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Author(s): Frank Levy

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Changes in the Distribution of American Family Incomes, 1947 to 1984

FRANK LEVY

The American family income distribution now lies at the center of several controversies. Some observers argue that the American middle class is vanishing, but U.S. census income statistics show income inequality has not changed appreciably since 1947. A second controversy involves whether average living standards have risen or fallen since the major oil price increase of 1973–74. These controversies can be partially resolved by understanding the sharp slowdown in the growth of workers' wages which occurred after 1973 and the demographic trends which kept per capita living standards rising despite stagnant wages, including more working women and low birthrates.

RECENT DISCUSSIONS OF THE AMERICAN FAMILY INCOME distribution have raised two controversies. The first involves income inequality. For at least a decade, a growing number of observers have argued that American income inequality is growing (1). Yet U.S. Bureau of the Census statistics show that family income inequality is not much different today than it was in 1947 or any year in between.

The second controversy involves the recent path of average living standards. By many measures, American income growth has been weak since the end of 1973, the time of the Organization of Petroleum Exporting Countries' (OPEC) first major oil price increase. Yet U.S. Department of Commerce statistics show that consumer spending per capita (adjusted for inflation) grew as fast between 1973 and 1984 as it had in the booming 1950s.

In this article, I explore these controversies by describing the major features of the American family income distribution as it has evolved since World War II. Neither controversy can be fully resolved, but we can achieve greater understanding by recognizing that income inequality is only one dimension of the income distribution. A second is the "level" of the distribution—the actual purchasing power associated with the distribution's median and other percentiles. A third dimension is the distribution's "content," the demographic characteristics of the families that comprise the distribution's various sections. While single-year income inequality has remained roughly constant since World War II, these other dimensions have changed substantially. Together they have decreased mobility and probably have increased long-run inequality in ways described below.

Estimates of Inequality, 1947 to 1984

The U.S. census estimates family income inequality by listing a sample of families in order of ascending income and dividing the list into five equal groups (quintiles) of families. It then calculates the

aggregate income received by all families on the list and the share of this aggregate received by families in the first (poorest) quintile, the second quintile, and so on.

Inequality estimates for selected years are contained in Table 1, where the data illustrate two points. First, the American family income distribution is highly unequal: today, the richest quintile receives about \$9.15 of income for every \$1 received by the poorest quintile. Second, trends in inequality are moderate. From 1947 through the late 1960s there was a drift toward equality. From the late 1960s through the 1970s, there was a drift away from equality. Since 1979, the movement away from equality has been slightly sharper. But all of these movements were modest. Despite suggestions that America's middle class is vanishing, the middle three quintiles, the broad center of the income distribution, have received between 52 and 54 percent of all family income in every postwar year.

Does this mean that income inequality has not really changed? Not exactly. Family income is the most frequent basis for measuring inequality but it is not the only one. Another is the distribution of men's annual earnings and this distribution has become less equal through time, with younger workers falling increasingly behind older ones (2, 3). But in the family income distribution, the relative decline in young men's earnings has been offset by the heavy reliance on young families' having both spouses work. In addition, the data in Table 1 refer to inequality among family incomes in a single year. An equally important (but harder to measure) concept is inequality among "permanent" family incomes—that is, family incomes averaged over the family life cycle. I shall argue below that this inequality, in all probability, has also increased (4).

The relatively constant inequality in Table 1 can also be questioned because of the way in which the census defines income. The census defines a family's income as its gross (pretax) money receipts. Although this definition is easy to use in household sample surveys, it raises problems. It overstates purchasing power by not subtracting taxes paid. It understates purchasing power by not adding the value of "nonmoney" income including food stamps, Medicare and Medicaid, and employer-provided fringe benefits. Nonetheless, when approximate corrections are made for these problems, the pattern of Table 1 remains: a drift toward equality through the early 1970s followed by a drift away from equality, all within moderate limits (5).

