recent low resulted from a small downward swing that followed a decade-long downward trend in the rate. In addition, job creation and destruction remained close together following the March 1991 trough, illustrating the slow growth of employment after the recession.

**Limitations of Industry-Based Data**

The most compelling problem with this approach to gross flows is the large measurement unit (an industry). To the extent that some firms within an industry increase employment during the same month that other firms decrease employment, we get net rather than gross flows. Obviously, this is far more likely to be a serious problem when the measurement unit is an entire industry rather than a single establishment or household. As industries grow, this problem becomes more severe. This effect is largely offset, however, as industry detail increases over time. A more extensive discussion of the netting issue is deferred until a later section.

In principle, these data, like the Davis and Haltiwanger data, are subject to classification errors. An establishment could incorrectly report employment levels in one month, thus generating spurious job creation or destruction (or both if the error were subsequently corrected). If these errors are not correlated within an industry, they may cancel out, but there is no evidence available on this question.6

### HOUSEHOLD DATA

Each month the Current Population Survey (CPS) collects employment data from a sample of about 60,000 households, obtaining information on about 113,000 persons 16 years of age or older (about 0.6 percent of this population). The survey attempts to establish whether each member of the household was employed (E), unemployed (U), or not in the labor force (N) during the previous week. Though there are some refinements to deal with special situations, broadly speaking an individual who worked during the survey week is counted as employed, and one who did not work but was actively looking for work is counted as unemployed. Otherwise the individual is not in the labor force.

Each household is in the sample for a total of eight months in two separated segments of four consecutive months. The households are divided into overlapping rotation groups so that about 75 percent of the households are the same in adjacent months.7 These continuing households make it possible to track changes in the labor market status of many individuals. The information from each household is weighted to produce estimates of economy-wide flows.8

The April 1993 to May 1993 flows among E, U and N and the relative sizes of the E, U and N pools are shown in Table 1 and Figure 4. The relative magnitudes of these flows are fairly typical. As Table 1 indicates, most of the adult population either stays employed (59.1 percent) or out of the labor force (31.5 percent) from month to month. The E to N (3.2 million) and N to E (3.0 million) flows shown in Figure 4 are the largest in absolute magnitude, but the U to E (2.0 million) and U to N (1.5 million) flows are

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6Uchitelie (1993) and Kreisler (1993) describe a recent incident that illustrates the vulnerability of data from establishments to reporting errors.


8The number of individuals unemployed five weeks or less and initial unemployment claims have also been used as crude measures of the gross flow of workers into unemployment. The former would measure movements from both employment and out of the labor force. The latter is tied to movements from employment to unemployment.
Figure 4

Millions, seasonally adjusted

E = Employed
U = Unemployed
N = Not in the Labor Force

Status of Working Age Population, May 1993

Millions, seasonally adjusted

E(119.2)
U(8.9)
N(65.2)
much larger in relation to the size of the group from which they are drawn. Table 1 illustrates this: More than two-thirds as many people left unemployment \((1.0 + 0.8 = 1.8\) percent) as remained unemployed \((2.6\) percent). On the other hand, less than 5 percent as many people left employment as stayed employed \((2.5\) percent compared with \(59.1\) percent).

Figure 5 shows gross job finding (the sum of U to E and N to E movements) and gross job separation (the sum of E to U and E to N), as a proportion of total employment, from mid-1968 to mid-1993. The terms job finding and job separation will be used throughout in connection with the household data to emphasize that these data are based on worker movements rather than the creation or destruction of specific jobs. Though job creation and finding are closely bound together, as are job destruction and separation, the measured gross flows are based on fundamentally different approaches.

The data in Figure 5 are seasonally adjusted using the X-11 procedure and are further smoothed using a five-month centered moving average.

