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REVIEW

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A New View for the *Review*

To long-time readers of the Federal Reserve Bank of St. Louis' *Review*, this issue may appear dramatically different from its predecessors. This re-design follows naturally from developments in publishing technology, as well as the Bank's commitment to provide our readers with fresh, provocative economic analysis.

We have adopted this new format and design to improve readability. For example, we have selected a suitable color for the tables to highlight the information and yet enhance photoreproduction, particularly for classroom use. Speaking of classrooms, we appreciate hearing from the many professors who use articles and material from the *Review*, and we continue to place a high priority on reaching this audience.

The *Review* has always enjoyed a diverse audience, from the interested layman to graduate students in economics to policymakers. We will continue to publish a wide array of articles, ranging from essays on policy issues for general readers to technical treatments of economic issues. Our editorial policy is to place articles written for the general reader first in each issue.

As always, please let us know what you think.

William T. Gavin
Editor
January 27, 1995

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unemployed person's decision to accept or reject a job offer is reduced to a comparison of the expected benefits from additional searching with the expected costs. They introduce a regression model consistent with job-search theory and illustrate the estimation of the model using a sample of approximately 1,200 former McDonnell Douglas employees, laid off because of cuts in defense spending. Their illustration highlights the effects that variables such as occupation, education, sex, tenure at McDonnell Douglas and unemployment insurance have on reemployment and prospective wage offers.

John C. Weicher is a senior fellow at the Hudson Institute and was a visiting scholar at the Federal Reserve Bank of St. Louis. Heidi L. Beyer provided research assistance.

Changes in the Distribution of Wealth: Increasing Inequality?

John C. Weicher

This article describes the changes in the distribution of wealth among U.S. households that occurred between 1983 and 1989, and analyzes the role of several demographic and economic factors in contributing to the changes. It makes use of the Federal Reserve Board's Survey of Consumer Finances, which is one of the few sources of time-series information on household wealth that reports asset holdings of individual households for a sample of the entire population. The period from 1983 to 1989 is a convenient and useful period to study, because it corresponds approximately to a single economic period: the economic expansion that began in November 1982 and ended in June 1990. Academic and popular interest in distributional issues has increased in recent years, and the 1980s have attracted particular attention in the popular press, although most of the attention has been given to changes in the distributions of income and wages.

The article first describes the data in some detail and then the measures of inequality. The third section reports changes in wealth holdings for U.S. households, cross-classified in several ways. This is followed by analysis of the changes in the distribution of wealth, including investigation of some possible explanations for the changes. The final section describes the wealth holdings of the richest 1 percent of U.S. households, who have a large share of total household wealth and whose holdings have been given special attention in previous research.

THE SURVEY OF CONSUMER FINANCES

The Survey of Consumer Finances is conducted by the Survey Research Center of the University of Michigan for the Federal Reserve Board. It was taken at six-to-eight-year intervals between 1962 and 1983, and at three-year intervals since then. The most recent available surveys that are also useful for analysis of the distribution of wealth are those for 1983 and 1989.[1] These surveys are partly longitudinal; some households were interviewed in both years, but they are not identified on the 1989 public-use tape.

In both of these years, the survey has two samples. The larger is a cross-section chosen randomly to represent the entire population of households. It consists of 3,665 households in 1983 and 2,277 in 1989.[2] The smaller is a "high-income" sample of households expected to have unusually large wealth holdings. Because the wealthiest 1 percent of households hold over a quarter of total household wealth, a national sample of households will therefore give little information about a large fraction of household wealth. The additional high-income sample was intended to overcome this limitation. It was selected from IRS records. Households selected were first asked if they would participate in the survey, and then interviewed if they were willing. Procedures were followed to insure confidentiality; the IRS did not know which households participated. There were 438 households in the high-income sample in 1983 and 866 in 1989.

The surveys are very similar but not identical. The 1983 survey, for example, reports calculations of the present value of Social Security benefits and private pensions expected by workers who are at least 40 years old and have not yet retired. These calculations are based on assumptions about future labor force participation, wages and inflation,

[1] The 1986 survey consisted of telephone re-interviews of 2,822 households from the 1983 SCF, with much less detail on asset holdings. The 1992 survey data tape is not yet publicly available, but Kennickell and Starr-McCluer (1994) report preliminary findings and a comparison with 1989.

[2] Another 159 households were interviewed in 1983 as part of the national cross-section, but are excluded from this analysis, as from the Federal Reserve Board's "cleaned sample," because of non-response. See Avery and Elliehausen (1990, pp. 16-18).

Measuring Long-Term Trends in Wealth

Wealth is the value of assets accumulated over long periods, and changes in total wealth and its distribution over short periods of a few years provide incomplete information about individual well-being. The Surveys of Consumer Finances provide the best recent information for different points in time, but it is still difficult to analyze long-term changes in the distribution of wealth with these surveys. The only previous Federal Reserve survey with a comparable sample, including high-wealth households, is the 1962 Survey of the Financial Characteristics of Consumers (SFCC). Wolff (1987, 1994) has compared the 1962 and 1983 data and finds little change in the distribution over that period as a whole for measures of wealth that include owner-occupied housing, but an increase in concentration for narrower measures limited to financial assets.

The 1977 survey has much less information on wealth holdings than the later surveys. It primarily reports on the credit experience of households, and is in fact entitled the Survey of Consumer Credit (SCC) rather than the Survey of Consumer Finances. It does not include all wealth categories, omitting some that are important, such as holdings of unincorporated or closely held businesses. The wealth holdings in each category are reported in brackets, with a top bracket of $200,000 or more, while the later surveys report holdings to the dollar. It is therefore difficult to compare 1977 with the later years. (Analysis of the 1983 SCF shows that the results are quite sensitive to whether the data are bracketed and what convention is used for the top bracket.) Also, the period between 1977 and 1983 includes two very different economic experiences: three years of accelerating inflation and economic expansion between 1977 and 1980, followed abruptly by back-to-back recessions and unanticipated disinflation during the early 1980s.

These limitations are worth mentioning because comparisons of the 1977 and 1983 surveys attracted substantial press attention when the data from the 1983 SCF were first available; a comparison published by the Joint Economic Committee appeared to show a dramatic increase in concentration. The increase turned out to be due to an apparent error in reporting the holdings of one wealthy household (Curtin, Juster and Morgan, 1989, discuss this and other individual observations with questionable responses). The more fundamental problems with comparisons are the differences in coverage of wealth and reporting procedures between the two surveys.

among other factors. The 1989 survey does not contain these calculations; it reports only the payment amount of a private pension. For 1983, locational information has been made available on the metropolitan area or county level for the cross-section sample (not the high-income sample), while for 1989 no geographic information has yet been provided on the data tape, although it was collected. Regional information will be released for 1989 in the future. Geographic information would obviously be useful for analyzing some components of wealth, notably real estate.[3]

With a survey design combining a random sample of all U.S. households and a separate sample of the top few percent of the wealth distribution, it becomes important to weight the individual observations appropriately so that the sample households adequately represent the universe of all households. Analysts at both the Survey Research Center and the Board have devoted substantial attention to the issue of weighting. Both surveys include weights for individual households on the basis of the national cross-section sample and the combined sample. The choice of weights can affect the results, as will be seen later in this article.

MEASURING WEALTH

Wealth is defined as the value of assets minus the value of liabilities. The SCF contains detailed, though not quite exhaustive,

[3] For more extensive descriptions of these surveys, see Avery and others (1984a), Avery and Elliehausen (1986), Avery, Elliehausen and Kennickell (1988), Kennickell and Shack-Marquez (1992) and Kennickell and Woodburn (1992).

information on both assets and liabilities, most of which is used in this analysis. The data in the surveys also pose some problems for analysts, particularly with respect to comparison with other surveys and the process of weighting the sample observations to represent the nation as a whole.

Available Data in the SCF

Assets reported in the SCF include both financial and real assets. Financial assets consist of household holdings at depository institutions in the form of checking accounts, savings accounts, money market accounts and certificates of deposit; holdings of publicly traded corporate stock; bonds of various kinds, including government bonds, U.S. savings bonds, corporate, municipal and foreign bonds; holdings of mutual funds; retirement accounts, such as IRAs and Keoghs; trusts; the cash value of life insurance policies; the current value of thrift-type pensions; and debts owed to the household.

As noted previously, the SCF also provides information on other private pensions that the household expects to receive in the future and (in 1983 only) Social Security benefits, even though the household cannot convert them to cash.

Real assets include: owner-occupied housing; other real estate, such as apartment buildings and office and commercial buildings; unincorporated, closely held businesses; automobiles; boats and airplanes; and collectibles such as coins, stamps or objets d'art.

The surveys do not include consumer durables besides automobiles and other vehicles, although the debt incurred to buy consumer durables is reported as a liability. The rationale for this is that consumer durables are generally held for use, not as a store of wealth. Estimating the value of consumer durables is also difficult. Nonetheless, they do constitute part of the possessions of households, perhaps a substantial part for lower-income households. They can be taken into account either by attempting to estimate their value (a procedure followed by Wolff, 1987), or by excluding the debt incurred to buy them as well as their value on the ground that the total value of all consumer durables is likely to be at least as large as the remaining debt on them, for most households. The latter is the simpler procedure.

Automobiles appear to be in an intermediate category. They are probably not held as a store of value, but they can be converted to cash much more easily than other consumer durables.

Liabilities consist of home mortgage debt, including: home equity lines of credit; debt on other real estate; lines of credit other than home equity loans; outstanding credit card debt; amounts owed on automobile loans; money owed to a business owned by the household; money borrowed against life insurance or other savings or retirement plans; and money owed to a cash or call money brokerage account.

Alternative Measures of Wealth

It is possible to construct several different definitions of wealth from the SCF, and analysts have done so. In this article, the basic definition includes all of the assets and liabilities in the SCF except the present value of pensions now being received and expected, which is reported in full only for 1983.[4] The difference between these assets and liabilities will be referred to as "net worth" or "wealth" without further qualification. This definition is the same as that used by Kennickell and Shack-Marquez (1992), except that they exclude miscellaneous assets (mainly collectibles) in 1983 but not 1989.[5] It differs from Wolff's (1994) preferred measure, termed "net worth," in two ways: Wolff excludes miscellaneous assets and the value of automobiles (but includes automobile loans). Wolff also reports a measure that includes the value of automobiles, termed "net worth plus autos," which is closer to the preferred measure in this article, and "financial net worth" (excluding both the value and the mortgage on owner-occupied housing as well as automobiles from net worth).

Other analyses have used both broader and narrower measures, which complicates comparisons between studies. Wolff (1987) includes miscellaneous assets for 1983, and reports five measures, ranging from an inclu-

[4] Some results excluding consumer debt are reported also.

[5] Avery and Elliehausen (1990) warn in the codebook for 1983 that "some estimates [for miscellaneous assets] look to be very dubious." Including or excluding miscellaneous assets in both years does not change the results in this article.

sive concept that adds an imputed value for other consumer durables and household inventories to the assets in the SCF, to "capital wealth," which is limited to currency, deposits in financial institutions, money market funds, and pension and insurance cash surrender value. Avery, Elliehausen and Canner (1984b) report net worth for 1983, and also 1977, excluding automobiles, the cash value of life insurance, the present value of expected future pension benefits, and equity in small businesses and farms (which were not reported in the 1977 SCC).

Weighting

With a survey design combining a cross-section sample of all U.S. households and a separate sample concentrated in the top few percent of the wealth distribution, it becomes important to weight the individual observations appropriately so that the sample households adequately represent the universe of all households. Analysts at both the Board and the Survey Research Center have devoted substantial attention to the issue of weighting, and have developed alternative weights, which are commonly referred to as FRB and SRC weights, respectively. In 1983, the FRB and SRC weights differed primarily in the way that they combined separate weights for the cross-section and the high-income samples.[6] After the initial weights were developed, a second set of FRB weights was constructed when 1982 individual income tax data suggested that the high-income sample may have been given too much weight. These are known as the "FRB extended-income" weights.[7] Alternative weights have also been constructed along a second dimension: whether the sample was "blown up" to the U.S. total on the basis of the 1980 decennial Census or the 1983 Current Population Survey (CPS). Most recent studies have used 1983 CPS weights, but these were not available on data tapes until after 1985; both Avery and others (1984a, 1984b) and Wolff (1987) used 1980 decennial Census weights.

In this article, the FRB extended-income weight and the latest SRC weight (the revised SRC composite weight) are used for 1983. (These are variables B3016 and B3019, respectively, on the data tape.) Kennickell and Shack-Marquez (1992) use the FRB extended-income weight.

For 1989, two SRC weights are available: a preliminary weight used by Kennickell and Shack-Marquez (1992) for comparing 1983 to 1989, and a final weight used by Kennickell and Starr-McCluer for comparing 1989 to 1992 (variables X40125 and X40131). Both are closer in design to the 1983 FRB weight than to the SRC weight.[8] An experimental FRB weight (variable X40202) was included in early versions of the public-use tape, but dropped from those currently available.[9] Wolff (1994) reports that it generates wealth totals that are less consistent with the Flow of Funds (FOF) than the SRC weights. (This issue is discussed further in the next section.) Both SRC weights are used in this article. The choice of weights can affect the results, as will be seen later.

Adjusting the Data for Consistency with Other Sources

The total asset and liability values in the SCF differ from information in other sources in both 1983 and 1989. In particular, there are substantial differences between the SCF and the FOF, published by the Federal Reserve Board, which reports aggregate data over time on the composition of national wealth. In several categories, the SCF total is much smaller. There appears to be general agreement that the SCF is a better source for the current values of owner-occupied housing and unincorporated businesses, but differing views on the relative accuracy of the data for financial assets and liabilities. The conceptual differences in coverage are analyzed most extensively by Avery, Elliehausen and Kennickell (1988) with reference to 1983, and by Antoniewicz (1994) for 1989 and 1992. Wolff (1987, 1994) also discusses the differences and compares them for both years.

Analysts have reached different conclusions about the relative merits of the two surveys and followed different procedures in adjusting for these discrepancies. Wolff (1987, 1994) takes the FOF as the more accurate source for financial asset values and adjusts many of the SCF figures for individual

[6] Conversation with Arthur Kennickell.

[7] See Avery and Elliehausen (1990, pp. 16-24) for a detailed discussion of weighting in the 1983 SCF.

[8] Conversation with Arthur Kennickell.

[9] Conversation with Gerhard Fries of the Federal Reserve Board. See Kennickell and Woodburn (1992) for detailed discussion of the differences between the FRB and SRC weights.

households by the ratio of the aggregate totals for the SCF and the FOF. Avery, Elliehausen and Kennickell (1988), Avery (1989) and Curtin, Juster and Morgan (1989) have argued that the SCF is more likely to be accurate for 1983 than the FOF in most instances. They conclude that total assets and liabilities in most categories are similar when the data are reported on the same conceptual basis. Avery (1989) points out that the FOF figures for households are computed as balancing residuals, and thus are sensitive to measurement errors for every other sector. He also notes that totals for broad categories of assets, such as bonds, are often closer than for sub-categories such as federal bonds or municipal bonds, and suggests this may result from misclassification.

If holdings of the sub-categories are not uniform across the wealth distribution, adjustment may distort the measured degree of inequality. Neither Avery and others (1984a, 1984b), Avery and Elliehausen (1986) nor Kennickell and Shack-Marquez (1992) adjust the SCF data. Smolensky (1989) reviews the issue for the 1983 data and concludes that the SCF is likely to be the better data source, partly on the general grounds that cross-section surveys usually employ state-of-the-art methodology, while time-series data collection and processing change slowly for an ongoing series, for good reason but perhaps at the cost of failing to capture changes in the economy.

Several basic differences between the SCF and FOF apply to all asset categories. The FOF "household" sector includes nonprofit institutions and personal trusts as well as households. Wolff uses a 1980 estimate for households alone, relative to the FOF for that year, to adjust the FOF for 1983 (and apparently also for 1989). Avery, Elliehausen and Kennickell use Federal Reserve Board estimates of the "real" households within the FOF sector to adjust the FOF totals. In addition, the data refer to slightly different periods. The SCF was conducted early in 1983. Wolff uses the average of 1982 and 1983 year-end totals from the FOF as the basis of comparison, while Avery, Elliehausen and Kennickell use the end of 1982. Since 1983 was a year of economic recovery, in which stock and bond prices rose by 20 to 30 percent, Wolff's method results in larger FOF values and a bigger difference.

Analysts also differ in their calculated SCF totals for individual asset and liability categories because they have used different weights. Wolff (1987) uses weights for the 1980 decennial Census, which blow up the sample to 79.8 million households, while Avery, Elliehausen and Kennickell use weights based on the 1983 CPS, which blow up the sample to 83.9 million households. In most cases, Avery, Elliehausen and Kennickell report a larger total for the SCF, and therefore a larger SCF/FOF ratio. Some of the differences are substantial: Wolff calculates mortgage debt at $704 billion, or 63 percent of the FOF total, for example, while Avery, Elliehausen and Kennickell calculate it at $975 billion, or 92 percent. In this article, the 1983-based weights are used and the calculated SCF totals are usually closer to Avery, Elliehausen and Kennickell than to Wolff.