Before leaving these numbers, it is important to note that the "richest" quintile of families is not composed solely of millionaires. Demarcation points for the 1984 family income distribution are contained in Table 2 which shows that the richest quintile began at \$45,300. If this number appears low, it is worth remembering that the family income distribution is based on all families: two-earner couples in the suburbs, retired couples in New England, families

The author is professor of public affairs at the School of Public Affairs, University of Maryland, College Park, MD 20742.

headed by young single women, and so on (6). Typically, we compare our own incomes to those of our peers—for example, young and middle-aged professionals with advanced degrees. In 1984 the income that delineated the top quintile of this group was not \$45,000, but about \$65,000.

The Level of the Income Distribution

It is all too easy to discuss income inequality trends without mentioning actual dollar incomes. Such discussion implies that inequality is the only dimension of income that matters in economic life, an obviously incorrect implication. A second dimension of income is purchasing power, the amount a family in the first quintile (or second quintile, and so on) can actually afford to buy. A third dimension involves whether that purchasing power is increasing or decreasing, a trend that depends as much on general economic growth as on income inequality per se.

To integrate inequality and economic growth, we begin by observing that the family income distribution is centered on median family income, sometimes called the income of the “typical” family. Where income inequality has moved within moderate limits, median family income has moved quite sharply. In 1947, median family income stood at \$14,100 (in 1984 dollars). It then grew steadily, never going more than 3 years without setting a new record, and reached \$28,300 in 1973. This was a virtual doubling in 26 years, and steady income growth was assumed to be automatic. During this time family income inequality decreased modestly (Table 1), but, more important, the whole income distribution kept moving to higher ground as most people saw their living standards rise (Fig. 1).

By many measures, 1973 was the last good year. Median family income has remained below \$28,000 (in 1984 dollars) in every year since, and in 1984 it stood at \$26,400. During this latter period, overall income inequality increased modestly. In the context of stagnant incomes, increased inequality translated into absolute income losses in all but the top fifth of the distribution (Fig. 1).

In a statistical sense, income inequality and income growth can be examined separately. In life, they blur into one another and provide one explanation of the controversy over trends in income inequality. For example, in 1984, a committee of the National Conference of Catholic Bishops issued a report on Catholic social teaching and the U.S. economy (7). In the letter, the committee criticized the fact that the richest 20 percent of families receive more total income than the lowest 70 percent. The popular press reported this fact as if it were something new. In reality, the proposition was as true in 1947 as it was in 1984 or any year in between. But in 1947, incomes were rising throughout the distribution, and most families were seeing steady economic progress. When incomes stopped growing, inequality became much more visible. In a similar fashion, consider a man who loses a job in a steel mill and has to take a new job at lower pay. If incomes are rising throughout the economy, he can imagine

Table 1. Shape of the family income distribution during the postwar period (16).

Year	Share of income going to each quintile (%)				
	1st (poorest)	2nd	3rd	4th	5th (richest)
1949		11.0	17.3	23.5	42.7
1959	4.9	12.3	17.9	23.8	41.1
1969	5.6	12.4	17.7	23.7	40.6
1979	5.2	11.6	17.5	24.1	41.7
1984	4.7	11.0	17.0	24.4	42.9

Table 2. Income levels defining the 1984 family income distribution (1984 dollars) (16).

Quintile	Income*
1st	\$12,489
2nd	\$21,709
3rd	\$31,500
4th	\$45,300
5th	\$73,230

*Incomes for the 1st, 2nd, 3rd, and 4th quintiles end at the amounts shown; for the 5th quintile, incomes begin where the 4th ends, but the amount shown is the beginning of incomes for the top 5 percent.

regaining his former standard of living in the future. When incomes are stagnant, such thoughts are fanciful, and it is a short mental leap for him and others to conclude that the middle class is vanishing.