These data show a striking cyclical pattern similar to the demand-side measures. The net drop in employment during recessions (the usual way of viewing employment) is clearly dominated by job separations, just as job destruction dominates in the establishment and industry gross flow measures. In four of the five recessions shown, job finding actually increases during the recession. A second prominent feature of Figure 5 is the downward trend in gross job finding and separation rates that starts around 1984. This may be accounted for by changes in the demographic structure of the working-age population but there are difficulties with this interpretation. Further discussion is deferred until the end of the article.

**Limitations of CPS Gross Flows**

Several serious problems with the CPS gross flow data have limited their usefulness. The least serious is sampling error. Even though the CPS sample is quite large, the number of transitions among states is relatively small; most of those reported as E/U/N this month will be iden-

tically reported next month (see Table 1). This means that the standard error around this estimate of the true number of people changing status will be large in proportion to the number. The sampling error, while comparatively large, is zero on average, so it does not bias the estimated flows.

The second problem is missing observations. The sampling unit for the CPS is actually a residence rather than a household; the interviewers return to the same address for four consecutive months. If the household moves, it drops from the sample and is replaced by the household living at that address, if any. If an adult moves into or out of the household, the individual appears in or disappears from the sample. About 7.5 percent of individuals in particular residences in the previous month cannot be found in data for the current month. In addition, about 7.5 percent of individuals in particular residences in the current month's data were not recorded in the previous month's data. Individuals who move are probably more likely to change labor force status than those who do not. This would bias the gross flows downward. Abowd and Zellner estimated gross flows corrected for nonrandom missing data and found that corrected flows into employment were 22 percent higher and corrected flows out of employment were 16 percent higher than unadjusted flows.

The third problem, classification error, has generated the most attention. If an employed individual is classified correctly in month 1, incorrectly as unemployed in month 2, and correctly in month 3, with no change in true status, two spurious transitions (E to U and U to E) have been recorded. These response errors arise partly because of the design of the survey. One individual from each household answers questions about every adult in the household, but this is not necessarily the same individual each month. Different respondents may answer questions about the labor force status of household members in different ways. In addition, there is some ambiguity about where the lines are drawn between employed, unemployed and not in the labor force. The line between unemployed and not in the labor force is particularly fuzzy (though not relevant for Figure 5).

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9 Various problems with the CPS gross flow data greatly distort the relationship between job finding and job separation rates in Figure 5. These problems are discussed extensively in the next subsection.


11 Abowd and Zellner, Table 3, p. 264.
Because actual transitions are relatively rare, a small probability of classification error can generate errors in the gross flow data that are quite large in proportion to the true flows. In January 1993, for example, the data indicate that 61.5 percent of the adult population was employed. If 2.3 percent of employed workers incorrectly report their status as not employed (the estimate reported by Poterba and Summers in table 3), then 1.41 percent of the sample report a spurious transition out of employment. Only about 3 percent of the sample actually reports such a transition in January 1993, so 46 percent (1.41/3) of the gross flow out of employment would be spurious under this scenario.

There have been several attempts, including those by Abowd and Zellner (1985) and Poterba and Summers (1986), to correct this upward bias in gross flow data using reinterview data collected by BLS as part of a quality control program. A small fraction of the original sample is surveyed a second time by experienced personnel, most of whom are asked to try to reconcile differences between the first and second interviews. Reinterview data are assumed to be correct and are used to estimate the probabilities of classification error for different demographic groups. These estimates are then used to correct the gross flow data. Poterba and Summers (1986) adjust both job finding and job separation downward by more than 60 percent for the 1977–82 period. Abowd and Zellner (1985) adjust the same flows downward by more than 25 percent.

This approach is not wholly satisfactory, however, for at least two reasons. First, two studies taking similar approaches to the problem...
come up with adjustments that differ widely, and neither is clearly superior. Second, the reinterview program does not sample randomly (from the entire CPS sample), but rather concentrates attention on interviews that are prone to error (for example, because the original interviewer is new to the job). This implies that the reinterview data are likely to exaggerate the extent of classification error.