The larger discrepancies occur on the liability side in both years. They are so large that adjusting individual household data for the difference between the SCF and FOF leads to some rather odd results, especially for households which report large consumer debt. Adjusted wealth for these households is sometimes large and negative, while unadjusted wealth is large and positive. In 1983, for example, the 10 poorest households on an adjusted basis included five with wealth over $1 million on an unadjusted basis; one household went from +$4.3 million to -$9.3 million. When assets and liabilities are adjusted, 17 percent of all households in 1983 and 13 percent in 1989 reported negative net worth. Wolff (1994) suggests that the differences in liabilities between the SCF and FOF probably occur because of failure to report a debt, rather than understatement by households which do report it; in that case, proportional adjustment is likely to misrepresent the position of households which actually report relatively large debt holdings to begin with. In his analysis of the 1989 SCF, he therefore adjusts assets, but not liabilities, to be consistent with the FOF. Given the much smaller SCF/FOF debt ratios for 1983, the same argument would appear to hold for that year as well.

Table 1

Mean Household Wealth, 1983 and 1989
(in thousands of 1989 dollars)

	1983 FRB (B3016)	1983 SRC (B3019)	1989 SRC (X40131)	1989 SRC (X40125)
Unadjusted:				
Including autos	$150.9	$160.5	$184.7	$180.7
Excluding autos	145.9	155.0	176.6	172.6
Excluding autos and homes	102.8	112.8	126.7	121.3
Including autos, homes, and present value of private pensions & Social Security	222.3	231.8	NA	NA
Adjusted (assets and liabilities):				
Including autos	$165.8	$173.4	$200.4	$194.7
Excluding autos	160.4	167.9	192.3	186.6
Excluding autos and homes	125.2	133.3	142.4	135.3
Including autos, homes, and present value of private pensions & Social Security	237.2	244.7	NA	NA
Adjusted (assets only):				
Including autos	$187.8	$196.9	$207.7	$201.8
Excluding autos	182.3	191.4	199.5	193.7
Excluding autos and homes	139.7	149.2	149.6	142.4
Income	$ 33.4	$ 35.0	$ 38.8	$ 35.8

NA - Not available in 1989 Survey of Consumer Finances

NOTE: 1983 values adjusted to 1989 using the CPI-U annual average for the calendar years (1983 values multiplied by 1.24498).

* Asset categories adjusted: (1983 and 1989) demand deposits and currency, time deposits, CDs, IRAs, money market accounts, bonds, stocks, call money accounts, mutual funds; (1983 only) cash surrender value of insurance, cash surrender value of pensions; (1989 only) trusts. Liability categories adjusted: (1983 and 1989) credit card debt, consumer loans, life insurance loans, margin account debt, automobile loans; (1983 only) home mortgage debt, mortgage debt on rental and commercial real estate, debt on land contracts.

SOURCE: Survey of Consumer Finances, 1983 and 1989

On balance, it seems best not to adjust the data, because the 1983-based weights are used and also because adjusting liabilities affects the individual household data so greatly. This article therefore uses unadjusted data for most of the analysis, but also reports results with Wolff's adjustments on both sides of the balance sheet (his 1983 procedure) and with assets adjusted but liabilities not adjusted (his 1989 procedure).

MEASURES OF MEAN HOUSEHOLD WEALTH

Table 1 reports mean household wealth for 1983 and 1989. The first panel uses unadjusted data for both sets of weights in each year. On any comparison, mean wealth increased between 1983 and 1989, but the magnitude depends on the weights chosen. The increase ranges from $20,000 to $34,000. The choice of weights is particularly important for 1983; the difference in mean wealth is almost $10,000. During the six years, mean household wealth increased by 13 percent to 22 percent. The first and last columns show wealth for the weights used by Kennickell and Shack-Marquez (1992). The increase was 20 percent on the basis of these weights.

The table shows the importance of owner-occupied housing and the present value of future pension benefits. Future pensions were close to one-third of mean household wealth in 1983, and owner-occupied housing constituted about 30 percent of the remainder in both years, more than any other asset. Automobiles were the most widely held asset (84 percent of all households in both years). Among financial assets, corporate stocks comprised the largest share (19 percent in both years), and checking accounts were the most widely held (79 percent of all households in 1983 and 75 percent in 1989). On the liability side, credit card debt was the most common form of debt in both years, but home mortgages were almost equally frequent. Home mortgage debt accounted for over half of all family debt in both years.

The lower panels show the effect of adjusting assets and liabilities. Adjustment adds $36,000 to $37,000 to assets and $22,000 to $23,500 to liabilities in 1983. It is less important in 1989, however, adding $21,000 to $23,000 to assets and $7,000 to liabilities. Using the adjusted data, increases in mean household wealth are smaller in both percentages and amounts. Home equity accounts for about one-third of the increase in the unadjusted data ($7,000 to $9,000), but over half ($15,000 to $17,000) when both assets and liabilities are adjusted.

The table also shows mean household income, which is a pre-tax figure reported by the respondent. The SCF asks about total income and also income from various sources. In many cases, the sum of the latter does not equal the total.

MEASURING THE DISTRIBUTION OF WEALTH

Two types of measures of distribution are commonly used in economics: measures describing the entire distribution and measures describing the extent of concentration at one end of it.

The most common examples of the first type are the Lorenz curve and its companion, the Gini coefficient, which are often used to measure the distribution of income. The distribution of wealth is usually measured by a concentration ratio, such as the share of total wealth held by the richest 5 percent or 1 percent of all households, because it is so highly skewed. Concentration ratios have also been popular because one of the few time-series measures of wealth is the estate multiplier, which is a method of estimating the wealth of the richest households from estate tax returns, which are filed mainly by well-to-do individuals, and mortality tables to estimate the holdings of well-to-do living households.

The SCF provides information not only about wealthy households but also about the broad middle class and the poor.[10] The Lorenz curve and the Gini coefficient can be used to describe the distribution of wealth among all households in the SCF in exactly the same way as they are used to measure the distribution of income in household surveys.

A schematic Lorenz curve is shown in Figure 1. It depicts the total number of households on the horizontal axis and their total wealth holdings on the vertical axis. To construct the Lorenz curve, households are first arrayed in ascending order by wealth. Then the cumulative total wealth is calculated, beginning with the poorest household and ending with the richest one. These values are plotted for each household on the diagram, and then connected to construct the curve. Thus, for example, the first point on a Lorenz curve might represent one household with wealth of $10, the second point might represent two households with total wealth of $21, and so on. Any given point on the curve shows that the poorest *x* percent of households own *y* percent of all wealth in the society.

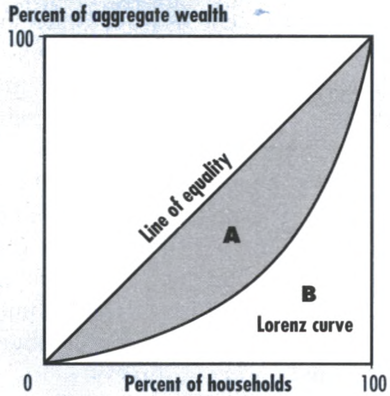
Two limiting cases are easily shown and may clarify the concept. If the distribution of wealth is perfectly equal, then every household has the same amount of wealth, and the Lorenz curve is the diagonal line running from the origin at the lower left at a 45-degree angle to the point in the upper right corner of the diagram representing the total number of households and their total wealth. At the opposite extreme, if all wealth belongs to one household, then the Lorenz curve lies along the horizontal axis until it reaches the point representing the total number of households; the Lorenz curve then becomes the vertical line on the right side of the diagram.

The Gini coefficient is calculated from the Lorenz curve as the ratio of the area between the diagonal and the Lorenz curve over the

[10] Avery, Elliehausen and Kennickell (1987) compare estate tax data with the SCF for 1983.

Figure 1

Lorenz Curve and Gini Coefficient



Gini Coefficient:

$$L = \frac{A}{A+B} = \frac{\text{area betw. curve and diagonal}}{\text{area under diagonal}}$$

area under the diagonal, or $L = A/(A+B)$. The Gini coefficient is therefore bounded by zero and 1. If the distribution of wealth is perfectly equal, the Lorenz curve lies along the diagonal, the value of A is zero, and the Gini coefficient is zero. If one household owns all the wealth, the area under the Lorenz curve is the same as the area between the diagonal and the x-axis, the ratio is 1.0 and the Gini coefficient is unity. The greater the concentration of wealth, the closer the Gini coefficient is to unity.

With weighted or bracketed data, the Lorenz curve consists of a series of straight-line segments, with the length of each segment being the weight of the observation. The 1983 and 1989 SCF contain more than 4,000 and more than 3,000 observations, respectively, so the line segments approximate closely to a curve and the area *B* approximates to the integral of the Lorenz curve. The Gini coefficients reported in this article are calculated from the line segments. The area *A* is the sum of the areas above the line segments and below the diagonals.

CHANGES IN THE DISTRIBUTION OF WEALTH, 1983-89

Table 2 reports Gini coefficients for 1983 and 1989, in a parallel form to Table 1. The data in the table demonstrate the importance of the technical issues discussed in the preceding section and suggest several broad conclusions.

The Importance of Weighting

The determination of whether there has been an increase in inequality depends on the choice of weights. For the broadest measure of wealth, and using unadjusted data, the change from 1983 to 1989 varies from -0.002 to +0.027. The Gini coefficients differ by 0.017 for the two sets of weights in 1983, and by 0.012 in 1989. The standard errors of these Gini coefficients, shown in italics in Table 2, are large enough to cast doubt on whether there was an increase in inequality over the period. To analyze the significance of the difference in the Gini coefficients, bootstrap estimates of standard errors were calculated using 1,000 replications.[11] The difference between the 1989 and 1983 Gini coefficients was positive in 920 cases when B3016 and X40125 were used as weights, and in 992 cases when B3016 and X40131 were used. However, it was positive in only 479 cases when B3019 and X40125 were used, and in 785 cases when B3019 and X40131 were used. Finally, the weights for each year were averaged (a technique used by Wolff, 1994, for the 1989 survey); in this instance, the difference was positive in 873 cases. These results indicate that the increase in inequality was more or less on the margin of significance. Whether the magnitude of the difference is politically or socially important is a matter for individual judgment.[12]

By most of the other measures reported in Table 2, the distribution of wealth became somewhat more unequal over the period. When first automobiles and then owner-occupied housing are excluded, all of the 1983-1989 comparisons show an increase in inequality, but the choice of weights still affects the extent of the increase.

In the remainder of this article, comparisons will be based on the weights used by Kennickell and Shack-Marquez (1992), unless otherwise indicated. These are variables B3016 and X40125.

[11] Efron and Tibshirani (1993) is an excellent introduction to the bootstrap method. The fact that the SCF sample is not random does not affect the bootstrap method as long as the re-sampled Gini coefficients are calculated using the same weights as the actual estimate. Each re-sampling from the biased sample generates the same bias (plus noise), so the bootstrap procedure traces out the behavior of the Gini coefficient estimates under the actual sampling procedure. For an alternative procedure using the jackknife technique, see Yitzhaki (1991), who provided a FORTRAN program that served as a starting point for the analysis. Also, see Lerman and Yitzhaki (1989).

[12] Wolff (1994) refers to an increase of .04 in the Gini coefficient between 1983 and 1989 as "sharp," and a difference of .02 between Gini coefficients for two different measures of wealth in 1989 as "not great." He does not report Gini coefficients to more than two places.

Table 2

Gini Coefficients, 1983 and 1989 (alternative weights)

	1983 FRB (B3016)	1983 SRC (B3019)	1989 SRC (X40131)	1989 SRC (X40125)
Unadjusted:				
Including autos	.778	.795	.805	.793
Standard error	*.008*	*.009*	*.008*	*.008*
Excluding autos	.798	.814	.826	.815
Excluding autos and homes	.900	.912	.925	.921
Including autos, homes, and present Value of private pensions & Social Security	.690	.708	N.A.	N.A.
Adjusted (assets only):				
Including autos	.773	.788	.813	.801
Excluding autos	.788	.803	.832	.821
Excluding autos and homes	.865	.877	.920	.915
Adjusted (assets and non-mortgage debt only):				
Including autos	.817	.827	.836	.825
Excluding autos	.836	.846	.858	.848
Excluding autos and homes	.948	.953	.967	.966
Income:	.465	.491	.540	.505

Alternative Measures of Wealth

The broader the definition of wealth, the more equal is its distribution, in either year. Gini coefficients are highest when automobiles, home equity and the present value of future pensions (in 1983) are excluded from wealth. They are lowest when these assets are included. Merely including automobiles in household net worth reduces the Gini coefficient by about 0.02. Including home equity reduces it by about 0.10, as does including the value of future pensions. These assets are widely held, as previously noted, and they clearly represent a large share of the wealth of relatively low-wealth households.

Excluding consumer debt does not have much effect on the analysis. Mean unadjusted consumer debt was $2,000 in 1983 and $1,100 in 1989. Gini coefficients are consistently lower when consumer debt is excluded, by 0.004 in both years. Since consumer debt is relatively more important for lower-wealth households, this is not surprising.

Adjusting Assets and Liabilities

The table demonstrates the importance of adjustment, particularly on the liability side of the balance sheet. Gini coefficients are all much higher, for each set of weights and each measure of wealth, by between 0.03 and 0.05 when liabilities are adjusted. As could be expected from the fact that the adjustments are larger in 1983, the coefficients for that year are raised slightly more than the coefficients for 1989, and therefore the measured increase in inequality is generally smaller.

The results in Table 2 do not adjust for mortgage debt in 1983. The coefficient would be raised still further in 1983, by about a further +0.030, if mortgage debt were also adjusted as Wolff (1987) has done, but since the SCF and FOF agree rather closely when 1983 weights are used, these results are omitted from the table.

When only assets are adjusted, the Gini coefficients are lower in 1983 and usually higher in 1989, compared to the coefficients

Table 3

Index Changes in Asset Value, 1983-89
(based on annual averages, except as noted)

Asset Category	Index	Percent Change, 1983-89
Stocks	Standard & Poor 500	101%
Taxable bonds*	Dow-Jones 20-bond index	21
Tax-exempt bonds	Standard & Poor's municipal	29
Owner-Occupied houses	Census one-family home index	27
Investment real estate**	Frank Russell property index	5
Unincorporated business***	Russell 2000	50
Unincorporated business	Nasdaq OTC composite index	63
Farms	USDA average value/acre	−16

* Yearly highs

** Compiled from quarterly averages; index for commercial real estate

**** Last trading day in December

SOURCES: *Statistical Abstract of the United States: 1992*; U.S. Bureau of the Census, *Price Index of New One-Family Homes Sold*; Frank Russell Company; U.S. Department of Agriculture; Lawrence J. White, *The S&L Debacle*, (pp. 110-11).

based on the unadjusted data. This may reflect the fact that the largest adjustment in 1983 is for savings accounts, which are widely held, while the largest adjustment in 1989 is for stocks, bonds and trusts. The increase in inequality is about double that based on unadjusted data.

EXPLANATIONS FOR THE CHANGE

A number of phenomena have been suggested as explanations for the changes in the distribution of wealth (or income) during recent years. It is possible to examine the effects of some of these phenomena and get at least a preliminary sense of their possible importance. Three in particular are worth attention: changes in asset prices; demographic changes; and the changing distribution of income.

Changes in Asset Prices

To some extent, the changes in the distribution of household wealth may be attributable to changes in asset prices. Even if each household held exactly the same assets in 1989 and 1983, the distribution of wealth would have changed. Wolff (1994) suggests that such changes may have contributed significantly to the increase in inequality that he measures. He notes specifically that stock prices increased more than house prices, and stock ownership is more concentrated among high-wealth households.

Table 3 reports commonly used price indices for almost all of the asset categories included in the SCF. Indices are not available for unincorporated businesses, but the change in their value may be approximated by the Russell 2000 and Nasdaq small-stock indices.

It is possible to measure the effect of these changes in asset values on the distribution of wealth by applying the indices to the 1983 holdings of each household. In behavioral terms, it is assumed that the household holds the same portfolio in both years, neither buying nor selling any assets, nor for that matter moving.

For most assets, the index can be simply multiplied by the reported 1983 value. In the case of owner-occupied housing, the change in the price of the house is not the change in home equity, for two reasons. First, for households with mortgages, home equity increases in percentage terms by more than the increase in the price of the home. The mean ratio of outstanding mortgage principal balance to house value was 23 percent in the 1983 SCF, and the mean equity was therefore 77 percent of house value. The full value of the increase in house value raises the owner's equity, so the mean home equity increased by 35 percent (27/77) instead of 27 percent. Second, it is assumed that the household continued to make mortgage payments during the six years; otherwise, it would default on the mortgage and lose the house, and thus change its portfolio. The mean remaining life of first mortgages was 15 years, eight months, in 1983; for second mortgages, it was seven years, 10 months. If homeowners continued to make mortgage payments for the six years between the two surveys, then on average they paid off a non-negligible share of the first mortgage and almost all the second (unless it was a balloon mortgage). The mean reduction in the outstanding principal balance was 24 percent, and the mean increase in home equity was 7.1 percent. The net effect of all the assumptions is to raise mean home equity by 42 percent.