Sources of Stagnation

We only have part of the answer to what lies behind this stagnation of family income. We know, for example, that changing demographics in the form of more families headed by women and more young “baby boom” families were not important causes. Rather, the stagnation of family income reflected a stagnation of individual wages that began in 1973 and affected workers of all ages. This can be seen most simply by looking at men as they pass from 40 to 50. By the time most men are 40, their major promotions are behind them, and if we look at census data for a single year, 40-year-old men and 50-year-old men have similar average earnings. But as men actually pass from 40 to 50, their earnings can increase if earnings are increasing throughout society (the rising tide that lifts all boats). Before 1973, this is exactly what happened, and an average man passing from 40 to 50 saw his income (adjusted for inflation) rise by 25 to 30 percent (Table 3). But men who were 40 in 1973 saw their income during the next 10 years decline by 14 percent, and workers of other ages had similar experiences (8).

The stagnation of wages reflects several events. The first was the 1973–74 OPEC oil price increase, which sent a substantial amount of domestic purchasing power overseas. Between 1973 and 1975 average real wages fell by about 5 percent.

Far more important was a slowdown in the growth of worker productivity. Productivity describes the value of output per hour of labor and rising productivity is the ultimate source of rising wages. It is measured by the Department of Commerce and is reported quarterly just as the rate of inflation and unemployment are reported (with much more fanfare) every month. Existing historical data suggest that from 1900 through 1940, worker productivity grew at about 2.5 percent per year. From 1947 through 1965, it grew at 3.5 percent per year before returning to the more normal 2.5 percent rate for 1966 through 1973. But after 1973, productivity growth slowed dramatically, averaging 0.8 percent per year between 1974 and 1982 (9).

Here we begin to encounter the limits of our knowledge since we lack a clear explanation of the productivity slowdown. Economists have postulated many causal factors including the sudden rise in oil prices, increases in government regulation, and a rapidly growing labor force which thinned the amount of capital per worker. But by most accounts, the sum of these factors still leaves a significant part of the slowdown unexplained (10).

A more speculative, but potentially important cause, was the changing nature of market growth. At the end of World War II, the U.S. population had lived through the Great Depression followed by the war’s rationed consumption, and thus they were starved for

consumer goods. Foreign producers could not supply this market since much of their industrial base had been devastated. As a result, domestic firms could expand quickly and install new technology as they expanded, thereby enhancing productivity. By the 1970s the context had changed. The most urgent domestic needs—for cars, single-family homes, refrigerators—had been met and now domestic producers faced increased competition from foreign producers within the slower growing markets. In this environment, improved productivity often required not expansion but painful shrinkage, which many managers were reluctant to undertake. The uncertainty created by the post-OPEC inflation and unemployment simply exacerbated the situation (11).

Whatever the cause of the productivity slowdown, it meant that real wages were very slow to recoup the losses imposed by the first OPEC price increase. By 1979, wages had almost returned to their 1973 level when the Iranian revolution precipitated a second major OPEC price increase and a repeat of the cycle such that by 1984, real wages had not yet regained their 1973 levels.

Coping with Stagnation

The post-1973 real wage decline is important, but it raises obvious questions. First, the decline in wages (Table 3) is far more dramatic than the downward movement in the income distribution (Fig. 1). More generally, the declining wages do not seem consistent with the economy we see around us—videocassette recorders, personal computers, a wide variety of restaurants, and other goods and services that were not part of the 1973 mass market. This is what we have called the controversy over living standards, and U.S. Department of Commerce statistics underline the point. Between 1973 and 1984, despite declining wages, real consumer expenditure per capita rose by 15 percent (during 11 years), a percentage increase similar to its increase in the booming 1950s. How can these statistics be reconciled with declining wages?

Here (unlike the productivity slowdown) demographic developments were important. Specifically (i) women of all ages entered the labor force in record numbers; (ii) the large baby-boom cohorts of the 1950s began their careers; and (iii) in comparison with earlier cohorts, the baby boomers married later and when they did marry, they postponed and reduced the number of children per family (12).