An idea of the overall seriousness of the problems with CPS gross flow data can be gleaned from Figure 6, which compares the change in household employment estimated in the usual way with the difference between flows into and out of employment. The former is based on the change in the number of people in the CPS who report that they are employed, whereas the latter is based on the responses of people who were surveyed in consecutive months and reported a change in employment status. In principle, the two should match quite closely, but the gross flows substantially understate employment growth over the entire sample period. This situation may improve significantly when a revised CPS is implemented in January 1994.

**HOW GROSS ARE GROSS FLOW MEASURES?**

Because the subject of this article is gross employment flows, an important concern is the extent to which any particular measure of gross flows really measures gross rather than net flows. This issue arises on both the time and cross-section dimensions of the data.

Netting occurs intertemporally if, for example, an individual reports working in two consecutive surveys but was unemployed between the two reports. Similarly, a firm may have laid off and rehired workers from one quarterly report to the next. Obviously, this intertemporal netting will be more important the longer the interval between observations on a measurement unit. The household and industry measures are based on monthly data, whereas the Davis and Haltiwanger data are based on quarterly information.

Netting also occurs in the cross-section dimension when the measurement unit is larger than a single worker. A firm may hire some workers and fire others within the observation interval. An industry may be a mix of firms that are...
increasing and firms that are decreasing employment (as well as firms that do both within the period).

Finally, since the degree of industry detail differs between sectors, with manufacturing employment by far the most finely subdivided, the degree of intraindustry netting almost certainly varies systematically across sectors.

Since there is an additional layer of netting involved in using industry gross flow data, it is important to understand the relationship between establishment- and industry-level variation in employment. Figure 7 compares the Davis and Haltiwanger series on job creation and destruction in manufacturing (labeled establishment data) with series based on industry employment data for manufacturing industries and using employment changes between the months of the Survey of Manufactures (February, May, August and November). These series differ mainly because they use different units of measurement (establishment vs. industry), although they are also based on different survey methodology. Two features of the comparison stand out. First, the profiles of the series are quite similar; the larger peaks and troughs coincide and have roughly the same size in both series, though the similarity is less apparent for job creation. The same is true for seasonally unadjusted data (not shown). Second, the Davis and Haltiwanger series are substantially higher than the industry series. A large share of this gap is gross job creation or destruction that nets out when the unit of measurement is the industry. A closer look at the gap reveals that it has no pronounced trend and is not noticeably cyclical, suggesting that most of the job creation and destruction that disappears in this way using the industry series may not be of great interest from a macroeconomic perspective.

COMMON AND CONTRADICTORY FEATURES

Magnitude

Though the magnitudes of the three gross flow measures differ for many reasons, some informative and some spurious, all three measures are strikingly high. Davis and Haltiwanger's manufacturing establishment data show, for example, 5 and 7 percent rates of creation and destruction for the first quarter of 1986. The industry-based (1972 base) data indicate job creation and destruction rates of about 2 percent (with or without government) for the same quarter. The household data indicate that job finding and separation rates were about 14 percent each for the same quarter. In addition, there are dramatic seasonal swings in these series (see the next section), so during the year the rates can be much higher than the average. Even the smallest of these magnitudes implies a labor market in which a great deal of activity takes place even when overall employment is not changing. There is evidence that European countries experience gross flows that are the same order of magnitude.

The household data (Figure 5) show a sharp downward trend in both job finding and separation rates, starting around 1984. Total job finding and separation levels (not shown) have a clear upward trend to this point and no apparent trend afterwards. There is a plausible demographic explanation for the downward trend in the household data: Workers in their 30s, 40s and 50s have lower rates of job separation and job finding. The baby-boom generation started to enter these years of stable labor force participation and job attachment in the early 1980s, and this increase in the proportion of workers with lower finding and separation rates would therefore depress the overall levels of gross job finding and separation.