In Table 4, the effect of these changes on the Gini coefficient is shown for several individual assets and combinations of assets. The wealth measure used in these calculations is unadjusted and includes automobiles.

The results suggest that changes in asset values as a whole had little effect on the distribution of wealth. The effect of changes for some individual asset categories were large. In three cases—stocks, unincorporated businesses (measured by the Russell Index) and owner-occupied housing—the coefficients change by more than the 1983 standard error, and are about as large or larger as the increase between 1983 and 1989. But the changes go in both directions and largely cancel each other. The changes in stock prices and unincorporated businesses both raise the Gini coefficient, but the change in home equity lowers it, and has about twice the effect of either. Even though stock prices rose more than any other asset and stock holdings are concentrated among richer households, the rise in house prices increased the wealth of a broad range of middle-class households by enough to make the distribution of wealth more equal. The combined effect of the changes in all assets was to lower the Gini coefficient slightly, by much less than its standard error.

The Gini coefficients were also calculated using the 1983 SRC weight (variable B3019), and the results are basically the same.

As a further check, 1989 was used as the base year for asset holdings, and values were deflated back to 1983. This is also shown in Table 4. The results were consistent with those using 1983 as the base year. The most notable differences are that the effect of deflating stock values from 1989 back to 1983 was much smaller in absolute value, and the effect of deflating equity in owner-occupied housing was much larger, so that the effect of changing all asset values simultaneously is larger in absolute value. The combined effect of all the changes is again in the opposite direction from the change in the Gini coefficient. There is also one qualitative inconsistency: Deflating investment real estate values from 1989 back to 1983 has the "wrong" sign. With 1983 as the base year, inflating real estate equity to 1989 has the effect of raising the Gini coefficient and increasing inequality. But with 1989 as the base year, deflating real estate equity back to 1983 also has the effect of raising the Gini coefficient and increasing inequality, whereas the opposite sign would be expected.

Using either year as the base, changes in asset values do not generate an increase in inequality, because the changes in home equity more than offset the changes in the value of other assets.

Table 4

Effect of 1983-89 Asset Value Changes on 1983 Gini Coefficients
(unadjusted net worth, including autos)

	Change in Gini Coefficient	
Asset	**1983 base year**	**1989 base year**
Stocks	+.01348	−.00214
Bonds	+.00147	−.00093
Owner-Occupied homes	−.02530	+.04437
Investment real estate	+.00101	+.00533
Unincorporated business	+.01311	−.01155
Farms	−.00088	+.00036
All assets combined	−.00240	+.04536
Net worth (from Table 2)	+.01497	−.01497

Demographic Changes

Changes in the composition of the U.S. population may also have contributed to the increasing inequality of the distribution of wealth. Table 5 shows the changes in the SCF sample between 1983 and 1989. The importance of the post-war baby boom can be seen in the age distribution. Almost the only group with a growing share of the population is households with the head age 35-44; these individuals were born in the years from 1939 to 1948 in the 1983 SCF, and from 1945 to 1954 in the 1989 SCF. The SCF also shows declines in married couples, households with children, and especially married couples with children. There is a reduction in the proportion of adults with less than a high school education and corresponding growth in those with at least some college.

In most cases, the weighted percentages in the SCF parallel the percentages in the population, as measured by the Current Population Survey (CPS), conducted annually by the Census Bureau. There are some exceptions. The most important is in the categorization of households by race and ethnicity. The 1983 SCF data report much lower proportions of households in the smaller minority groups than does the CPS. This is apparently because race and ethnicity were determined in 1983 by the interviewer for the SCF, while in the CPS the respondent was asked to identify himself or herself. In 1989, both the SCF and CPS used the self-identification method, which is more commonly used. The CPS reports that persons of Hispanic origin amounted to 7.2 percent of all U.S. residents, compared to only 3.7 percent in the 1983 SCF. Asian and Pacific Islanders were about 1.6 percent of the population in 1983, and American Indians and Alaska natives were 0.6 percent, while the SCF reports 1.1 percent for both groups combined. The CPS and SCF are much closer in 1989: 8.8 percent in the CPS versus 7.7 percent in the SCF for the Hispanic origin population, and 3.7 percent in the CPS versus 4.3 percent in the SCF for other races.[13] There are also other differences in the age distribution and household composition, which will be discussed later.

It is possible to get an idea of the importance of these demographic changes on the distribution of wealth by changing the weights for each category of household, substituting the 1989 proportions for each group within the category for the 1983 proportions. This procedure represents the effect of changes for individual households in some cases, such as age and household composition. People tend to add to their wealth as they age, and changes in household status, such as marriage, divorce or the death of a spouse may directly affect the household's wealth. In others it may not. Individuals do not automatically increase their wealth by completing another level of schooling, for example, although college graduates in general are richer than high school graduates. An adult who completes additional schooling is likely to benefit in the first instance through an increase in income, and then only gradually through an increase in wealth. For the United States as a whole, the effect of educational changes on the accumulation and distribution of wealth will also be felt gradually: New households formed by young adults with more schooling gradually supplant older households whose heads have less, and immigrants with relatively little education arrive in the country. Nor does the overall change in the racial and ethnic composition in the survey correspond to the experience of individual households.

Table 5 also shows the mean wealth for each group in the 1983 survey. The data in the table suggest that the change in the age distribution should reduce the degree of inequality, since the age group closest to the overall mean is almost the only group comprising a larger share of the population in 1989, while groups with higher and lower wealth declined in importance. Conversely, there was a decline in the importance of the household type closest to the mean wealth—married couples with children—but in this case there were also declines in groups with both more and less wealth. All minority groups have mean wealth that is farther from the overall U.S. mean than the large white majority, so the growth of minority households should also increase inequality. In the case of education, the effect is uncertain because low-wealth groups declined in importance and high-wealth groups increased.

As Table 6 shows, most of these demographic changes would have contributed to an increased concentration of wealth, but the effects are small. All are less than the standard error for the 1983 coefficient. The largest effect is from the changing racial and ethnic composition of the population, but this is suspect for the reasons discussed. None of the other demographic changes accounted for as much as a quarter of the change in the distribution of wealth. The changing age distribution by itself contributed modestly to a lessening of inequality, and the combined effect of age and household composition changes also reduced inequality.

The same tests for consistency were conducted for the demographic changes as for the changes in asset values, with similar

[13] Asian and Pacific Islander, and American Indian and Alaska native, are reported as two separate categories on the 1983 data tape (with 37 and nine observations, respectively) and combined into a single category in 1989.

results. When the Gini coefficients were calculated with the 1983 SRC weight, the magnitudes and patterns of changes were basically the same. When 1989 was used as the base year, substituting the demographic characteristics for 1983, there were some differences, as can be seen in Table 6. The change in household composition has a positive effect instead of the expected negative one, and the change in the age distribution has a much larger effect when 1989 is used as the base year.

These results may derive from differences between the surveys. For both characteristics, the sample size in one category is much smaller in 1989 than in 1983, and the weighted proportion of the population in that category is larger in the SCF than the CPS in 1983, and smaller in 1989. Single males with children is the smallest household composition category. The sample size in 1989 is only 17, and the weighted share in the SCF is less than half the 1.1 percent reported in the CPS; in 1983, the sample size is 40 and the proportion in the SCF is much closer to the CPS figure of 0.9 percent.

There is also a very large difference between the two surveys in mean wealth for these households; in 1983, they are relatively poor on average and in 1989 they are above the mean for all households, with mean wealth almost three times as large as in 1983. The difference in sample size suggests that the 1983 figure is likely to be more accurate. Similarly, "household head under 25" is the smallest age category, and also the poorest. The sample size is only 94 in 1989, and the weighted share in the SCF is somewhat smaller than the 5.5 percent reported in the CPS, while in 1983 the sample size is 295 and the proportion in the SCF is larger than the 6.8 percent in the CPS.

These differences suggest caution in interpreting the results in Table 6. To investigate their importance, weights were changed on the basis of each characteristic separately to match the 1983 and 1989 CPS for age and household composition, and the 1980 and 1990 decennial censuses for race and ethnicity. The inconsistencies in Table 6 did not appear, and the Gini coefficients were generally close to those reported in the top row of Table 2.

Table 5

Demographic Composition of SCF, 1983 and 1989

Category:	Mean Wealth (in $1,000s of 1989 dollars) 1983	1989	Percent of Sample: 1983	1989
Age of household head:				
Under 25	$ 15.3	$13.5	8.0	4.8
25-34	47.1	73.2	22.6	20.9
35-44	117.9	149.7	19.5	23.3
45-54	220.9	284.1	15.5	14.2
55-64	245.5	265.9	15.0	14.5
65-74	273.3	254.8	12.2	13.1
75+	163.2	194.8	7.2	9.2
Household composition				
Married couple, no children	$271.9	$305.6	29.4	29.8
Married couple, children	132.1	175.1	31.2	28.6
Single male, no children	91.8	124.2	12.0	12.8
Single male, children	61.4	167.9	1.1	0.4
Single female, no children	83.6	95.7	18.1	21.8
Single female, children	36.2	32.2	8.2	6.7
Race/ethnicity				
White	$175.1	$216.4	82.3	75.4
Black	35.9	48.6	12.9	12.6
Hispanic*	31.9	49.2	3.7	7.7
Other**	88.6	176.8	1.1	4.3
Educational attainment				
Grade school or less	$ 56.6	$ 75.4	14.5	14.1
Some high school	69.1	85.7	13.4	12.7
High school graduate	104.0	108.3	31.5	30.0
Some college	168.9	157.3	17.7	19.6
College graduate or more	308.9	406.0	22.9	23.6
Mean wealth for all households:	150.9	180.7		

* Hispanics are counted separately from the other groups, in contrast to Census Bureau practice, where they are identified both as members of a racial group and as Hispanics.

** Asian and Pacific Islander (80 percent in 1983); American Indian/Alaska native (20 percent in 1983)

Alternative weights might be constructed from the CPS, as a more extensive consistency check, but the CPS does not publish cross-tabulations in sufficient detail and does not use the two smallest racial categories as controls.[14]

[14] Conversation with Daniel Weinberg of the Census Bureau.

Table 6

Effect of 1983-89 Demographic Changes on 1983 Gini Coefficients
(unadjusted net worth, including autos)

Demographic Category	Change in Gini Coefficient 1983 base year	1989 base year
Age of household head	−.00292	+.00841
Household composition	+.00148	+.00267
Combined	−.00452	+.01392
Race/ethnicity of head	+.00625	−.00770
All three combined	+.00257	+.00479
Education of head	+.00259	−.00047
Net worth (from Table 2)	+.01497	−.01497

The limitations should not obscure the basic conclusion. None of the results, using either year as the base or any set of weights, suggest that demographic changes contributed to the change in the distribution of wealth (with the dubious exception of the racial and ethnic changes). All but one of the separate and combined effects of age and household composition are in the direction of making the distribution of wealth more equal, and the effect of education changes is small.

Income and Wealth

Both income and wealth (on most comparisons) were more unequally distributed in 1989 than in 1983. Indeed, as reported in the SCF, there was a greater increase in income inequality. The Gini coefficient for income rose more than the coefficient for wealth by any comparison in Table 2.

The association of these increases suggests that the changes in the distribution of wealth and income may have affected each other, and it is easy to jump to the conclusion that the increase in income inequality caused the increase in wealth inequality, or vice versa. In fact, the relationship between wealth and income is complicated both theoretically and empirically. Part of a household's current income is derived from the assets reported in the SCF, especially for the richest households, and at the same time part of the household's current income may be saved and add to wealth in the future. CPS data show that the distribution of income became slightly more unequal from year to year between 1983 and 1989, while mean and median household income were rising, which might enable the richer households to add relatively more to their assets. The interrelationships cannot be addressed systematically in this article. Nonetheless, it is interesting to look at how the relationship changed between 1983 and 1989.

There are several reasons why income and wealth might not be highly correlated in the SCF. The income reported in the survey is current income, which is not necessarily the household's normal or permanent income. Illness, windfalls and many other circumstances may cause the household's income in a given year to depart from its usual level. Wealth, which is in part the accumulated savings from past income, is likely to be more highly correlated with permanent income than current income. The relationship between current income and wealth is also affected by the age of the adults in the household. Older individuals have higher wealth for given income levels than younger ones, both because they have had more time to accumulate wealth and because, once they retire, their current income is low relative to their past income. Conversely, young adults typically have little wealth relative to their income.[15]

Despite these caveats, the relationship between income and wealth is strong. In Table 7, household wealth has been regressed on income and the square of income for both years. The coefficients of determination are quite high. The relationship between income and wealth was stronger in 1983 than in 1989, however, and also more elastic: The intercept is lower in 1983 and the coefficient of income is larger. (The coefficient of income squared is significant in both regressions but its magnitude is too small to generate a measurable departure from a simple linear relationship.)

The two regression lines cross at an income of about $33,800 (measured in 1989 dollars). This is the income level at which wealth is the same in the two years. The median household income was $24,300 in 1983 and $25,000 in 1989 (both also measured

[15] Weicher (1989) analyzes the relationship between wealth and age, and the relationship between income and wealth among the elderly for the 1977 SCC and the 1983 SCF.

in 1989 dollars). Thus, upper-income households were not as wealthy at any given income level in 1989 as they were in 1983, while those at middle- and lower-income levels were wealthier in the later year. This is surprising, since the change in the age distribution shown in Table 5 might suggest that wealth would be higher for households at any given income level in 1989.

It is worth noting that the change in the income distribution reported in the SCF is substantially greater than the change reported in the CPS, which has a much larger sample of about 57,000 households. Between 1983 and 1989, the Gini coefficient in the CPS rose by 0.017, from 0.414 to 0.431. This is less than the increase for three of the four SCF comparisons in Table 2. The comparison for which the changes in the SCF and CPS are closest is also the comparison showing a very slight decrease in wealth inequality.

WHO ARE THE RICH?

This section adopts a different focus on the distribution of wealth. Instead of looking at inequality across all households, it looks at the holdings and characteristics of the richest 1 percent of households (a group that has attracted interest among other analysts). The purpose is to see if the same households were rich in both years. Attitudes toward an increase in inequality may be different if the absolute level of wealth and the relative position within the distribution change frequently for individual households, especially if this occurs at the upper tail of the distribution.

The SCF has been designed in part to answer the question of how individual households have fared over time, by re-interviewing some of the same households in 1986 and 1989 who were interviewed in 1983. Unfortunately, it is impossible to track any individual households longitudinally because the information about re-interviewing has been suppressed in the 1989 public-use data tape. Nonetheless, it is still possible to analyze the position of the same types of households over time. The threshold for inclusion in this group is \$1.71 million in net worth in 1983 and \$1.97 million in 1989.

Table 7

The Relationship Between Wealth and Income, 1983 and 1989
(net worth including autos, adjusted for assets; 1989 dollars)

Variable	1983	1989
Intercept	−177,338 (10.9)	−37,026 (1.6)
Income	10.84 (32.8)	6.70 (30.2)
$Income^2$	53.3E-8 (4.0)	−6.4E-8 (23.4)
R-squared	.396	.231

Note: Numbers in parentheses under the coefficients are t-ratios.

Household Characteristics

Table 8 shows the demographic characteristics of these rich households. Nearly all were white and nearly all were married couples, although the proportion who were members of minority groups rose from less than 1 percent to more than 5 percent, and the proportion who were not married rose from 10 percent to 16 percent. A substantial majority were college graduates. About three-quarters had no children, or at least none living at home. The median age of the household head was 58 in both years, but in 1989 there were more relatively young households among the rich (17 percent compared to 10 percent in 1983), and fewer in the 55-64 age bracket. A more detailed classification (not reported in the table) shows that about half the households in the 45-54 age bracket had children in 1983, but few households did at older ages. This suggests that by about age 50, the children of these families have grown up and left home.

Comparison with Table 5 shows that these households are much better educated and quite a bit older than the general population, and are disproportionately white. They are more likely to be married but, perhaps because of their age, less likely to have children living at home. However, the precision of the percentages in Table 8 should not be overemphasized. The number of observations in the top 1 percent of each survey is

Table 8

Demographics of the Richest 1 Percent of U.S. Households, 1983 and 1989

	1983	1989
Age of household head:		
Under 25	0.0%	0.0%
25-34	2.1	1.3
35-44	8.4	15.5
45-54	27.9	27.0
55-64	30.3	22.2
65-74	20.9	22.1
75+	10.4	11.9
Household composition:		
Married couple, no children	66.2%	58.5%
Married couple, children	23.3	25.1
Single male, no children	4.0	9.5
Single male, children	0.1	2.6
Single female, no children	6.4	3.7
Single female, children	0.0	0.7
Race/ethnicity of household head:		
White	99.2%	94.5%
Black	0.1	0.7
Hispanic	0.0	1.1
Other	0.7	3.7
Education of household head:		
Grade school	1.3%	2.8%
Some high school	1.5	1.3
High school graduate	14.1	8.8
Some college	20.3	14.0
College graduate or more	62.8	73.2

not large to begin with: 287 in 1983 and 456 in 1989. Thus, there are not likely to be many in some of the smaller demographic categories. Where the surveys have marked differences in the samples and weighted proportions for the smaller categories, as shown in Table 5 and discussed in the previous section, the representation of these categories among the top 1 percent is likely to vary as well, and the proportions in these categories in Table 8 may be suspect. The figure for minority groups in 1983 is especially suspect because of their underrepresentation in that year's SCF, as discussed earlier.