These trends were not all caused by the bad economy. The birth-rate, for example, began to fall sharply in the mid-1960s when the economy was strong. But in terms of consumption, the trends helped to mitigate the stagnation's effects. The proportion of the entire population at work rose from 41 percent in 1970 to 50 percent today (despite increasing early retirement among men). This meant that consumption per capita (that is, per man, woman, and child) could keep growing despite declining wages because an increasing proportion of the population went to work. In this sense, the period 1973 through 1984 was an inversion of the 1950s. Then, workers' wages were growing rapidly (Table 3), but birthrates were very high (the baby boom) and so consumption per capita grew less rapidly.

In this way, demographics help explain the controversy over living standards, but they also play a role in our perception of growing inequality. The rapid increase in the median age of first marriage for both young men and women gave rise to a class of "young singles" who were not in families and so were not included in the family income distribution. Many of these young singles gave the appearance of affluence, and their ability to purchase "upscale" goods and services added to a sense of growing inequality. But in many cases, these purchases were possible only because the young people had not yet assumed the costs of children and single-family

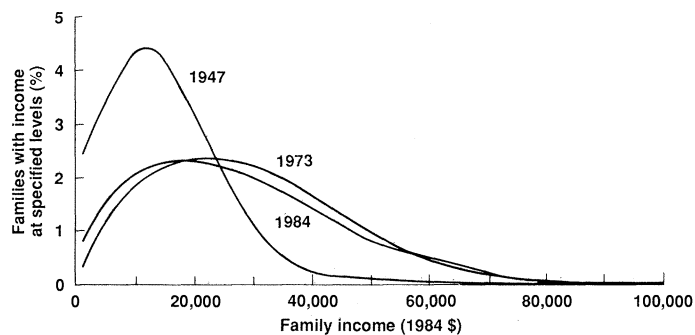


Fig. 1. The percentage of families with incomes at specified levels for three different years.

homes. For example, in 1973, 17 percent of men 25 to 34 years old had individual incomes above \$35,000 (in 1984 dollars), but in 1984 only 10 percent of men in that age group had individual incomes this high (13).

Rising consumer expenditures had one more explanation: our willingness at both the individual and national level to take on debt. In the government accounting system that defines gross national product (GNP), various kinds of debt are related through a simple equation

$$\text{Total savings} = \text{Total investment}$$

or

$$\begin{array}{r} \text{Savings by} \\ \text{households} \end{array} + \begin{array}{r} \text{Savings by} \\ \text{businesses} \\ \text{(retained} \\ \text{earnings)} \end{array} + \begin{array}{r} \text{Savings by} \\ \text{government} \\ \text{(budget} \\ \text{surpluses)} \end{array} + \begin{array}{r} \text{Net capital} \\ \text{inflow} \end{array} = \begin{array}{r} \text{Domestic} \\ \text{investment} \end{array}$$

The equations describe the way in which each dollar of investment goods (that is, goods that are not consumed in the current year) must be financed by a dollar of savings. Table 4 displays the average values of this equation for the periods 1971–1973 and 1983–1985, where three movements stand out. (i) The government sector (federal, state, and local combined) has gone from running an essentially balanced budget to running a deficit equivalent to 3.4 percent of GNP. (ii) In theory, the government deficit could be financed by increased private savings but this has happened only in part because while the business savings rate has increased, the household savings rate has declined. In sum, the domestic savings rate (households plus businesses plus government) has declined by 2.0 percentage points. (iii) The rate of investment has remained constant, despite the declining savings rate, because foreign capital is now flowing into the country at a rate in excess of 2 percent of GNP per year. In 1986, borrowing from abroad exceeded 3 percent of GNP.

In the context of stagnant wages, the government sector deficit—really the federal budget deficit—is simple to explain. The deficit reflects the federal government's willingness to cut taxes coupled with its reluctance to cut expenditures. The net effect is to put more money into people's pockets, yet another way of keeping consumption growing. But this effect is possible only because the nation is willing to borrow from abroad.

Table 3. The income growth of men passing from age 40 to age 50 (1984 dollars) (17).