The puzzle remains, however. This demographic hypothesis should also apply to the industry-data because private payroll employment (from the CES) and household employment (from the CPS) show similar trends over time. The 1972 industry base includes almost all private payroll employment. However, the downward trend in job creation (industry data, 1972 base) is weaker than that in job finding (CPS data) and there is no downward trend in job destruction comparable to that in job separations. The main coverage differences between the CPS and CES employment series are (1) the CES excludes agricultural workers, self-employed workers and several smaller categories and (2) the CES data will record individuals with more than one job in the nonfarm payroll sector.

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13 Adding together monthly job finding and separation rates to get quarterly rates (as was done here) is somewhat misleading since it is likely that many of the same people are moving repeatedly into and out of employment.

Figure 7
Rates of Job Creation in Manufacturing
Seasonally adjusted

Rates of Job Destruction in Manufacturing
Seasonally adjusted
more than once. Neither of these seems likely to account for such a large difference in trends during the 1980s. The industry job creation and destruction data shown in Figures 2 and 3 do not include government workers, but the trends do not change when government workers are included.

**Seasonal Movements**

Not surprisingly, there are extremely pronounced seasonal patterns in the gross flow measures. The 1992 seasonal patterns estimated by the X-11 seasonal adjustment procedure for the household and industry series (1972 base) are shown in Figure 8. These are seasonal factors for levels of creation and destruction (the data are not divided by total employment). They are the ratio of the unadjusted series to the seasonally adjusted series.

The industry data for job destruction show a dramatic seasonal peak in January, when the ratio of unadjusted to adjusted data is nearly 4. The ratio of the highest to lowest seasonal factors for job destruction is nearly 15, meaning that about 15 times as many jobs are destroyed in January on average as in April. The ratio is about 7.5 for job creation, with the high and low months being June and January.

Seasonal movements in job finding and separation are also quite significant, though the scaling of Figure 8 hides this. Seasonal factors in 1992 range from 0.8 to 1.2 for job finding levels and from 0.8 to 1.3 for job separations. By contrast, seasonal factors for total civilian employment are only about one-tenth of this size (0.98 to 1.02).

Figure 8 highlights the fact that the seasonal fluctuations in the CPS gross flows data have much smaller amplitude than those in the industry data. The different underlying data sources are one reason for this. A worker who moves immediately from one seasonal job to another is not unemployed between the jobs, but this movement can correspond to seasonal job destruction in the first industry and seasonal job creation in the second. Similarly, if a seasonal job is a second job for an individual, there is no change in his or her labor market status as recorded by the CPS when the job begins or ends. No gross flow is generated in the CPS data in either case, but a job is recorded as both created and destroyed in data based on employers' payroll records. These are relatively infrequent occurrences, but because labor market transitions are also relatively rare, their relative importance is much greater in measuring gross flows than in measuring total employment.

**Cyclical Movements**

One common feature of all three approaches to measuring gross flows is that employment declines during recessions are dominated by rises in job destruction or separation. Job creation or finding rates usually begin to decline well before the business cycle peak. Similarly, job destruction or separation rates tend to begin rising before the official onset of a recession.

The timing of the business cycle peaks in job destruction and troughs in job creation is interesting in two respects. First, the two usually almost coincide in both the industry and establishment series. This does not occur in the CPS data. Second, the peak of job destruction/separation tends to occur toward the trough of the recession and never occurs at the peak.

The household and industry data both indicate that the 1990-91 recession was characterized by much smaller movements in gross destruction/separation and creation/finding rates than earlier recessions. This suggests that highly visible downsizing efforts by firms are somewhat misleading for the economy as a whole:

15Seasonal factors (1986) for the Davis and Haltiwanger manufacturing series range from 0.9 to 1.3 for destruction and from 0.98 to 1.04 for creation. Part of the reason seasonal factors are smaller for the Davis and Haltiwanger series is that they are quarterly, so some of the seasonal fluctuations have already been smoothed out.