Assets Held by the Rich

Table 9 describes the components of net worth for these households. As the top panel shows, in both years unincorporated businesses constituted the largest share of their wealth, over one-third in 1983 and almost 40 percent in 1989. Commercial and rental property accounted for about one-sixth in both years. The most surprising finding is the sharp decline in the importance of stock ownership, despite the stock market boom of the 1980s.

These patterns vary by age. In general, stocks are more important and unincorporated businesses are less important for older households. In 1983, for households under 65, unincorporated businesses were the largest component of net worth; for those 65 or over, stocks were. In 1989, stocks were the largest holding only for those 75 or over. At the other end of the age distribution, if young households did manage to qualify for inclusion among the very rich, they did it as owners of unincorporated businesses or perhaps, in 1983, as real estate investors.

The second panel shows the importance of the different assets to individual households: What was the most important asset in the portfolio of each rich household? Unincorporated businesses were the most important by this measure also in both years, although the proportion declined from 42 to 34 percent. Investment real estate was the most important asset for about one-fifth of the richest households in both years. Stocks declined by this measure as well.[16]

The marked increase in the importance of miscellaneous assets (collectibles, debts owed to the household, oil and gas leases) in both panels may result from a change in the questionnaire. Nine more categories were listed separately in 1989, including future proceeds from a lawsuit or an estate, royalties, deferred compensation, futures contracts, non-publicly traded stock, and cash not elsewhere classified. At the same time, however, the most frequently cited miscellaneous asset in 1983—boats—was moved to the "vehicle" category in 1989, along with campers, airplanes and motorcycles.

Three times as many households reported owning miscellaneous assets in 1989 as in

[16] Wolff (1994) shows that a large share of wealth of the top one-half of 1 percent (which he terms the "super-rich") in 1989 consisted of unincorporated businesses and investment real estate, and he speculates that this was the avenue to wealth in the 1980s. The data in Tables 8 and 9 only partly support this inference. Unincorporated businesses were a larger share of the total net worth of the richest 1 percent, but were the most important asset in the portfolio for fewer of them.

1983 among the population as a whole, and this is reflected among the richest households as well. Miscellaneous assets were the most important asset for a remarkably large number of wealthy households in 1989. Mean holdings of miscellaneous assets for wealthy households reporting such assets increased from $148,000 in 1983 to $546,000 in 1989 (both measured in 1989 dollars). Not many wealthy households reported holding assets in the categories added in 1989, but those who did typically reported holdings of $250,000 or more. In addition, a category of "other" was available in 1989, besides the 29 specified, and one household reported $28 million worth of such "other" miscellaneous assets.

Given the importance of unincorporated businesses among the richest households, it is worth taking a brief look at the kinds of businesses they own. The SCF asks what the business does, for those in which the household has a management interest. In 1983, the most common classification was "professional practice," an unfortunately broad category including law, medicine, accounting and architecture specifically, and perhaps others as well. Some 22 percent of the richest households owning unincorporated businesses were in this category. The second most common classification, at 20 percent, was "other wholesale/retail outlets," including everything except food and liquor, restaurants, gas stations and direct sales. In 1989, real estate/insurance was much the most common, at 43 percent, but few of the richest households were in these lines of business in 1983. "Other outlets" was the second most common classification, at 26 percent. In general, there is not much correspondence among the kinds of businesses owned between the two years, except in the broadest classifications.

Respondents were asked about the value of two actively managed businesses in 1983 and three in 1989, along with summary questions about other actively managed businesses in both years. Also in 1983, households in the high-income sample were not surveyed unless they volunteered to participate, while in 1989 they were surveyed unless they *declined* to participate. These differences may limit the comparability of the richest households between the surveys.

Table 9

Asset Holdings of the Richest 1 Percent of Households, 1983 and 1989

Relative Importance of Individual Asset Categories

	1983	1989
Unincorporated business	33.8%	39.7%
Stocks	18.2	7.7
Investment real estate	16.7	16.5
Home equity	8.7	8.2
Trusts	6.4	3.8
Bonds	5.9	5.7
Farms	2.7	2.6
Miscellaneous assets	1.0	5.9
All other	6.0	9.9

Proportion of Households for Whom Asset Category Is Largest Share of Net Worth

	1983	1989
Unincorporated business	41.8%	33.7%
Investment real estate	20.5	22.2
Stocks	16.3	9.0
Farms	7.0	3.1
Trusts	4.9	7.4
Bonds	4.5	3.6
Miscellaneous	0.3	8.9
All other	4.7	12.1

Taken at face value, the data on unincorporated business suggest that different households were in the top 1 percent in both years. The shifts in portfolio composition support the same inference.

CONCLUSION

The distribution of wealth probably became slightly more unequal between 1983 and 1989, but this conclusion does not hold for all specifications analyzed in this article. The sign and magnitude of the change depend on how broadly wealth is defined, and on such technical issues as what weights are used and whether and how the data for individual households are adjusted on the basis of national balance sheet data.

No single explanation appears to account for most, or very much, of the change in the distribution of wealth. Neither changes in asset values or broad demographic changes are very important. The high correlation between current income and wealth suggests that the change in the distribution of wealth may mirror the change in the distribution of income, but the relationship between income and wealth became less pronounced over the period.

The analysis in this article can best be described as a preliminary exploration of the wealth data in the SCF, and it has considered fairly simple explanations of the change in the distribution. A number of more specific and sophisticated issues may merit further analysis, based on the work to date:

(1) It is possible to look more closely at the effect of changes in household composition, particularly divorce and remarriage, since changes in marital status between 1983 and 1989 are reported for individual respondents in the 1989 SCF.

(2) The growing employment opportunities for women suggest that it would be worthwhile to analyze the effect of the labor force status of both members of married couples. Two-earner, two-professional couples (doctors married to doctors or to lawyers, for example) appear to be growing in importance; these may be high-wealth households. More generally, the contribution of a second earner to household wealth can be studied in the SCF.

(3) The 1983 SCF illustrates the importance of pensions and Social Security in the portfolios, broadly defined, of households with relatively low net worth. It may be possible to extend these calculations to 1989, to investigate whether inequality is rising when they are included and whether lower-wealth households are substituting them for other types of assets.

Finally, it may be that the increase in inequality is a cyclical phenomenon. As noted at the beginning of this article, the years from 1983 to 1989 comprise most of a long economic expansion. The Census Bureau reports that the distribution of income tends to become more unequal during expansions. Gini coefficients for household income have risen in every year since 1968, except three: 1974, 1980 and 1990, all of them years of recession. Over the 1968-92 period, the Gini coefficient rose from 0.388 to 0.433, or slightly less than 0.02 per year. During the 1983-89 expansion, it rose from 0.414 to 0.431, or about 0.024 per year. There are so few surveys with data on household asset holdings that it is difficult to consider the distribution of wealth cyclically, but the 1992 SCF may shed light on this conjecture, since it covers the downturn of 1990-91.

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The Effects of Fair Value Accounting on Investment Portfolio Management: How Fair Is It?

Anne Beatty

During the late 1980s, the Securities and Exchange Commission (SEC) challenged the use of historical cost accounting for financial instruments because this method values these assets using the interest rate in effect at the purchase date. Thus, it does not reflect changes in values that arise from changes in market interest rates. In a 1992 address to the American Accounting Association, Walter Schuetze, the chief accountant of the SEC, claimed the magnitude of losses in the thrift industry were increased by a lack of regulatory discipline made possible by the use of historical cost accounting.[1] He argued that regulators were able to avoid making decisions about capital adequacy in the thrift industry when estimates of the deficit in net worth of the industry on a market value basis were as high as $118 billion, because the net worth of the industry on a historical cost basis was positive. The experience in the thrift industry, combined with the large number of bank failures in the 1980s, caused former SEC Chairman Richard Breeden to express concerns that historical cost accounting might contribute to even larger losses in the banking industry.[2]

In a 1990 letter, the SEC lobbied accounting rulemakers to require financial institutions to use market values when accounting for securities investments. The letter argued that historical cost accounting produces information that is irrelevant to valuing investment portfolios and provides an opportunity for managers to manipulate the numbers reported in financial statements.[3] The Financial Accounting Standards Board (FASB) responded by adopting Statement of Financial Accounting Standards Number 115 (SFAS 115) in May of 1993. This statement requires that investment securities be valued using market interest rates, and requires that equity accounts be adjusted to reflect changes in these fair, or market, values.[4]

The adoption of this standard has been controversial. Opponents of fair value accounting have objected to the new standard because it focuses on a single type of asset. Bankers and regulators have claimed that the mismatching caused by ignoring concurrent changes in the values of other assets and liabilities such as loans and deposits will induce unrealistic volatility in bank equity. Bankers claim that efforts to mitigate this increase in volatility will result in reductions in the proportion of assets held in investment securities, the maturity of investments held, and in the flexibility of investment portfolio management.

These arguments were important in the recent decision by regulators to exclude the effects of SFAS 115 from the definition of regulatory capital ratios. In addition, bankers argue that the new standard will not eliminate the opportunity to manipulate the financial statements.

The arguments by both sides rely on the assumption that actions by regulators, investors, or depositors and creditors are based strictly on the numbers reported in the financial statements. This assumption is important in the debate over the effects of this accounting change because financial statement disclosures contain the information necessary to restate the investment account from a cost- to a fair-value basis.

This article examines the adoption of SFAS 115 by bank holding companies to determine if a desire to influence the

[1] His speech, which was entitled "Relevance and Credibility in Financial Accounting and Reporting," was given on August 12, 1992, at the annual meeting of the American Accounting Association.

[2] See *The Wall Street Journal* (September 27, 1990).

[3] See *The Wall Street Journal* (September 14, 1990).

[4] The FASB uses the term fair value to include the market value of items not traded on active secondary markets. See SFAS 115, paragraph 109.

numbers in the financial statements, including reported equity volatility, affects investment portfolio management. The focus of this article is on whether investment portfolio management was changed by the adoption of SFAS 115. I did not attempt to verify the claims of bankers and regulators that these changes will reduce income earned from investment securities or increase exposure of the market value of banks to interest rate changes. Evidence in this article suggests that SFAS 115 did affect investment portfolio management, and it suggests the need for further research.

ACCOUNTING FOR INVESTMENT SECURITIES

In May of 1993, the FASB issued SFAS 115, which must be followed in fiscal years beginning after December 15, 1993. The standard could have been adopted at the end of an earlier fiscal year if the annual financial statements for that year were issued after May of 1993. For bank holding companies whose fiscal year ends in December, SFAS 115 could be adopted as of December 31, 1993, or for the year beginning January 1, 1994.

Changes in Investment Securities Accounting Due to SFAS 115

Prior to implementation of SFAS 115, debt securities that banks intended and were able to hold on a long-term basis were carried at amortized cost with no adjustment for changes in value resulting from changes in interest rates. Equity securities and debt securities that might be disposed of in the foreseeable future, in contrast, were accounted for at the lower of cost or market. This method requires that declines in the value of securities be recorded as an adjustment to equity, but does not allow increases in the value of these securities above cost to be recorded. Sales of securities, whether accounted for at amortized cost or the lower of cost or market, resulted in a gain or loss from the sale equal to the difference between their sales price and their amortized cost. This gain or loss was recorded in both income and equity. Finally, debt securities held for trading were recorded at their market values.

Although most securities were recorded in the financial statements at amortized cost prior to adoption of SFAS 115, information about the market value of these securities was disclosed in the footnotes to the annual reports. Typically, this footnote information was also provided on the face of the balance sheet. The availability of information about both the amortized cost and the market value of investment securities at both the beginning and ending financial statement dates made it possible for users of the financial reports to restate the financial statements to the values that would have been recorded if investment securities were accounted for at market values.

SFAS 115 requires that each security be placed into one of three portfolios depending on the reason for acquiring the security and on whether the security will be held to maturity, resold in the near term, or available for sale in some intermediate period. Accounting for the income generated from these securities and for the acquisition and sale of the securities was not changed by SFAS 115 and is the same regardless of the classification of the security. The accounting treatment of unrealized holding gains and unrealized holding losses differs for the securities in each of these three categories.

Securities held to maturity are debt securities that management intends to hold until maturity. Securities in the held-to-maturity portfolio are recorded at amortized cost. No unrealized gains are recognized. Unrealized losses are recognized only if there is a large and permanent decline in the fair value of the security.

Held-to-maturity securities are allowed to be sold or transferred to one of the other two portfolios for the following reasons: deterioration in issuer's creditworthiness; change in the tax law affecting the tax-exempt status of interest on debt security; a major business combination or disposition by the reporting entity; change in regulation modifying permissible level of an investment; or significant change in risk weights used in computing risk-based capital. The following are not acceptable reasons for selling or transferring securities from the held-to-maturity portfolio: change in market interest rates; need for liquidity; change in yield on other investments;

change in funding sources and terms; or a change in foreign currency risk. In addition, sales of debt securities are allowed if they occur near enough to the maturity date so that interest rate risk is substantially eliminated as a pricing factor (for example, within three months), or if they occur after at least 85 percent of the principle outstanding at acquisition has been collected.[5]

The FASB has not established a penalty for unauthorized sales or transfers of held-to-maturity securities. Banks that make unauthorized dispositions from this portfolio will most likely find it difficult to convince auditors and regulators that they intend to hold other securities to maturity. As a result, these banks may be required to re-classify all securities in the held-to-maturity portfolio to one of the other two portfolios.

Trading securities are debt or equity securities bought and held principally for the purpose of selling them in the near term. Trading securities are recorded at market value with unrealized gains and unrealized losses recognized in income. Thus, the accounting treatment for trading securities was not affected by SFAS 115.

Securities available for sale are debt or equity securities not classified as trading securities or as held-to-maturity. Securities in the available-for-sale portfolio category are recorded at market value with unrealized gains and losses (net of tax) recorded as a separate component of shareholder's equity. Changes in the market value of these securities are not recorded in income.

INVESTMENT PORTFOLIO MANAGEMENT UNDER SFAS 115

Bank managers can use the investment securities portfolio to achieve several objectives. The investment portfolio provides a source of interest income, collateral to secure deposits and other liabilities, liquidity to meet needs that arise from fluctuations in deposit and loan balances, and cash flows from assets that can be matched with those from liabilities to reduce interest rate risk. In addition, to the extent there are gains or losses on investment securities not yet recognized in either equity or earnings, sales of investment securities can provide management with an opportunity to influence reported equity or earnings.

Prior to SFAS 115, there were few restrictions on the use of investment securities to achieve these objectives. Under SFAS 115, use of securities classified as available-for-sale is still unrestricted, but the virtual prohibition of the sale of securities classified as held-to-maturity dramatically reduces the usefulness of these securities in investment portfolio management. Held-to-maturity securities will still provide the bank with interest income, but these securities will not be available to manage liquidity or interest rate risk, or to influence reported equity or earnings because they can be sold only under very restrictive conditions or with the penalty of re-classifying this portfolio as available-for-sale. Without some offsetting benefit, these severe restrictions on the use of held-to-maturity securities suggest that bank managers would not choose to classify any of their securities in this portfolio. The only advantage of classifying securities as held-to-maturity rather than available-for-sale is that unrealized gains and losses will not be recorded in equity. The relative costs and benefits of classifying securities as held-to-maturity will depend on how actively the investment portfolio is managed, and how costly it is to include unrealized gains and losses on investment securities in reported equity.

The Importance of SFAS 115 in Bank Regulation

In December of 1993, the Board of Governors of the Federal Reserve System proposed that capital requirements be amended to include unrealized holding gains and losses on securities available for sale in Tier 1 capital,[6] despite arguments made by Federal Reserve Chairman Alan Greenspan that SFAS 115 would result in a distortion of bank financial statements and would erect barriers to effective interest rate risk management.[7] The proposal stated that the amendment was consistent with the intent of the requirement in the Federal Deposit Insurance Corporation Improvement Act of 1991 (FDICIA) that regulatory

[5] See SFAS 115, paragraphs 8-11.

[6] Tier 1 Capital is defined in the Board of Governors of the Federal Reserve System *Capital Adequacy Guidelines* as: Common equity, qualifying noncumulative perpetual preferred stock, and minority interest less goodwill and other intangible assets required to be deducted from capital.

[7] See *The Wall Street Journal* (November 8, 1990; and January 18, 1993).

accounting standards be no less stringent than Generally Accepted Accounting Principles (GAAP), and noted that including the unrealized gains and losses in Tier 1 capital would affect prompt corrective action regulations, brokered deposit restrictions, and the risk-related insurance premium system.