Men who were 40 in	Income at 40	Income 10 years later	Change (%)
1949	\$12,858	\$17,290	34
1959	18,958	24,421	29
1973	28,118	24,098	-14

Table 4. Average rates of U.S. savings and investment for 1971 to 1973 and 1983 to 1985 (18). (All numbers are expressed as percentages of GNP.)

Period	Household savings (%)	+ Business savings* (%)	+ Government savings† (%)	+ Net foreign capital inflow investment (%)	= Domestic investment (%)
1971–1973	5.4	11.0	0.0	0.0	16.4
1983–1985	3.8	14.0	-3.4	2.1	16.5

*Business savings corresponds to retained earnings. †Government savings corresponds to the net budget surplus of federal, state, and local governments combined. A negative value (government dissavings) reflects a net budget deficit for all units combined.

To summarize, we have kept consumption rising, despite stagnant wages, through a series of demographic and financial adaptations. But as should be clear, each of these adaptations has limits. Among young families (with heads of household under age 35) almost two-thirds now depend on two earners: they cannot further increase their income by putting an additional earner into the labor force. Similarly, the birthrate has turned up slightly since the late 1970s, and we cannot expect additional dramatic reductions in family size. From a macroeconomic perspective, it is unlikely that we can continue to borrow the equivalent of 3 percent of our GNP from other nations indefinitely. Thus if productivity and wages do not begin to grow again, consumption per capita will begin to stagnate as well.

Content of the Income Distribution

Stagnant incomes and increasing numbers of young singles served to increase our perception of inequality. A third factor in these perceptions was a change in the content of the income distribution—particularly in the lowest (poorest) quintile. During the last 15 years, many of the elderly have moved from the bottom of the distribution to the lower middle (the second quintile). Their vacated places at the bottom have been occupied by the growing number of female-headed families and by two-parent families hurt by the serious 1980–1982 recession.

The improved position of the elderly reflects the increasing coverage of recent retirees by private pensions, but it also reflects the workings of the Social Security program. In 1972, Congress specifically tied Social Security benefits to the rate of inflation as measured by the consumer price index (CPI). When they were debating the proposition, it seemed to be both prudent and equitable. Workers' wages had increased faster than the rate of inflation since World War II (see, for example, Table 3), and so giving the elderly an inflation-adjusted benefit seemed quite fair. Congress could not know that real wages would begin to stagnate after 1973. Because of this stagnation, inflation-adjusted Social Security benefits (and greater private pension coverage) had the effect of modestly raising the incomes of the elderly while the rest of the income distribution declined around them, a decline that was caused in part by stagnant wages and the high unemployment that began with the 1980–1982 recession.

At the same time, the proportion of families headed by women under 65 years of age increased substantially. Among all families with children, the percentage headed by such women rose from 12 in 1970 to 21 in 1984. In a time when many families came to rely on two earners, a family headed by a single woman was at a substantial disadvantage and more than half were in the bottom quintile of the income distribution. The trend toward female-headed families had particularly negative effects on the incomes of blacks. By 1984, fully 40 percent of black families were headed by a woman aged 65 or

less. The median income for these families was about \$8,500, far less than both the median income for black husband-wife families (\$23,418) and for all white families (\$27,686) (14).

These changes were accompanied by shifts in the bottom quintile's sources of incomes. At the close of World War II, an early retirement was rare. Even though the bottom quintile contained large numbers of families with a head over 65, most families in the quintile had at least one worker. By 1984, the growing number of female-headed families (many of whom received welfare) and those elderly retirees who remained in the bottom quintile had changed this situation. Nearly half the families in the bottom quintile had no earner whatsoever and only 42 percent of all income in the quintile came from earnings (15).

These changes did little to change the overall shape of the income distribution (Table 1), but they added to our perception of inequality by sharply increasing the likelihood that children would be in the poorest quintile. The changes have also increased inequality in what economists call "permanent," or life-cycle income. Imagine, for example, a young husband and wife who begin married life with a joint income somewhere below the middle of the income distribution. As they grow older and receive promotions, their total income increases (compared with other families), and they move toward the higher end of the distribution. When they retire, they move toward the bottom of the distribution. If all families followed this pattern, income inequality in any one year would be less a cause for concern.