16This regularity is even more pronounced in unsmoothed data. A very simple model of job creation would predict that creation and destruction should be (distorted) mirror images of each other. Suppose that the change in employment for a particular firm or industry is given by $g_t = e_t + u_t$, where $e_t$ is an aggregate shock and $u_t$ is a firm/industry specific shock that does not depend on time. A decrease in $e_t$, then shifts the distribution of $g_t$ to the left, throwing some firms/industries from the job creation column to the job destruction column. Job creation falls and job destruction rises.
Figure 8
1992 Seasonal Factors (NSA/SA) for Job Finding and Creation (1972 Base)

1992 Seasonal Factors (NSA/SA) for Job Separation and Destruction (1972 Base)
despite its visibility, job destruction was at surprisingly low levels during and after the 1990-91 recession. Two observations may help to reconcile perceptions with the job destruction statistics. First, BLS data indicate that an unusually large proportion of job losses during and after the 1990-91 recession were permanent rather than temporary layoffs (as reported by workers), increasing the perceived seriousness of the job destruction. Second, though job destruction in manufacturing did not reach particularly high levels during the recession, manufacturing has continued to shed jobs (that is, job destruction exceeded job creation) in almost every month since the end of the recession. Manufacturing layoffs tend to be quite visible.

MACROECONOMIC APPLICATIONS

Most macroeconomic analyses involving gross labor market flows have tried to assess what is often called the sectoral shift hypothesis. This hypothesis focuses on changes in the distribution of demand among sectors of the economy rather than on aggregate shocks. The macroeconomics literature typically assumes that business cycles are driven by aggregate shocks. Various sources of aggregate shocks have been hypothesized by macroeconomists—private expectations, monetary policy, oil price increases and technology shocks, to name a few. They share the common feature that all firms and individuals in the model are affected in relatively similar ways.

In a seminal paper, Lilien (1982) argued that shocks to the distribution of demand among different sectors might account for a large portion of the variation in the level of economic activity. Adverse shocks to demand in specific industries could cause dislocation of workers and other resources that would not flow smoothly into more productive pursuits. The adjustment period would be characterized by a decline in economic activity generally, and an increase in the unemployment rate in particular, so there would be a positive relationship between cross-sectional variation in industry employment growth and the unemployment rate. Lilien estimated the relationship between the unemployment rate and a measure of the cross-sectional dispersion of employment growth in 11 broad industry groups. He found that more than half of the variation in the overall unemployment rate could be accounted for by variations in the cross-sectional dispersion of employment changes.17

Lilien's results have not been regarded as conclusive. Abraham and Katz (1986) pointed out that an increase in Lilien's measure of the cross-sectional dispersion of employment growth could be induced by aggregate shocks, given plausible assumptions about industries' trend rates of growth and cyclical sensitivities. They argued that if the positive correlation between Lilien's dispersion measure and the unemployment rate were accounted for by sectoral shifts, there would also be an increase in job vacancies when the dispersion measure increased. Holding the overall level of aggregate demand fixed, some industries would be trying to hire as others' laid-off workers, causing a mismatch of workers and jobs and an increasing vacancy rate. If the business cycle is driven by aggregate demand, however, the relationship between dispersion and vacancy rates would be negative. They found a strong negative relationship, implying that aggregate demand fluctuations are the dominant source of variation in the unemployment rate.18

The sum of job creation and destruction series such as those by Davis and Haltiwanger or those produced using industry data can be used as a cross-sectional dispersion measure. For the Davis and Haltiwanger data:

\[
SUM_t = JC_t + JD_t = \frac{1}{E_t} \sum_{i=1}^{N_i} |\Delta E_{it}|.
\]

\(SUM_t\) increases when there is more variation in employment change in individual industries. Both \(SUM_t\) and an analogous measure based on industry data move countercyclically since \(JD_t\) tends to rise more than \(JC_t\) falls during recessions.