Given the language used in the proposed amendment to the capital requirements, it seems reasonable that at the time bank managers implemented SFAS 115, they would have assumed that the resulting unrealized holding gains or losses would be included in Tier 1 capital. In November of 1994, however, the Board of Governors decided not to include the effects of SFAS 115 in Tier 1 capital. This decision, which occurred after SFAS 115 had been required for financial reporting purposes for three quarters, may cause banks to adjust their investment portfolio holdings.

POTENTIAL ADVANTAGES AND DISADVANTAGES OF SFAS 115

Influencing Financial Statements Through Gains Recognition

Fair value proponents have criticized historical cost accounting because it provides the potential for manipulation of the numbers reported in the financial statements through the sales of investment securities. This criticism also applies to the fair value accounting required by SFAS 115. The new standard actually increases the potential for certain types of manipulation.

SFAS 115 does not eliminate opportunities to influence the numbers that are reported in the financial statements. When this standard was implemented, there was an adjustment to equity equal to the after-tax net unrealized gain or loss on the securities classified as available-for-sale. This change provided managers with a transitory ability to affect reported equity. First, managers could affect the timing of this adjustment through the choice of when to adopt the standard. Second, managers can affect the amount of the adjustment through the selection of securities for classification as available-for-sale. In addition, after SFAS 115 is in place, managers will still be able to influence reported earnings through the recognition of gains or losses on securities sales. SFAS 115 reduces the restrictions on sales of securities classified as available-for-sale.

Accuracy of Reported Equity

Fair value proponents also argue that improving the measurement of the investment securities account by using fair value rather than historical cost accounting will improve the measurement of equity. Although this would certainly be true if the values of assets and liabilities were uncorrelated, it need not be the case when they are related. Changes in interest rates primarily cause changes in the market values of the investment securities held by banks.[8] Changes in interest rates also cause changes in the values of other bank assets, such as loans, and changes in the values of bank liabilities, such as deposits and long-term debt. The values of these assets and liabilities are therefore likely to move together. This is especially true when the investment portfolio is used to hedge the effects of interest rate changes on equity. For this reason, the volatility in reported capital that will occur as a result of stating only the investment portfolio at market value may not be indicative of the true risk of the bank. Fair value accounting will provide managers with an incentive to reduce the volatility in reported equity, assuming that those who use financial statements do not adjust for the effects of unrealized securities gains and losses.

A number of theoretical and empirical studies have evaluated market value accounting systems in which all assets and liabilities are marked to market. For example, see: Berger, King and O'Brien (1991); Shaffer (1992); and Mengle and Walter (1991). Partial market value accounting, with only one category of assets recorded at market value, has received relatively less attention.

Two studies examining past changes in the market value of banks' investment portfolios have concluded that the effects of implementing SFAS 115 are likely to be small. Barth, Landsman and Wahlen (1995) document an increase in volatility of reported equity during 1970-90, when changes in

[8] Banks invest primarily in U.S. Treasury and U.S. agency securities, which have virtually no default risk.

investment securities values are included in equity. They argue, however, that this increase in volatility is not important to investors or regulators. In a study of the effects of market value accounting for investment securities on regulatory discipline, Carey (1995) reaches no conclusion about whether regulatory discipline will be improved or worsened, but does conclude that the effects are likely to be small. Both papers acknowledge that there are limitations on the inferences that can be drawn from past data, since bank behavior will likely be different once SFAS 115 is in effect.

In contrast, Ernst and Young (1993) report that more than half of respondents to their survey anticipated altering their investment behavior if SFAS 115 were adopted. Ernst and Young (1994), however, report that 60 percent of the respondents to a follow-up survey claimed to have actually changed their investment strategies as a result of adopting SFAS 115. More than 95 percent of respondents in the original survey claimed they would shorten the maturity of debt securities held, and roughly 40 percent said they would increase their hedging activity. In addition, respondents said they might reduce the proportion of assets held in investment securities. In the follow-up survey, the respondents said they had shortened the maturity and duration of their portfolio and had reduced their holdings of mortgage-backed securities and mortgage derivatives. The fraction claiming they would increase their hedging activity was reduced to roughly 10 percent.

Under SFAS 115, any change in the after-tax net unrealized gain or loss on the securities in the available-for-sale account will result in an adjustment to equity, resulting in an increase in the volatility of the reported equity balance. This volatility in reported equity will be higher as more securities are included in the available-for-sale account and the more sensitive these securities are to changes in interest rates.

Bank managers who want to minimize the increase in volatility of reported equity that will result from adopting SFAS 115 can either classify securities as held-to-maturity or change their investment security holdings to minimize the effect on reported equity. The second option can be achieved either by reducing the proportion of total assets held in the investment portfolio or reducing the sensitivity of the value of investments held to changes in interest rates. Since the sensitivity of securities' values to changes in interest rates increases with their maturity, reducing the maturity of the investment portfolio will decrease the volatility in reported equity caused by changes in the values of available-for-sale securities.

SAMPLE SELECTION AND DESCRIPTIVE STATISTICS

Bank holding company data during the implementation period of SFAS 115 are used to examine two aspects of investment portfolio management. First, I ask whether the decision about when to adopt this accounting standard was affected by the transitory ability to influence reported equity. Second, I explore whether bank managers' desire to reduce volatility in reported equity affects the proportion of assets held in investment securities, the maturity of the investment securities held, and the proportion of securities held in the available-for-sale portfolio. A sample of bank holding companies was identified from the consolidated financial statement for the bank holding companies report (FR Y-9C) filed with the Federal Reserve System during the second quarter of 1993 through the first quarter of 1994. In addition to the data available from this file, information from the annual report footnote disclosures was required to determine when SFAS 115 was adopted and to obtain data on the proceeds of sales from the investment portfolios.

Publicly traded companies are required to file annual reports with the SEC. Therefore, to be retained in the sample, the holding company also had to be listed on the New York Stock Exchange, American Stock Exchange, National Association of Stock Deals Automated Quotation System, or over-the-counter. This matching resulted in a sample of 369 bank holding companies as of December 31, 1993. Bank holding companies were eliminated from the sample if their annual reports could not be obtained directly from the company or from the National Automated Accounting Retrieval Services database. This requirement resulted in the exclusion of 78 bank holding companies. Bank holding companies were also eliminated if they did not report the proceeds from sales of investment securities, and 40 bank holding companies failed to report proceeds data.

Table 1 provides definitions of characteristics used to analyze the effects of implementing SFAS 115 by bank holding companies. Table 2 profiles bank holding companies included in the sample by peer group.[9] As of September 30, 1993, the sample bank holding companies had assets ranging from $157 million to $221 billion, and are fairly evenly distributed within the six peer groups represented. Due to the exclusion of bank holding companies with missing data, the average size of the sample bank holding companies of $10.921 billion is slightly larger than the average of $7.796 billion for all publicly traded bank holding companies.

Many characteristics of bank holding companies differ across peer groups. The average leverage ratio decreases with average bank holding company size, while the average return on equity increases. SFAS 115 affects reported equity and therefore will affect the numerator of the leverage ratio and the denominator of the return on equity. Both the existence of interest rate contracts and the average portfolio turnover are increasing with bank holding company size. These variables suggest that larger bank holding companies are more active in liquidity and interest rate risk management and therefore may be affected more by SFAS 115. Slightly more than 44 percent of sample bank holding companies adopted SFAS 115 during the fourth quarter of 1993. This fraction, although different across peer groups, does not increase uniformly with bank holding company size.

Table 3 compares the characteristics of early and late adopters of SFAS 115. On average, early adopters of SFAS 115 have lower leverage ratios, higher past excess gains, and investment securities with longer maturities. Although early adopters decreased the fraction of their assets held in the investment portfolio and decreased the maturity of the securities held in their investment portfolios more in the fourth quarter of 1993 and less in the first quarter of 1994 than did late adopters, these mean differences are not statistically significant.

EARLY ADOPTION OF SFAS 115

As of the end of 1993, 93 percent of all publicly traded bank holding companies had net unrealized gains in their investment portfolios. By adopting SFAS 115 early, this unrealized gain could be used to increase reported equity. A probit model of the decision to adopt SFAS 115 in 1993 rather than waiting until 1994 is estimated to determine if the ability to increase reported equity influences the decision about when to adopt this standard.

The probit model includes three variables used to test whether the increase in reported equity resulting from the adoption of SFAS 115 was important in the decision to adopt early. Bank holding companies with lower leverage ratios are predicted to be more concerned with increasing reported equity and, therefore, more likely to be early adopters. Similarly, bank holding companies with higher returns on equity are predicted to be more willing to report an increase in equity, thereby reducing this measure of performance commonly used by regulators and investors. Finally, bank holding companies that have managed their securities portfolios in the past to increase reported equity are predicted to be more likely to adopt SFAS 115 early.

Carey (1994) points out that a bank can increase capital by selecting securities for sale with an average unrealized gain larger than the average for all securities in the investment portfolio. Past excess securities gains are used to measure differences across bank holding companies in their desire to boost reported capital.

These variables are likely to be related to other bank holding company characteristics such as size and structure of the investment portfolio. The probit model also includes several control variables to capture other factors that may be important in the decision about when to adopt SFAS 115.

Implementation of SFAS 115 is likely to require a change in investment management, which may require a great deal of planning.

[9] Peer group classifications, which are outlined in *A User's Guide for the Bank Holding Company Performance Report*, published by the Board of Governors of the Federal Reserve System, are bank holding companies with total assets in billions of dollars: greater than 10 are in group 1; between 10 and 3 are in group 2; between 3 and 1 are in group 3; between 1 and 0.5 are in group 4; between 0.5 and 0.3 are in group 5; and between 0.3 and 0.15 are in group 6.

Table 1

Identification of Characteristics

Early adoption	1 if SFAS 115 was adopted as of December 31, 1993; 0 otherwise
Leverage ratio	the ratio of tier 1 capital to total assets as of September 30, 1993
Leverage ratio$_{75\%\ tile}$	1 if the leverage ratio is above the 75th percentile of sample bank holding companies as of September 30, 1993; 0 otherwise
Leverage ratio$_{50\%\ tile}$	1 if the leverage ratio is between the 50th and 75th percentile of sample bank holding companies as of September 30, 1993; 0 otherwise
Leverage ratio$_{25\%\ tile}$	1 if the leverage ratio is between the 25th and 50th percentile of sample bank holding companies as of September 30, 1993; 0 otherwise
Average leverage ratio	the average leverage ratio for the fourth quarter of 1990 through the fourth quarter of 1992
Return on equity	net income for the first three quarters of 1993 divided by equity as of September 30, 1993
Average return on equity	the average Return on Equity for the third quarter of 1990 through the fourth quarter of 1992
Past portfolio turnover	the annual proceeds from sales of securities divided by the market value of the securities averaged for 1990-1992
Past excess gains	the average of securities gains realized less the product of the net unrealized gains and the portfolio turnover divided by assets for 1990-1992
Past gains	securities gains realized divided by assets averaged for the fourth quarter of 1990 through the fourth quarter of 1992
Unrealized holding gains	the market value less the book value of investment securities divided by total assets as of September 30, 1993
Interest rate contracts	1 if an interest rate contract was held as of September 30, 1993; 0 otherwise
Investments$_{maturing < 1}$	the book value of investment securities maturing within 1 year divided by total assets as of June 30, 1993
Investments$_{1 < maturing < 5}$	the book value of investment securities maturing in more than 1 and less than 5 years divided by total assets as of June 30, 1993
Investments$_{maturing > 5}$	the book value of investment securities maturing in more than 5 years divided by total assets as of June 30, 1993
Investment$_{WA}$	$0.5(\text{Investments}_{maturing<1}) + 3(\text{Investments}_{1<maturing<5}) + 8(\text{Investments}_{maturing>5})$[1]
Investment	the book value of investment securities divided by total assets
Δ Investment$_{WA}$	the change in InvestmentWA
Δ Investment	the change in Investment
Δ Investment$_{AWA}$	Δ Investment$_{WA}$ − Δ Investment (Investment$_{WA}$)
Available for sale	the book value of securities classified as available for sale divided by the book value of total investment securities as of March 31, 1994
Peeri	1 for bank holding companies in Peer Group i; 0 otherwise

[1] Assumes that the maturity of securities in these categories equals the average of the minimum and maximum maturity for the category is consistent with the assumption made in the proposal to revise risk-based capital standards to account for interest rate risk.

Some bank holding companies may be able to respond to this new reporting requirement more quickly than others. Indicator variables for the bank holding companies' peer group are included to control for these factors, and to control for other differences among bank holding companies that depend on size such as differences in average capital ratios and differences in average return on equity.

An indicator variable for whether the bank holds interest rate contracts such as swaps, forwards and purchased options is included to capture differences in how bank holding companies manage their interest rate risk. Bank holding companies that use interest rate contracts to manage interest rate risk are expected to be more likely to alter their investment strategies as a result of SFAS 115. This may be important in the decision about when to adopt this accounting standard. Similarly, variables measuring the maturity of the investment portfolio are included since these

Table 2

Mean Value of Characteristics by Peer Group

Variable	Peer Group 1	2	3	4	5	6
Assets range (billions)	10.330–221.307	3.096–9.515	1.007–2.982	0.512–0.995	0.301–0.478	0.157–0.296
Fraction of sample	0.183	0.171	0.215	0.195	0.116	0.120
Leverage ratio	0.070	0.079	0.079	0.084	0.083	0.084
Return on equity	0.127	0.122	0.089	0.081	0.040	0.050
Early adoption	0.565	0.372	0.537	0.306	0.379	0.467
Interest rate contracts	1.00	0.721	0.278	0.143	0.069	0.133
Past portfolio turnover	0.252	0.156	0.151	0.150	0.129	0.104

Table 3

Mean Value of Characteristics of Early and Late Adopters of SFAS 115

Variable	Early Adopter	Late Adopter
Leverage ratio	0.075	0.083***
Average leverage ratio	0.069	0.077***
Return on equity	0.102	0.080
Average return on equity	0.020	0.026
Past portfolio turnover	0.174	0.153
Unrealized holding gains	0.007	0.008
Past excess gains (%)	−0.028	−0.050*
Interest rate contracts	0.523	0.336***
$\text{Investments}_{\text{maturing} < 1}$	0.055	0.061
$\text{Investments}_{1 < \text{maturing} < 5}$	0.091	0.121***
$\text{Investments}_{\text{maturing} > 5}$	0.127	0.092***
Investment_{WA}	1.316	1.127**
$\Delta\ \text{Investment}_{WA}$		
fourth quarter 1993	−0.009	0.009
first quarter 1994	0.070	0.041
Δ Investment		
fourth quarter 1993	0.001	0.007
first quarter 1994	0.004	0.001
$\Delta\ \text{Investment}_{AWA}$		
fourth quarter 1993	−0.005	0.005
first quarter 1994	0.060	0.039

Note: ***, ** and * indicate that the difference in the means for early and late adopters is statistically different from zero at the 0.01, 0.05 and 0.10 levels.

variables may be important in explaining the reaction to this accounting standard and, thus, the decision about when to adopt SFAS 115.

Estimation Results

Table 4 shows the results of the probit estimation of the decision to adopt SFAS 115 in 1993 versus 1994, including alternative combinations of the explanatory variables. Evidence consistent with SFAS 115 being adopted early to increase reported capital is provided by coefficients on the leverage ratio, return on equity, and the past excess gains recognized.

The significantly negative coefficient on the leverage ratio indicates that companies with lower capital are more likely to increase their reported equity by adopting SFAS 115 early.[10] Similar evidence is provided by the coefficients on the indicator variables that measure the percentile of the leverage ratio. Companies whose leverage ratio falls in the top 75th percentile were significantly less likely than those whose leverage ratio falls in the bottom 25th percentile to adopt SFAS 115 early. The same is true for those who fall between the 50th and 75th percentile, although the reduction in probability is lower for this group. Those that fall between the 25th and 50th percentile are not found to be significantly less likely than those in the bottom 25th percentile to adopt SFAS 115 early. The coefficient estimates on these three indicator variables suggest the decline in probability of early adoption is linearly related to the increase in the leverage ratio.

The significantly positive coefficient on return on equity provides further evidence that the effect on reported equity of SFAS 115 is important in the decision to adopt early.[11] This suggests that companies performing well in 1993 were more willing to have this measure of performance reduced by the increase in equity that occurred as a result of adopting SFAS 115 early.

Finally, the positive coefficient on the excess gains variable, which is significant when the investment control variables are included, suggests that companies that have boosted reported equity in the past through the disproportionate recognition of securities gains

[10] In discussing the results, t-statistics greater than 1.66, which are significant at the 5 percent level for one-tailed tests and at the 10 percent level for two-tailed tests, are considered to be statistically significant.

are more likely to adopt SFAS 115 early to increase their reported equity during 1993.