Mobility within the distribution was never this perfect, of course, and the recent changes in the bottom of the income distribution suggest that it may have diminished further. Middle-class families who retire are now covered by both Social Security and private pensions and do not now fall so far down in the distribution. Families at the bottom of the distribution, at least those families headed by single women, have relatively weak prospects for future income growth that would allow them to move up in the distribution. For both groups, current income seems more closely related to past and future income and long-run inequality has increased correspondingly.

Prospects for the Future

At this point the country faces two economic challenges. The first is to revive the growth of worker productivity and, through productivity, the growth of real wages. The second is to keep inequality from sharply increasing.

With respect to productivity, many of the most damaging aspects of the 1970s have now abated. Energy prices are stable. General inflation is low. The baby-boom and older women have gone to work and the labor force is once again growing slowly. But these old problems have been replaced with new problems that are largely of our own making. The government deficit and the need to draw in foreign capital led to an environment of still high interest rates (adjusted for inflation), and a high international value for the dollar that is only now declining. The high dollar has made imports relatively cheap, and import competition, together with high interest rates, has directed U.S. investment away from new plants and equipment. Without such new plants and equipment, it will be hard for productivity to revive to historical levels of 2 to 2.5 percent per year. Reversing this situation will require balancing the federal budget and living with more expensive imports, both of which will lower living standards in the short run.

If wages begin to grow, the issue of inequality will become more, rather than less, prominent. Forty years ago, we were a nation of one-earner families. Today a majority of families have two earners while about 15 percent of families, many at the bottom of the

income distribution, have none. The stagnation of wages has, to an extent, obscured these differences. But should wages begin to grow again, there is a danger that significant numbers of families will be left behind and inequality will correspondingly increase. Finding ways to better integrate these families into the mainstream economy will be a major priority of the period ahead.