To get more insight into what might drive changes in dispersion, equation (1) can be re-written in terms of growth rates:

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18Abraham and Katz used a normalized help-wanted index to proxy for a direct measure of vacancies in the United States. They found similar results in British data using a direct measure of vacancies.
the variation in fluctuations can account for the significant time variation in the contribution of idiosyncratic effects.\textsuperscript{19} Davis and Haltiwanger find that nearly all of the variation in $\sum t$ over time can be attributed to the $\tilde{g}_n$ component. For example, when the sectors indexed by $s$ correspond to two-digit industries (a relatively broad industrial classification), $\tilde{g}_n$ accounts for 87.6 percent of the variation in $\sum t$. Replacing $g_n$ with $\tilde{g}_n$ in (2) gives a dispersion measure $\sum nt$ that has average aggregate and industry growth rates removed. Davis and Haltiwanger find that $\sum nt$ is also countercyclical. They conclude, “We interpret these variance ratio results as a decisive rejection of the hypothesis that the normal pattern of sectoral responses to aggregate fluctuations can account for the significant time variation in $|\sum t|$... The time variation in $|\sum t|$ results overwhelmingly from time variation in the contribution of idiosyncratic effects.”\textsuperscript{19}

This empirical observation does not necessarily mean that shifts in industry demand, broadly defined, are not the source of much of the variation in $\sum nt$ or $\sum n_i$, however. The variance decomposition technique labels only variation common to all establishments as industry variation. In other words, only if employment grows at exactly the same rate in all establishments will the variance decomposition attribute all variation to industry shocks. Any assumption used to distinguish industry shocks from establishment shocks, however, will be to some extent arbitrary, and this particular assumption may not be the best way to think about industry shocks. In the 1970s and 1980s, for example, the U.S. steel industry shrank dramatically, largely as a result of international competition. This increasing international competition could reasonably be interpreted as an industry shock, but its effects clearly differed from one firm to another. Some firms disappeared altogether.

Rather than assuming, as Davis and Haltiwanger do, that all firms respond identically to an industry shock, we could assume that the industry shock hits the weakest firms hardest. This would imply that firms’ responses to industry shocks are extremely heterogeneous—in other words, that firms have idiosyncratic responses to industry shocks rather than truly idiosyncratic shocks. It is easy to demonstrate that this assumption can dramatically change the results of a variance decomposition exercise. The new identifying assumption may be equally arbitrary but illustrates the sensitivity of variance decomposition exercises to the assumptions used to identify industry shocks. Another way to state this conclusion is that the idiosyncratic shock $\tilde{g}_n$ as constructed by Davis and Haltiwanger is not necessarily independent of the fortunes of the industry.

Though the best way to isolate responses to industry or aggregate shocks is a topic that deserves further study, it is certainly clear from Davis and Haltiwanger’s work that firms’ responses to cyclical shocks vary dramatically even within industries. Understanding the size and sources of heterogeneity in firms’ employment responses may be critical to understanding the role of business cycles in the economy. Macroeconomic models that assume firms’ responses to shocks are homogeneous within industries will not capture any of the possible ramifications of this heterogeneity.

Dispersion ($\sum n_i$) is not the only aspect of these data that should be of interest to macroeconomists and, in fact, may be considerably less informative than its two halves, job creation and destruction. An important puzzle is the asymmetry between job creation and destruction in recessions, with changes in job destruction swamping those in job creation. Blanchard and Diamond (1990) argue that standard textbook models of entry and exit would predict the opposite. Existing firms exit (destroy jobs) only when they cannot cover variable costs, so exit is relatively insensitive to economic conditions. Potential entrants (job creators) must expect to cover total costs, including any fixed costs of entry. This implies that job creation will vary more than job destruction. Blanchard and Diamond speculate that differences in the costs...