The coefficients reported in Table 4 provide estimates of the changes in probability of early adoption of SFAS 115, given changes in the corresponding variable. Therefore, a coefficient of -2.766 on the leverage ratio indicates that increasing the leverage ratio from the Peer 1 group average of 0.070 to the Peer 6 group average of 0.084 would result in roughly a 3.9 percent decline in the probability of adopting SFAS 115 early. Similarly, a coefficient of 0.438 on return on equity indicates that decreasing the return on equity from the Peer 1 group average of 0.127 to the Peer 6 group average of 0.050 would result in roughly a 3.4 percent decline in the probability of adopting SFAS 115 early.

Once other characteristics have been controlled for, the size of the bank holding company generally does not appear to be important in the decision to adopt SFAS 115 early, although bank holding companies in Peer group 3 are more likely than those in Peer group 1 to adopt early. The only other variables that are significant in explaining the early adoption decision are the amount of securities maturing in more than one year and less than five years, and the existence of interest rate contracts. Inclusion of these variables does not alter the conclusions drawn from the coefficients on the other variables included in the estimation.

The mean predicted probability of adopting SFAS 115 early is significantly higher for early adopters than for late adopters for all three probit models estimated. In addition, the fraction of bank holding companies correctly classified as early versus late adopters for all three probit models is significantly better than the fraction that would be correctly predicted by assuming that the probability equals the mean proportion in the sample.

CHANGES IN INVESTMENT SECURITY HOLDINGS

Regression models using three different measures of changes in investment security holdings are estimated to determine if changes in the investment portfolio are made in the quarter that SFAS 115 is adopted. The

Table 4

Results of Probit Estimation of Early Adoption Decision

Variable			
Intercept	0.248	0.029	0.020
	(2.389)	(0.448)	(0.159)
Leverage ratio	−3.630		−2.766
	(−2.768)		(−2.021)
Leverage$_{75\%tile}$		−0.162	
		(−2.700)	
Leverage$_{50\%tile}$		−0.109	
		(−1.859)	
Leverage$_{25\%tile}$		−0.015	
		(−0.266)	
Return on equity	0.524	0.475	0.438
	(1.953)	(1.731)	(1.600)
Unrealized holding gains			4.811
			(1.000)
Past excess gains	37.313	37.419	49.476
	(1.503)	(1.604)	(1.889)
Investments$_{maturing<1}$			0.385
			(0.825)
Investments$_{1<maturing<5}$			−0.704
			(−1.894)
Investments$_{maturing>5}$			0.338
			(1.274)
Interest rate contracts			0.156
			(2.490)
Peer 2	−0.077	−0.071	−0.051
	(−1.267)	(−1.033)	(−0.679)
Peer 3	0.032	0.037	0.143
	(0.400)	(0.570)	(1.732)
Peer 4	−0.091	−0.081	0.022
	(−1.451)	(−1.163)	(0.238)
Peer 5	−0.037	−0.037	0.096
	(−0.465)	(−0.500)	(0.953)
Peer 6	−0.005	0.001	0.180
	(−0.068)	(0.012)	(1.118)
Mean predicted probability			
late adopters	0.402	0.401	0.374
early adopters	0.491**	0.494**	0.525**
Fraction correctly predicted	0.657**	0.626*	0.669**
Psuedo − R^2(%)	6.955	7.203	12.028

Notes: t-statistics are provided in parentheses, and ** and * indicate statistical significance at the 0.01 and 0.05 levels in either the difference in means for early and late adopters, or in the difference between the fraction correctly predicted and the proportion of early versus late adopters in the sample.

[11] For the model presented in the third column, the coefficient on this variable is only significant at the 6 percent level using a one-tailed test.

first measure examined is the change in the maturity-weighted investment portfolio. This variable measures both changes in the proportion of assets held in investment securities and changes in the maturity of the securities held. The second measure examined is the change in total investments. This variable measures only the change in the proportion of assets held as securities, ignoring changes in the maturity of the securities. The third measure is an adjusted maturity-weighted measure designed to eliminate changes in the weighted maturity of the portfolio that occur merely due to changes in the proportion of assets held in investment securities.

These three measures provide information on the overall change in investment security holdings and the two components of that change. Changes in the investment portfolio may occur for reasons other than the accounting change, such as changes in interest rates. Determining the expected change would require a comprehensive model of investment portfolio management. If the change in investment portfolio holdings associated with this accounting change occurs in the quarter that the standard is adopted, then the bank holding companies that did not adopt SFAS 115 during the quarter can be used as a control group. If the non-adopters provide a measure of the changes that would have occurred in the absence of the accounting standard, then the difference between the adopters and non-adopters can be used to determine the change due to the accounting standard. This is a common approach used to study treatment effects and program effectiveness.

A common problem in these studies is that participants often choose the group that they are in and therefore may be different for reasons other than the treatment or program. In this case, the period of adoption of SFAS 115 is not random and early adopters are different in a variety of ways from late adopters. Correction of the self-selection bias that results requires that these differences in characteristics be used to predict who will choose to be included in each group. The estimates from this prediction model can then be used to construct a variable that corrects for the bias that occurs because we cannot observe the values of the dependent variables for the alternative choice. This self-selection variable is computed using the predicted probabilities from the probit estimation of early adoption of SFAS 115 in the last column in Table 4.[12] The coefficient on this variable can be used to determine if the conclusion drawn from the estimation would have been affected by a self-selection bias.

The importance of reducing reported equity volatility is measured using the average leverage ratio and the average return on equity. The cost of increasing equity volatility is assumed to be negatively related to the level of these ratios and, therefore, the lower the average leverage ratio and average return on equity, the greater the expected reduction in the maturity of the investment portfolio.

Several control variables are also included in the regression to capture other factors that may be important in explaining the change in investment portfolio holdings. Since changes in maturity may depend on the initial maturity, the weighted average maturity of the investment portfolio at the end of the second quarter of 1993 is included in these regressions. In addition, the size of the bank holding company may be important in explaining the desired holdings. Peer group dummy variables are also included as control variables. Finally, the desired investment portfolio holdings may depend on the bank holding company's hedging activity and, therefore, an indicator variable for the existence of interest rate contracts is included.

Estimation Results

Table 5 reports the results of the analysis of change in investment portfolio holdings for the fourth quarter of 1993 and Table 6 reports the results for the first quarter of 1994. Three regression models are estimated. The significantly negative coefficient on the early adoption dummy in the fourth quarter of 1993, and the significantly positive coefficient on that variable in the first quarter of 1994 for the maturity-weighted and total-investments equations provide evidence that bank holding companies reduced both the proportion of assets held in the investment portfolio and the maturity of those investments in the quarter that they adopted SFAS 115.

[12] See Greene (1993) for a discussion of the computation of the self-selection variable that corrects for the truncation in the distributions of observed dependent variables when there is self-selection into treatment groups.

Given a weighted-average maturity of the investment portfolio on June 30, 1993, of 1.21, the coefficient of -0.318 on the early adoption variable reported in column one indicates approximately a 27 percent decrease in the ratio of the maturity-weighted investment securities to assets resulting from the adoption of SFAS 115. Part of this decline is due to a decrease in the proportion of assets held in the investment portfolio. A coefficient of -0.045 on the early adoption variable in the regression examining the change in the ratio of investment securities to assets implies a 16 percent decline in the size of the investment portfolio, given an average ratio of investment securities to assets of 28 percent at the end of June 1993.

The significant coefficient on the self-selection variable indicates that the estimates would be biased if this variable were not included. In addition, the sign on the coefficient on this variable indicates the direction of the bias on the early adoption variable if the selectivity correction were omitted. The positive coefficients on the self-selection variable in the fourth quarter of 1993 regressions imply an upward bias on the coefficient on the early adoption variable without the selectivity correction, indicating that the estimated change in the investment portfolio holdings for the early adopters would have been understated. The opposite is true for the first quarter of 1994 regressions.

The significantly negative coefficient on the average leverage ratio in the fourth quarter of 1993 provides evidence of cross-sectional differences in the concern over increased capital volatility resulting from the adoption of SFAS 115. I find little evidence that the average leverage ratio was important in explaining the change in investment portfolio holdings in the first quarter of 1994. In addition, I find little evidence that the average return on equity is important in explaining the changes in either quarter.[13]

Once other factors have been controlled for, the size of the bank holding company generally does not appear to be important in explaining the change in the maturity of the investment portfolio, although these variables are important in explaining the change in the proportion of assets held in the investment portfolio. In the fourth quarter of 1993, the weighted average maturity of the investment portfolio is important in explaining the change in the maturity, while the existence of interest rate contracts is important in explaining the change in the first quarter of 1994.

Table 5

Estimation Results for Changes in Investment Security Holdings in the Fourth Quarter of 1993

Variable	Δ Investment$_{WA}$	Δ Investment	Δ Investment$_{AWA}$
Intercept	0.283 (2.949)	0.035 (2.722)	0.243 (2.875)
Early adoption	−0.318 (−2.540)	−0.045 (−2.922)	−0.265 (−2.404)
Self-selection	0.209 (2.662)	0.025 (2.608)	0.178 (2.589)
Average leverage ratio	−2.366 (−2.569)	−0.301 (−2.441)	−1.924 (−2.374)
Average return on equity	0.815 (1.815)	0.016 (0.258)	0.653 (1.652)
Investment$_{WA}$	−0.034 (−2.034)		−0.038 (−2.138)
Investment		−0.034 (−2.034)	
Interest rate contract	0.029 (0.630)	0.014 (2.217)	0.017 (0.417)
Peer 2	0.024 (0.483)	−0.001 (−0.131)	0.031 (0.727)
Peer 3	0.071 (1.284)	0.019 (2.568)	0.057 (1.172)
Peer 4	0.024 (0.437)	0.017 (2.266)	0.014 (0.279)
Peer 5	0.159 (2.549)	0.038 (4.495)	0.112 (2.035)
Peer 6	0.083 (1.298)	0.025 (2.891)	0.059 (1.036)
Adj. R^2(%)	8.37	11.03	7.43

Note: t-statistics are provided in parentheses.

Timing of Portfolio Restructuring

To test the reasonableness of the assumption that changes in investment portfolio holdings are made in the quarter that SFAS 115 is adopted rather than before or after, I compare the proceeds from securities sales during 1993 for bank holding companies that adopted in 1993 versus those that adopted in 1994. I also compare annual rather than

[13] The regressions were also estimated allowing the coefficients on the average leverage ratio and the average return on equity to be different for early and late adopters. These coefficients were statistically significant only for the leverage ratio in the fourth quarter of 1993, and the conclusions drawn about changes in the investment portfolio in the quarter of adoption of SFAS 115 were unchanged using this specification.

Table 6

Estimation Results for Changes in Investment Security Holdings in the First Quarter of 1994

Variable	Δ $Investment_{WA}$	Δ Investment	Δ $Investment_{AWA}$
Intercept	−0.052 (−0.468)	−0.022 (−1.598)	−0.002 (−0.016)
Early adoption	0.263 (1.851)	0.032 (2.050)	0.181 (1.402)
Self-selection	−0.153 (−1.725)	−0.019 (−1.947)	−0.103 (−1.282)
Average leverage ratio	−0.311 (−0.288)	0.138 (1.054)	−0.490 (−0.500)
Average return on equity	−0.311 (−0.481)	−0.022 (−0.282)	−0.222 (−0.379)
$Investment_{WA}$	0.000 (0.016)		−0.002 (−0.105)
Investment		−0.024 (−1.396)	
Interest rate contract	−0.084 (−1.576)	0.000 (−0.069)	−0.076 (−1.567)
Peer 2	0.093 (1.682)	0.009 (1.341)	0.079 (1.567)
Peer 3	0.071 (1.120)	0.009 (1.186)	0.064 (1.115)
Peer 4	0.092 (1.462)	0.012 (1.517)	0.070 (1.223)
Peer 5	0.002 (0.029)	0.005 (0.575)	0.002 (0.028)
Peer 6	0.051 (0.667)	0.009 (0.987)	0.048 (0.694)
Adj. R^2(%)	2.28	−0.40	1.23

Note: t-statistics are provided in parentheses.

quarterly proceeds because only annual proceeds are disclosed in the financial statements. If early adopters change investment portfolio holdings during 1993, then, correcting for the self-selection bias, these bank holding companies should have higher proceeds during this period. For proceeds on sales of investment securities, I conduct a regression analysis similar to the analysis for changes in investment portfolio holdings. The results of the regression analysis of turnover of the investment portfolio in 1993 indicate that controlling for past portfolio turnover, bank holding company peer group, and the self-selection bias, early adopters had a higher portfolio turnover in 1993 than late adopters. The results of this regression provide some support for the assumption that changes in the investment portfolio were made in the period when SFAS 115 was adopted.

In addition, the regressions performed during the period of the accounting change are also estimated for the same quarters during 1991 and 1992. Finding no significant difference in the change in investment portfolio holdings during these early periods for companies that adopted SFAS 115 early versus those that did not would provide reassurance that any differences found during the SFAS 115 adoption period are actually attributable to the accounting change. In the estimation of the equations reported in Tables 4 and 5 for the same quarters in 1991 and 1992, I find no evidence of differences between the early adopters and other companies.[14]

PROPORTION OF SECURITIES CLASSIFIED AS AVAILABLE-FOR-SALE

An alternative approach that can be used to reduce the volatility in reported equity that results from the adoption of SFAS 115 is to reduce the proportion of securities classified as available-for-sale. A regression model is estimated to examine how the desire to maintain flexibility in investment portfolio management and to reduce volatility of reported capital affects the proportion of investment securities classified as available-for-sale.

The importance of liquidity and interest rate risk management is measured using past portfolio turnover. The benefit of being able to sell investment securities for liquidity or interest rate risk management is assumed to be higher for bank holding companies, the more active their management of the investment portfolio has been. Portfolio turnover is used to measure the level of portfolio management activity. Bank holding companies with higher portfolio turnover are expected to classify a larger proportion of their investments in the available-for-sale portfolio.

The importance of influencing reported earnings through the sale of securities is measured using the past excess securities gains recognized. The benefit of being able to recognize gains on the sale of securities

[14] The largest t-statistic found in these estimations was 1.315 and generally the t-statistics were less than 1.

to influence earnings is assumed to be higher for bank holding companies that recognize a disproportionate amount of gains on security sales. Excess securities gains recognized are computed as the difference between the ratio of recognized gains to the market value of investment securities, and the ratio of unrealized gains to the market value of investment securities multiplied by the portfolio turnover. This measure assumes that in the absence of earnings, management gains will be recognized in proportion to the unrealized gains. The average past securities gains recognized are used as an alternative measure of the desire to influence reported earnings through the recognition of gains on securities sales.

As for the change in investment portfolio maturity regression, the importance of reducing reported equity volatility is measured using the leverage ratio and return on equity. The cost of increasing equity volatility is assumed to be negatively related to the level of these ratios and, therefore, the proportion of securities classified as available-for-sale is assumed to be positively related to the level of these ratios.

I also include several control variables in the regression to capture other factors that may be important in explaining the proportion of securities classified as available-for-sale. Since the sensitivity of the investment portfolio value to changes in interest rates will depend on the timing of cash flows from the securities held, I include a measure of the maturity of the investment portfolio. In addition, the size of the bank holding company may be important in determining how active the investment portfolio management is, and may also be related to the other measures included in the regression. Therefore, I add peer group dummy variables as control variables.

Estimation Results

Table 7 reports the results of regression analysis of the proportion of securities classified as available-for-sale. The results show that reducing volatility in reported capital as well as maintaining flexibility in managing liquidity and interest rate risk, and in influencing reported earnings are important in deciding what proportion of securities to classify as available-for-sale.

Table 7

Estimation Results for Proportion of Securities Classified as Available-for-Sale

Variable			
Intercept	0.254 (2.399)	0.258 (2.434)	0.218 (2.053)
Average leverage ratio	1.830 (1.480)	1.883 (1.520)	1.825 (1.492)
Average return on equity	2.035 (2.139)	2.007 (2.108)	2.333 (2.458)
Positive past excess gains			39.735 (2.431)
Past excess gains	13.142 (2.244)	12.451 (2.104)	1.524 (0.203)
Past gains		66.574 (0.850)	
Past portfolio turnover	0.462 (3.407)	0.398 (2.560)	0.338 (2.354)
$\text{Investment}_{\text{maturing}<1}$	0.666 (1.506)	0.675 (1.524)	0.741 (1.689)
$\text{Investment}_{1<\text{maturing}<5}$	−0.115 (−0.393)	−0.213 (−0.677)	−0.080 (−0.277)
$\text{Investment}_{\text{maturing}>5}$	0.317 (1.397)	0.249 (1.033)	0.360 (1.596)
Peer 2	−0.072 (−1.016)	−0.062 (−0.863)	−0.074 (−1.053)
Peer 3	−0.039 (−0.564)	−0.030 (−0.423)	−0.036 (−0.522)
Peer 4	0.003 (0.046)	0.007 (0.098)	0.005 (0.072)
Peer 5	−0.036 (−0.442)	−0.029 (−0.351)	−0.036 (−0.445)
Peer 6	−0.057 (−0.647)	−0.054 (−0.615)	−0.048 (−0.553)
Adj. R^2(%)	2.78	2.66	4.84

Note: t-statistics are provided in parentheses.