REFERENCES AND NOTES

1. See, for example, R. Kuttner, "The declining middle" [*Atlantic Monthly* (no. 252) (July 1983), p. 60] and L. C. Thurow, "The disappearance of the middle class" (*New York Times*, 5 February 1984, sect. 3, p. 2).
2. Some authors have attributed this growing variance to the shift of men to service sector jobs as distinct from jobs in goods production (manufacturing, mining, and construction). The attribution is not correct. Among all male workers (16 years and older), the service sector has relatively large earnings inequality because of the large number of part-time workers in retail sales. But among men who work full time, earnings inequality in the service sector and in the goods-producing sector is relatively equal. Since 1979, earnings inequality in both sectors has increased significantly (3).
3. F. Levy, *Dollars and Dreams: The Changing American Income Distribution* (Russell Sage-Basic Books, New York, 1987), chap. 5.
4. On the concept of permanent income, see M. Friedman, *A Theory of the Consumption Function* (Princeton Univ. Press, Princeton, NJ, 1957).
5. For a discussion, see Levy (3, chap. 9).
6. At the same time, the growing number of people who live alone are not counted in the family income distribution but in a second distribution confined to unrelated individuals. Immediately after World War II, unrelated individuals contained disproportionate numbers of the elderly and the disabled. Since that time, a rising divorce rate and a post-1970 rise in the median age at first marriage have resulted in a growing number of prime-age individuals who also live as unrelated individuals.
7. National Conference of Catholic Bishops, Ad Hoc Committee on Catholic Social Teaching and the U.S. Economy, "First draft of pastoral letter on Catholic social teaching and the U.S. economy," *National Catholic Reporter*, 23 November 1984, pp. 9-31.
8. Young workers had the additional burden of belonging to the baby-boom cohorts who would have had slower-than-average wage growth because of their large numbers. Before 1973, a young man passing from age 25 to 35 could expect real income increase of about 110 percent. Young men who were 25 in 1973 saw their income during the next 10 years increase by 16 percent (3, chap. 7).
9. For summaries of productivity issues, see M. N. Baily, *Science* 234, 443 (1986); E. F. Denison, *Trends in American Economic Growth, 1929-1982* (Brookings Institution, Washington, DC, 1985).
10. See Denison (9, chap. 3).
11. For example, high post-OPEC rates of inflation forced most Western governments to run their economies at rates well below full employment, and this further limited market growth.
12. Between 1970 and 1984 the median age of first marriage rose from 23.2 to 25.4 for men and 20.8 to 23.0 for women so that they were now as high as they had been in the early 1900s [Bureau of the Census, *Current Population Reports* (Series P-20, no. 399, Washington, DC, 1986).
13. Bureau of the Census, *Current Population Reports* (Series P-60, no. 97, Washington, DC, 1975), table 53; *ibid.*, no. 151 (1986), table 32.
14. See Bureau of the Census, *Current Population Reports* (Series P-60, no. 151, Washington, DC, 1986), table 16. The median income figure for black families headed by a woman under 65 years of age is the author's estimate based on data in this reference. The income figures for black husband wife families and all families nationwide are taken directly from this reference.
15. For a discussion, see Levy (3, chap. 8).
16. The data for Tables 1 and 2 come from the Bureau of the Census [*Current Population Reports* (Series P-60, Washington, DC, 1986), table 12].
17. The data for Table 3 come from the Bureau of the Census [*Current Population Reports* (Series P-60, no. 7, Washington, DC, 1951), table 17; *ibid.*, no. 35 (1961), table 23; *ibid.*, no. 75 (1970), table 45; and tables referenced in (13)]. In constructing Table 3, "income at 40" refers to the published statistic for median individual income for all men aged 45 to 54 (surveyed 10 years after the first observation).
18. The data for Table 4 come from the Department of Commerce [Bureau of Economic Analysis, *The National Income and Product Accounts of the United States, 1929-76* (Washington, DC, 1981), table 5.1; "National income and product accounts, 1982-85," in *Survey of Current Business* 66 (no. 3) (1982), table 5.1].

Phosphorus in Antique Iron Music Wire

MARTHA GOODWAY

Harpichords and other wire-strung musical instruments were made with longer strings about the beginning of the 17th century. This change required stronger music wire. Although these changes coincided with the introduction of the first mass-produced steel (iron alloyed with carbon), carbon was not found in samples of antique iron harpsichord wire. The wire contained an amount of phosphorus sufficient to have impeded its conversion to steel, and may have been drawn from iron rejected for this

purpose. The method used to select pig iron for wire drawing ensured the highest possible phosphorus content at a time when its presence in iron was unsuspected. Phosphorus as an alloying element has had the reputation for making steel brittle when worked cold. Nevertheless, in replicating the antique wire, it was found that low-carbon iron that contained 0.16 percent phosphorus was easily drawn to appropriate gauges and strengths for restringing antique harpsichords.

HISTORICAL INSTRUMENTS ARE BEING RESTORED TO PLAYING condition for the performance of baroque music in the original voices. In harpsichords the practical details of restoration include the choice of appropriate wire for each string. The first published data on wire strings occur in Mersenne's *Harmonie universelle* of 1636 (1), and, although most of the contemporary documents that relate to the historical harpsichord were compiled by Hubbard in *Three Centuries of Harpsichord Making*

(2), there is little practical guidance in these documents for the choice of stringing material. The surviving instruments, however altered in the intervening centuries, remain a more reliable and comprehensive source.

A collection of the original materials for harpsichord construction and stringing was established at the Smithsonian Institution in 1966 by J. S. Odell. Although strings were routinely replaced during the active life of an instrument, fragments of earlier ephemeral parts overlooked in prior restoration or reconditioning of antique instruments have been discovered either by visual examination or by radiography. Wire has been found embedded in soft wood sound-

The author is at the Conservation Analytical Laboratory, Smithsonian Institution, Washington, DC 20560.