\textsuperscript{19}Davis and Haltiwanger (1990), p. 138.
of hiring and firing workers may lead to bunching of job destruction during recessions. They point out, however, that aggregate behavior is often not analogous to microeconomic behavior in these types of models, so they find the explanation only partly persuasive.

Blanchard and Diamond also observe that, since cyclical changes in employment are dominated by job destruction, Schumpeterian theories of business cycles seem to be ruled out. These theories argue that booms are brought about by waves of product innovations (computers, for example) that produce new jobs, whereas recessions occur when these waves recede. This kind of theory implies that employment changes will be dominated by changes in job creation.

Job creation and destruction data that are based on a comprehensive cross-section of the labor market, such as the industry-based series constructed for this paper, could prove useful in several areas. Although establishment-level data are clearly closer to ideal than industry data for the study of job creation and destruction, it is important to know what happens beyond manufacturing (where establishment data are available), as the experience of the most recent cycle indicates.

Comprehensive data on gross flows could also provide insight into the employment outcomes of a free-trade agreement. Opponents of such agreements argue that jobs will be lost. Proponents argue that while jobs will be lost, there will be a net gain in employment. Little is known, however, about the patterns of job gains and losses surrounding such agreements. If there is a net employment gain, as most economists would predict, are the corresponding consequences for job creation and destruction of a comparable or greater order of magnitude than the net gain? In other words, how significant is the inevitable worker dislocation relative to the net job gain? Although intra-industry netting makes it impossible to disaggregate job creation and destruction very far using industry-based data, it may be possible to discern which broad sectors experience the largest effects.

SUMMARY

Gross flow data, for all their faults, provide a perspective on the U.S. labor market that cannot be obtained from any other source. This paper studies three approaches to measuring gross flows of workers and jobs, including a new, broadly based measure based on detailed industry employment data. Each of the measures is flawed in a different way, but an important message comes through nevertheless: Both seasonal and business cycle downturns are dominated by increases in job destruction, not by declines in job creation. This may have interesting and important implications for macroeconomics, but analysis of gross job creation and destruction is a relatively undeveloped area of macroeconomics.

The data also point to a striking fact about the most recent business cycle: Job destruction during the downturn appears to have stayed at very low levels compared with previous recessions. Moreover, in contrast to previous recoveries, there was no surge in job creation following the trough.

REFERENCES


20 One recent example of this type of theory is Shleifer (1986).
Appendix
Constructing Job Creation and Destruction Using Industry Employment Data

This appendix describes fully the procedure used to generate the job creation and destruction series described in the Industry Data section. The raw data are employment levels for 606 industries and are not seasonally adjusted. They are a mixture of two-, three- and four-digit SIC industries with varying start dates. The following steps detail the procedure.

1. For each two- or three-digit industry for which three- or four-digit subindustries are defined, a new residual industry is defined by subtracting employment in all of the subindustries from the total. The original two- or three-digit industry is then dropped from the data, leaving a set of non-overlapping industries that still include all employment in the original set of industries. In cases where four-digit industries start before three-digit “parent” industries, the two-digit residual is created by subtracting only employment in the four-digit industry from employment in the two-digit industry until the three-digit industry starts. After this point, both the four-digit industry and three-digit residual are subtracted from employment in the two-digit industry to get the two-digit residual. In some cases, the subindustries partition the entire industry, leaving no employment in the residual industry. If data for a two-digit industry start after the start date, the corresponding residual industry is dropped (though some three- or four-digit subindustries may be included if their data go back to the start date).

2. A start date is chosen, say 1947 (all industries start in January). All three-digit industries that start after 1947 and are part of a two-digit industry not in the 1947 data are dropped. If a four-digit industry starts after 1947 and is part of a three-digit industry that starts after 1947, and the three-digit industry is part of a two-digit industry that starts after 1947, the four-digit industry is dropped. Three- or four-digit industries that start after 1947 but are part of a two-digit industry that starts in or before 1947 are retained, however. These will be referred to below as new industries and are all treated as spin-offs of the appropriate residual industry.