The significantly positive coefficient on portfolio turnover suggests that bank holding companies that have more actively engaged in liquidity and interest rate risk management in the past classify a higher fraction of their investment securities in the available-for-sale portfolio.[15] Similarly, the significantly positive coefficient on excess gains on securities sales indicates that bank holding companies that have used gains on the sale of securities to influence reported earnings and capital in the past classify a higher proportion of securities as available-for-sale. The positive coefficients on both the leverage ratio and return on equity suggest that bank holding companies with more capital and higher earnings are more willing to incur the increased volatility in reported equity that will occur when a higher fraction of their investments are included in the available-for-sale portfolio. The coefficients on the average leverage ratio, however, are only significant at the 7 percent level using a one-tailed test.

The size of the bank holding company and the maturity of the investment portfolio are generally not important in explaining the proportion of securities classified as available-for-sale.

CONCLUSIONS

Bank managers and regulators have opposed the adoption of SFAS 115, claiming that the increased volatility in reported equity caused by this accounting standard is not indicative of true volatility in equity and will cause bank holding companies to alter their investment portfolio management. In addition, they have argued that banks will continue to have opportunities for manipulating the numbers reported in the financial statements.

Based on bank holding companies' response to the implementation of SFAS 115, this article provides several pieces of evidence that suggest that bankers' and regulators' concerns about the impact of SFAS 115 are well-founded. The decrease in both the proportion and maturity of investment securities held in the quarter when SFAS 115 was adopted, and the reduction in the proportion of securities classified as available-for-sale as bank holding companies' average leverage ratio and average return on equity decline indicate that concerns about volatility in reported equity induced by SFAS 115 led to a change in investment portfolio management.

The importance of the leverage ratio and return on equity in the decision to adopt SFAS 115 early, and the higher proportion of securities classified as available-for-sale if excess securities gains have been recognized in the past indicate that management can still influence the numbers reported in the financial statements under SFAS 115. Management of the investment portfolio under SFAS 115 appears to be affected both by a desire to reduce the volatility in reported capital and the desire to maintain flexibility to influence reported earnings through the recognition of gains on security sales.

If the documented changes in investment portfolio management continue, they could have important consequences for the banking industry and the economy. Although no attempt is made in this article to assess how costly these changes will be, shortening the maturity of the investment portfolio may result in a reduction in the interest income earned by bank holding companies or may increase their interest rate risk. Reduction of the flexibility to sell securities from the held-to-maturity portfolio may increase the cost of managing liquidity and interest rate risk. Reduced flexibility in liquidity management could make banks unable to meet increases in loan demand, thereby decreasing the availability of credit. Increased exposure to changes in interest rates could make the banking industry more volatile.

Even in the absence of changes in the investment portfolio, including the effects of SFAS 115 in regulatory capital could be costly if bank holding companies must maintain additional capital or if regulatory actions are taken against viable bank holding companies as a result of the change in accounting method. The recent decision by regulators to exclude the effects of SFAS 115 from the definition of regulatory capital ratios may lead to further changes in investment portfolio management that will ameliorate these effects.

[15] For the model presented in the third column of Table 7, the coefficient on this variable is only significant at the 7 percent level using a one-tailed test.

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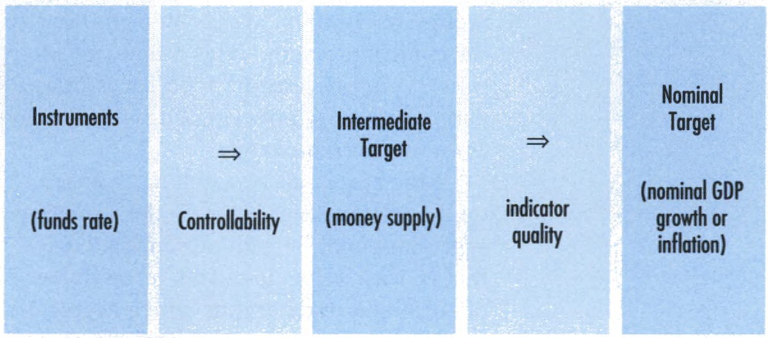
Narrow Vs. Broad Measures of Money as Intermediate Targets: Some Forecast Results

Michael J. Dueker

One of the key challenges of monetary policy is to forecast the links between policy actions and the ultimate objective of stabilizing prices. Measures of the money supply have long been considered links between monetary policy actions and the course of nominal spending and prices. Central banks around the world adopted monetary targets to stop the acceleration of inflation in the 1970s. The strategy worked to end the acceleration of inflation and to lower the inflation rate to moderate levels. The occurrence of high and accelerating inflation, however, triggered financial innovation and deregulation, two processes that seem to have destabilized the income velocity of money. In response, central banks have begun to target their objectives more directly. In some cases, such as New Zealand, Canada and the United Kingdom, they have adopted explicit multi-year targets for inflation. In others, such as the United States, the monetary targets were deemphasized and the *de facto* policy appears to be something like nominal GDP growth targeting. The question is whether any role remains for intermediate monetary targets.

In the United States, the Federal Reserve uses the interest rate on bank reserves, the federal funds rate, as a guide for supplying bank reserves, so that the monetary aggregates, even the monetary base, are not directly controlled. Here I assume the monetary authority makes policy operational by setting quarterly targets for either nominal spending growth or the rate of inflation. Thus, using a monetary aggregate as an intermediate target implies a multi-stage process that can be diagrammed in the following way:



The monetary aggregate used as an intermediate target ideally has two properties: First, the monetary aggregate ought to be controllable in the sense that policymakers know where to set the policy instrument in order to obtain the desired growth in the money supply. Second, it should have a predictable, though not necessarily stable, relationship with the nominal target variable. If the nominal target variable is nominal GDP, then the intermediate monetary aggregate ought to have a predictable velocity. If the target variable is inflation, then the demand for real money balances ought to be predictable.

No intermediate target will be perfect with regard to these two properties. An intermediate target, however, will be a more useful link between policy actions and the nominal target if its errors as an indicator are small and negatively correlated with the errors in controlling it. In other words, the two errors might largely cancel each other on a regular basis, implying that an intermediate monetary target could potentially improve the policy process.

Control error, which results from imprecise policy control over the growth of central bank credit and thereby the money supply measures, forces policymakers to forecast the effects of policy actions on the monetary aggregates. The study of control error is not new, although the present analysis brings different statistical techniques to bear. Other empirical studies of monetary control published in this *Review* include Andersen and Karnosky (1977) and Thornton (1992). In related work, Feldstein and Stock (1993) suggest using M2 as an intermediate target when the nominal target is nominal GDP. They propose a system of uniform reserve requirements on all M2 accounts to remedy the control problem.[1] This article, in contrast, explicitly considers control error as part of monetary policymaking with money as an intermediate target.

Much previous research has focused on the relationships between the monetary aggregates and the path of nominal GDP, that is, their velocities. This research has often sought to determine which aggregates have stable velocities. The implication has been that the best intermediate target is the monetary aggregate with the most stable velocity. For example, based on the apparent long-run stability of M2's velocity from the late 1950s through the late 1980s, many people viewed it as a reliable nominal anchor (Hallman, Porter and Small, 1991). In the early 1990s, however, M2 velocity increased at a time when its opportunity cost generally decreased by a sufficient amount to raise doubts about the stability of its velocity (Feinman and Porter, 1992; Ritter, 1993).

The comparisons between aggregates in this article, on the other hand, focus on the predictability of an aggregate's velocity, not its stability. Furthermore, in the literature on intermediate targeting, the dual problems of monetary control and velocity are acknowledged but they are often addressed separately. This article addresses both jointly in a consistent statistical framework. One caveat, however, is that one time-series forecasting method will be used. Thus, the results are conditional on this method and may be sensitive to changes in the methodology.

This article quantitatively investigates the twin issues of controllability and indicator quality associated with using one of the monetary aggregates as an intermediate target. Restated in concrete terms, the issues are: First, how predictable is the relationship between changes in the funds rate and growth in monetary aggregates? Second, how predictable is the relationship between the monetary aggregates and the nominal targets (nominal GDP growth and inflation)? Third, which monetary aggregate would likely produce the compound forecast error (instruments to money to nominal target) with the smallest variance?[2]

The next section describes the forecasting model used to generate estimates of the error variances in the links between the funds rate, alternative monetary intermediate targets, and two alternative nominal targets: nominal GDP growth and inflation. The third section presents empirical results which consist of one-step-ahead, mean-squared forecast errors for the control error, the velocity error and their sum, the compound error, along with tests for serial correlation. I also perform Bartlett tests for equal variance among the compound errors for the alternative monetary intermediate targets. The fourth section summarizes the results and concludes with policy implications.

USING MONEY TO LINK POLICY ACTIONS TO NOMINAL TARGET VARIABLES

This article includes two sets of results, depending on whether the operational goal of policy is to steer nominal GDP growth or inflation. Of course, long-run inflation will tend to equal long-run nominal GDP growth minus growth in potential real GDP, but in the short run, nominal GDP and inflation may differ in the extent to which they have predictable relationships with the monetary aggregates.

I study four different measures of the money supply as potential intermediate targets: the adjusted monetary base (MB) as calculated by the Board of Governors; M1; M2; and a newer measure called M2-Plus (M2+), which consists of M2 augmented by bond and equity mutual funds.[3]

In equation 5 below, GDP stands for *nominal* GDP and *ff* for the federal funds rate. The rate of nominal GDP growth accompa-

[1] Thornton (1992) also discusses the possibility of applying reserve requirements across all M2 accounts.

[2] For a broad survey of potential intermediate targets for monetary policy, including variables other than monetary aggregates, see *Intermediate Targets and Indicators for Monetary Policy*, a publication of the Federal Reserve Bank of New York.

[3] See Orphanides, Reid and Small (1994) and Collins and Edwards (1994) for a complete description of M2+.

nying a given change in the funds rate can be written as the sum of three components: the predicted growth in GDP given predicted growth in the monetary aggregate; the predicted growth in the monetary aggregate given the change in the funds rate; and an overall forecast error:

$$\Delta \ln\left(\frac{GDP}{1+ff}\right)_t$$

$$(1) \quad = \Delta \ln\left(\frac{GDP}{MB}\right)_{t|t-1} + \Delta \ln\left(\frac{MB}{1+ff}\right)_{t|t-1} + e_{1t}$$

$$(2) \quad = \Delta \ln\left(\frac{GDP}{M1}\right)_{t|t-1} + \Delta \ln\left(\frac{M1}{1+ff}\right)_{t|t-1} + e_{2t}$$

$$(3) \quad = \Delta \ln\left(\frac{GDP}{M2}\right)_{t|t-1} + \Delta \ln\left(\frac{M2}{1+ff}\right)_{t|t-1} + e_{3t}$$

$$(4) \quad = \Delta \ln\left(\frac{GDP}{M2+}\right)_{t|t-1} + \Delta \ln\left(\frac{M2+}{1+ff}\right)_{t|t-1} + e_{4t}$$

$$(5) \quad = \Delta \ln\left(\frac{GDP}{1+ff}\right)_{t|t-1} + e_{0t},$$

where $t \mid t-1$ denotes the value forecasted for time t using information available through time $t-1$.

The forecast error in equation 5, e_{0t}, is based on a direct forecast of the relationship between the funds rate and nominal GDP growth, without reference to an intermediate target. This forecast error will serve as a baseline against which the others, $e_{1t}, \ldots, e_{4t}$, are measured, that is, the extent to which an intermediate target reduces the overall or compound error.[4] The forecast errors, $e_{1t}, \ldots, e_{4t}$, are compound errors in that they equal the sum of the velocity forecast error and the control error. For example, for *M1*

$$e_{2t} = \Delta \ln\left(\frac{GDP}{M1}\right)_t - \Delta \ln\left(\frac{GDP}{M1}\right)_{t|t-1}$$

$$+ \Delta \ln\left(\frac{M1}{1+ff}\right)_t - \Delta \ln\left(\frac{M1}{1+ff}\right)_{t|t-1}$$

$$= \textit{velocity error} + \textit{control error}.$$

When discussing the results, I use root mean-squared forecast error as the criterion in judging, for example, whether e_1 is large relative to e_0. The paper also includes analogous comparisons in which inflation, measured by the percentage change in the implicit GDP price deflator, is assumed to be the nominal target of monetary policy. In this case, the price level is substituted for *GDP* and the error in predicting velocity is replaced with the error in predicting the demand for real balances in equations 1-5.

A FORECASTING MODEL FOR UNSTABLE RELATIONSHIPS

To generate the forecasts needed to estimate the magnitude of the uncertainty from control and velocity error for alternative monetary aggregates, I use two time-varying coefficient models that do not rely on stable relationships for their forecasts: One is for the control relationship between the funds rate and money growth; the other is for the velocity relationship between money growth and growth in the nominal target. Two reasons not to rely on the existence of stable relationships are: (1) M2 velocity, which had been the most stable among the velocities of money, has not appeared stable in recent years; and (2) the relationship between monetary growth and changes in the funds rate almost certainly varies with factors such as the level of inflation, the stage of the business cycle and the degree of credibility of the central bank.

Bernanke (1993) and Eichengreen (1992) argue that the loss of credibility among central banks led to a shift from stabilizing speculative flows in the pre-World War I period to destabilizing speculative attacks in the inter-war period. One implication is that larger policy actions are needed to achieve the same result in the face of destabilizing speculation. Hence, the relationship between the policy instrument and money growth varies with central bank

[4] Note that all variables are measured as a percent.

credibility. In the sample period used in this paper, 1959-94, the credibility of the Federal Reserve probably decreased in the 1970s when inflation accelerated in contradiction to stated policy objectives. The disinflation of the early 1980s, however, probably enhanced the credibility of the Federal Reserve, because it largely achieved its stated intention of reducing inflation. Moreover, at the statistical level, Dueker (1993) includes tests that reject constant-coefficient models of velocity growth in favor of time-varying coefficient models.

I implement a time-varying coefficient (TVC) forecasting model using the Kalman filter. The TVC model allows for heteroskedastic errors, which means the Kalman filter updates the inferred coefficients cautiously when the error variance is high and more liberally when the variance is low. This feature helps the model use the optimal signal-to-noise ratio each period when updating the coefficients and forming next period's forecast.

To keep the forecasting models parsimonious, I limit the models to three explanatory variables: quarterly changes in the three-month and 10-year bond yields and lagged money growth. The changes in the three-month and 10-year rates summarize developments in the yield curve, which varies with the business cycle, and also indicates when asset substitution is likely to occur between short- and long-maturity assets. Thus, when forecasting changes in M1 velocity, for example, the third explanatory variable is lagged M1 growth:

$$(6)\ \Delta \ln\left(\frac{GDP}{M1}\right)_{t|t-1} = \beta_{0t} + \beta_{1t}\,\Delta TB3mo_{t-1} + \beta_{2t}\,\Delta TB10yr_{t-1} + \beta_{3t}\,\Delta \ln M1_{t-1},$$

where $TB3$mo is the three-month Treasury bill yield, and $TB10$yr is the constant maturity, 10-year Treasury bond yield. The coefficient on lagged M1 growth, β_{3t}, is expected to have a negative sign because faster money growth does not generally lead to a one-to-one increase in nominal GDP growth immediately. The estimated coefficient tends to be less than unity because some of the stimulus is absorbed by decreases in velocity due to lagged adjustments, and because of time aggregation and other factors. The three-month and 10-year bond yields provide information about the changing opportunity costs of different types of savings accounts by providing information on yield curve spreads.

Similarly, the equation for predicting the relationship between changes in the funds rate and M1 growth takes the form

$$(7)\ \Delta \ln\left(\frac{M1}{1+ff}\right)_{t|t-1} = \beta_{0t} + \beta_{1t}\,\Delta TB3mo_{t-1} + \beta_{2t}\,\Delta TB10yr_{t-1} + \beta_{3t}\,\Delta \ln M1_{t-1}.$$

The coefficients on the lagged short and long-term interest rates are both expected to be negative, because higher interest rates at all points along the yield curve will generally be associated with a higher funds rate and lower M1 growth. The coefficient on lagged M1 growth, on the other hand, does not have a clearly implied sign. When policy is geared toward disinflation, high M1 growth in the last period can portend substantial increases in the funds rate, implying decreases in the M1/funds rate ratio. When nominal interest rates are relatively stable, however, positive serial correlation in M1 growth rates can imply a positive coefficient.

The accompanying box contains plots of the time-varying coefficients for the M1 equations to illustrate the changes in relationships between variables in the sample period. Further details on the forecasting model are also in the appendix and in Kim (1993).