In some cases four-digit subindustries start before their parent three-digit industries. In this case, the three-digit residual industry is treated as a new industry that spins off from the appropriate two-digit residual and is considered zero until its start date.

3. In months when no new industries start (most months), job creation and destruction are calculated by totaling employment in industries where employment change is positive and negative, respectively.

4. In the starting month for a new industry, the data show employment going from zero to some positive number in the new industry and show a drop of the same amount in the residual industry (plus the growth of the rest of the residual industry). These changes are induced by reclassification of jobs, not job creation or destruction. Therefore, employment in the new industry is added to employment in the residual industry and the new industry is ignored in creating job creation and destruction for that month. With this proviso, the job creation and
destruction totals can be calculated by summing employment in industries in which employment change is positive and negative, respectively.

5. The final series for gross job creation, gross job destruction and total employment in the industries under consideration are separately seasonally adjusted using X-11.

The three following examples may help to clarify the procedure.

**Example 1**

<table>
<thead>
<tr>
<th>SIC</th>
<th>Starts</th>
</tr>
</thead>
<tbody>
<tr>
<td>17</td>
<td>1972</td>
</tr>
<tr>
<td>171</td>
<td>1958</td>
</tr>
<tr>
<td>172</td>
<td>1958</td>
</tr>
<tr>
<td>173</td>
<td>1958</td>
</tr>
<tr>
<td>174</td>
<td>1972</td>
</tr>
<tr>
<td>175</td>
<td>1972</td>
</tr>
<tr>
<td>176</td>
<td>1958</td>
</tr>
</tbody>
</table>

The residual industry would be

\[
\text{SIC17R} = \text{SIC17} - \text{SIC171} - \text{SIC172} - \text{SIC173} - \text{SIC174} - \text{SIC175} - \text{SIC176}.
\]

If the start date for Example 1 were 1947, all of these industries would be dropped. If the start date were 1972, they would all be included. If the start date were 1958, SIC17R, SIC174 and SIC175 would be dropped, but SIC171, SIC172, SIC173 and SIC176 would be included.

**Example 2**

<table>
<thead>
<tr>
<th>SIC</th>
<th>Starts</th>
</tr>
</thead>
<tbody>
<tr>
<td>27</td>
<td>1939</td>
</tr>
<tr>
<td>275</td>
<td>1958</td>
</tr>
<tr>
<td>2752</td>
<td>1972</td>
</tr>
<tr>
<td>2759</td>
<td>1972</td>
</tr>
</tbody>
</table>

Residual industries

\[
\text{SIC275R} = \text{SIC275} - \text{SIC2752} - \text{SIC2759}
\]

and

\[
\text{SIC27R} = \text{SIC27} - \text{SIC275R} - \text{SIC2752} - \text{SIC2759} - \text{(other subindustries of SIC27)}
\]

would be created. SIC27 and SIC275 would be dropped, and SIC275R = SIC275 until 1972. If the start date is 1947, SIC275R is treated as a new industry in 1958. SIC2752 and SIC2759 are new industries in 1972.

**Example 3**

<table>
<thead>
<tr>
<th>SIC</th>
<th>Starts</th>
</tr>
</thead>
<tbody>
<tr>
<td>41</td>
<td>1958</td>
</tr>
<tr>
<td>411</td>
<td>1972</td>
</tr>
<tr>
<td>412</td>
<td>1958</td>
</tr>
<tr>
<td>413</td>
<td>1947</td>
</tr>
<tr>
<td>415</td>
<td>1972</td>
</tr>
</tbody>
</table>

If the start date is 1947 in this example, only data from SIC413 would be used. If the start date is 1958 or later, SIC41R and all of the three-digit industries would be included.
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