ESTIMATED VELOCITY AND CONTROL FORECAST UNCERTAINTY

Case I: Nominal GDP as the Nominal Target Variable

Table 1 contains results for nominal GDP growth, including four cases with alternative intermediate monetary targets and one in which no intermediate target is employed. Control error refers to the error in predicting

Changes in Time-Varying Coefficients

Figures 1-4 illustrate the changes in the coefficients on the variables explaining the growth in M1 velocity over time. The financial deregulation of the late 1970s and early 1980s appears to have brought structural change to M1 velocity that was only partially undone when the inflation rate stabilized in the mid-1980s. The drift in M1 velocity was steady until the late 1970s, when it decreased, never to return to its 3 percent annual upward trend of the 1960s and 1970s. The response of M1 velocity to changes in the three-month T-bill rate, for example, declined in an irregular pattern until the early 1980s when checkable deposits began paying interest. The response of M1 velocity to changes in the 10-year Treasury bond rate, on the other hand, has generally trended upward from the beginning of the sample period until the late 1970s. Since then it has been fluctuating around a positive value. The coefficient on lagged M1 growth is negative and suggests that high M1 growth today will lead to decreased velocity next quarter, although this elasticity was near zero when inflation was high in the late 1970s and early 1980s.

Figures 5-8 illustrate the estimated changes in the coefficients from equation 7. In general, the coefficients underwent relatively large changes or changes in their trend around the time the inflation rate was stabilized in the mid-1980s. In the late 1960s and 1970s, inflation gradually accelerated, and in the late 1970s and early 1980s disinflation occurred until the inflation rate stabilized at an annual rate of roughly 3 or 4 percent. The drift or intercept term in Figure 5 shows an upward trend until inflation stabilized and then decreased dramatically before resuming an upward trend again. The coefficients on the short- and long-term interest rates are negative as expected. The coefficient on the short rate, shown in Figure 6, became less negative until the mid-1980s, when it became more negative than in the 1960s. The response of the M1-federal funds rate ratio became more negative from the beginning of the sample period through the late 1980s. The coefficient on lagged M1 growth shifted from positive in the 1960s to negative during the period of high and volatile interest rates, and then became positive and larger as inflation and interest rates declined.

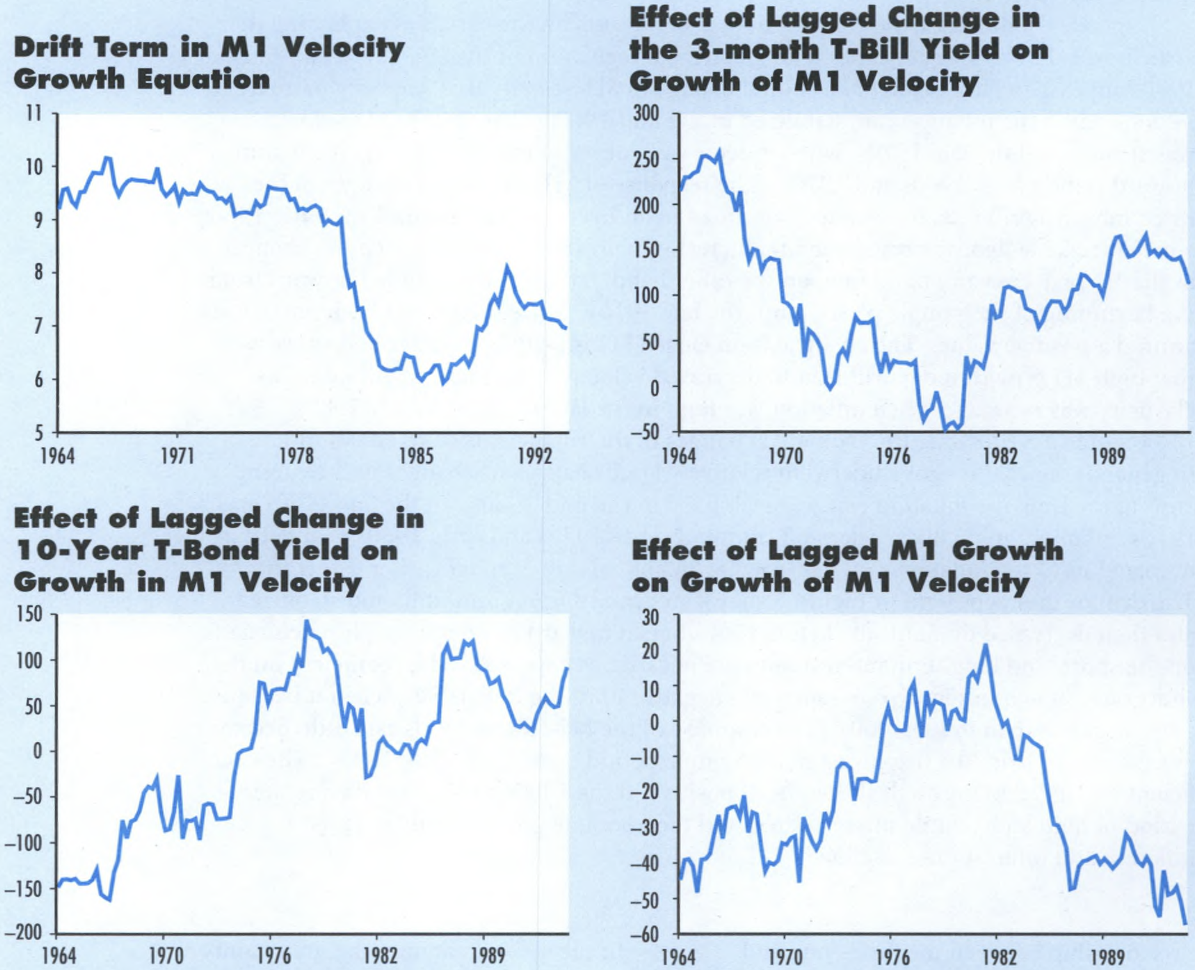
the relationship between the funds rate and money growth. Velocity error stems from the uncertain link between money growth and nominal GDP growth. Summing the errors yields the compound error. Moving across columns in Table 1, we start with control error.[5]

In the first column, we see that narrower measures of money are generally more controllable than broader ones. The Q statistics in parentheses indicate whether the forecast errors displayed significant serial correlation. The χ^2_{24} critical value is 36.4, which is exceeded only by the control error for the base. With this lone exception, however, the Q statistics are not significant in the control errors, the velocity errors or the compound errors in Table 1, so the forecasting models almost uniformly generate forecast errors which are not significantly serially correlated.

In the second column, the uncertainty in velocity is apparently not directly linked to the narrowness of the monetary aggregate. The base, M1 and M2 have very similar degrees of uncertainty in velocity. Hence, even though base and M1 velocity are not as stable as M2 velocity, they are roughly as predictable. In the the third column, the uncertainty in the compound errors indicates that the variance of the sum is uniformly less than the sum of the variances, which implies that the covariances between control and velocity errors are negative. M1 has the lowest RMSE in the compound error, but is closely followed by the null choice of no intermediate target and the monetary base. To test whether the forecast error variance for M1 is significantly lower than the variances associated with the other measures, I performed Bartlett tests for equal variances

[5] I report results from 1964:Q1 through 1993:Q4 even though the sample starts in 1959:Q3, because several early observations are set aside to initialize the Kalman filter.

Figures 1-4

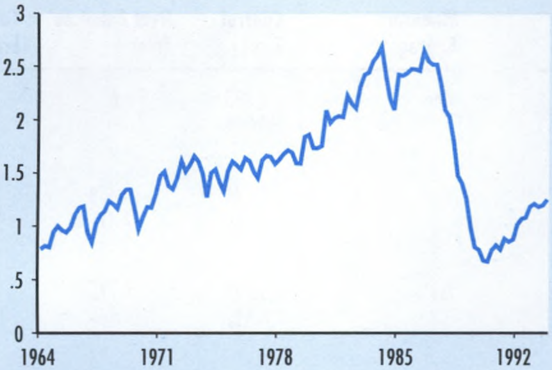


across the compound errors. M2+ had the highest test statistic of 0.064, but this is still well below the χ_1^2 critical value of 3.8. M1 has the lowest compound forecast error variance in the links between monetary policy actions and nominal GDP growth, but the other monetary aggregates have variances that are not significantly higher.

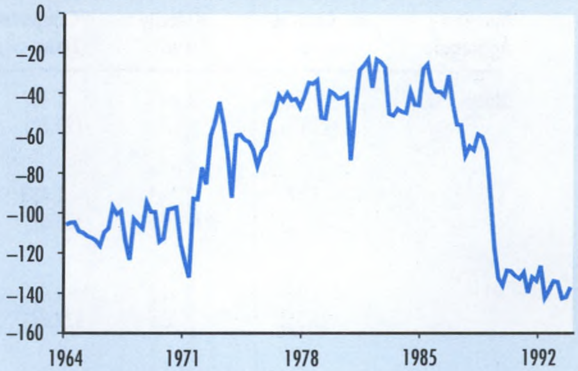
Since this exercise was conducted with quarterly data, however, this method of calculating the compound forecast errors may overstate control errors, because data on reserves, the base and monetary aggregates are available on a weekly basis. Within each quarter, policymakers could change the funds rate in response to any emerging control error to try to hit the end-of-quarter monetary target. In practice, however, the Fed seeks to mitigate excess volatility in short-term interest rates (Bryant, 1983). Thus, the claim that weekly money-supply data would allow the achievement of zero control error is not realistic either. The true degree of uncertainty lies somewhere between the control errors reported here and zero. Moreover, the ability of policy to respond to intra-quarter developments in money growth is difficult to quantify, given current Federal Open Market Committee (FOMC) procedures for changing the funds

Figures 5-8

Drift Term in the Relationship Between the Federal Funds Rate and M1 Growth

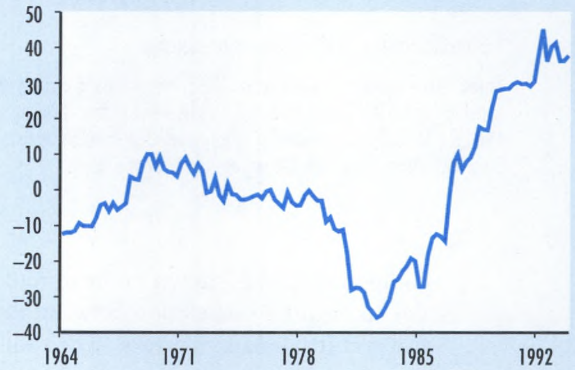


Effect of Lagged Change in the 3-Month T-Bill Yield in Predicting the Relationship Between the Federal Funds Rate and M1 Growth



Effect of Lagged Change in the 10-year T-Bond Yield in Predicting the Relationship Between the Federal Funds Rate and M1 Growth

Effect of Lagged M1 Growth in Predicting the Relationship Between the Federal Funds Rate and M1 Growth



rate between regular meetings, which take place every six to eight weeks. Any attempt to adjust the estimated control errors for intra-quarter funds rate adjustments is beyond the scope of this study.

Case II: Inflation as the Nominal Target Variable

This section performs analogous, but not directly comparable, analysis of potential intermediate targets under the assumption that the rate of inflation is the nominal policy target. When inflation is the ultimate objective, it is necessary to forecast growth in the price level/money supply ratio (the negative of the growth rate of real balances), rather than velocity growth. The control errors are unaffected as we change the nominal target variable objective, except for the control error resulting from targeting the inflation rate directly from the federal funds rate, that is, with no intermediate target. With this exception, the first column in Table 2 is the same as in Table 1.

In the analysis of Table 2, we begin in the second column by noting that the base and M2 have the most predictable relationships with inflation. M1 has somewhat higher real balances error, but still achieves the lowest

Table 1

Intermediate Targetry Comparison
(nominal target: nominal GDP; policy instrument: federal funds rate)

Monetary Aggregate	Root Mean-Squared Forecast Errors (RMSE) Control Error	Velocity Error	Compound Error
None*	1.467 (23.70)	n.a.	1.467 (23.70)
Base	1.171 (40.95)	1.103 (17.01)	1.483 (26.68)
M1	1.349 (25.55)	1.122 (24.85)	1.450 (22.27)
M2	1.647 (31.35)	1.121 (20.68)	1.529 (30.85)
M2+	1.771 (31.98)	1.305 (20.86)	1.539 (29.53)

* Direct forecasts of GDP/funds rate relationship

Notes: Mean-squared forecast error (MSFE) for compound error is not equal to sum of MSFEs due to covariances between errors. Time period: 1964:Q1-1993:Q4. Q statistic for serial correlation in parentheses: 5 percent critical value with 24 degrees of freedom is 36.4

Table 2

Intermediate Targetry Comparison
(nominal target: inflation; policy instrument: federal funds rate)

Monetary Aggregate	Root Mean-Squared Forecast Errors (RMSE) Control Error	Real Balances Error	Compound Error
None*	1.393 (33.01)	n.a.	1.393 (33.01)
Base	1.171 (40.95)	0.489 (17.41)	1.447 (28.32)
M1	1.349 (25.55)	0.710 (19.86)	1.243 (29.12)
M2	1.647 (31.35)	0.463 (23.59)	1.290 (40.91)
M2+	1.771 (31.98)	0.644 (17.88)	1.272 (38.21)

* Direct forecasts of inflation/funds rate relationship

Notes: Mean-squared forecast error (MSFE) for compound error is not equal to sum of MSFEs due to covariances between errors. Time period: 1964:Q1-1993:Q4. Q statistic for serial correlation in parentheses: 5 percent critical value with 24 degrees of freedom is 36.4

compound RMSE, shown in the third column, due to negative correlation between the control and real balances errors. The root mean square of the compound errors of M2 and M2+ are only slightly larger than for M1, but they are significantly serially correlated, as indicated by the statistics. As with the nominal GDP results, the Bartlett tests for differences in compound forecast error variances prove to be rather weak; once again, the test failed to reject the hypothesis that the other monetary aggregates had the same compound forecast error variance as M1. The monetary base had the highest Bartlett test statistic of 0.62, which was nonetheless below the χ_1^2 critical value of 3.8. As with nominal GDP, M1 has the lowest compound forecast error variance in the links between monetary policy actions and inflation, but the other monetary aggregates have variances that are not significantly higher.

SUMMARY AND CONCLUSIONS

This article has shown that the errors in predicting the effect of policy actions—summarized by changes in the federal funds rate—on the growth of potential intermediate monetary targets (control errors) are often as large or larger than the error in predicting changes in the velocities of the monetary aggregates (velocity error). Thus, control error, an often-neglected dimension of using money as an intermediate target, appears to be of roughly equal concern as velocity error in evaluating alternative monetary aggregates as intermediate targets.

With respect to the question of whether to use M1 or M2 as an intermediate target, I find that, when accounting for both control and velocity error, M1 and M2 achieve compound forecast errors that are not significantly different from each other, whether nominal

GDP or inflation is the assumed nominal target variable. One obvious question, however, is whether the use of a monetary intermediate target offers any advantages relative to forecasting directly the effects of policy actions on the nominal policy target—nominal GDP growth or inflation. M1 is the only monetary aggregate with RMSEs uniformly lower than the RMSEs associated with direct forecasts of the relationships between the funds rate and both nominal GDP growth and inflation. Bartlett tests for equality of forecast error variances fail to find a statistically significant difference between the forecast error variances, however. Thus, the evidence in favor of using an intermediate target variable is not decisive.

The emphasis on control error in this article also serves to remind market participants that recent growth rates in the monetary aggregates do not necessarily represent the thrust of monetary policy, given that control and velocity errors are generally negatively correlated. Thus, control error introduces a potentially large difference between the rate at which the money supply is actually growing and the rate of effective or velocity-adjusted money growth. Thus, at times when observers have expressed concern about unusually fast or slow M2 growth, for example, it is likely that control error was responsible for much of the anomaly. Figure 9 illustrates this point by plotting the difference between actual M2 growth and the growth that would have taken place if there had been no control error, that is, if M2 had turned out as predicted. Figure 9 shows the relationships between predicted and actual M2 quarterly growth rates and inflation. In the late 1970s and early 1980s, predicted M2 growth signalled a tightening of monetary policy that preceded the disinflation of the early 1980s, whereas actual M2 gave no such signal. An increase in predicted M2 growth in the mid-1980s also indicated that the inflation rate would stop falling. Actual M2 growth rates, on the other hand, continued to decrease. In the early 1990s, predicted M2 growth has been consistently stronger than actual M2 growth, indicating that the inflation rate would not continue falling toward zero, as some analysts projected.

Figure 9

Relationships Between Predicted and Actual M2 Growth and Inflation

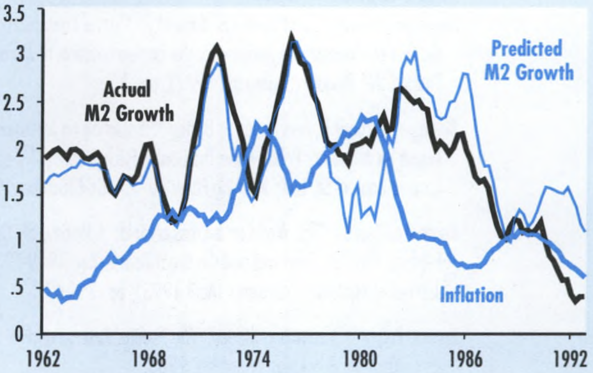


Figure 10

Actual and Predicted M2 Growth and the FOMC's Target Range

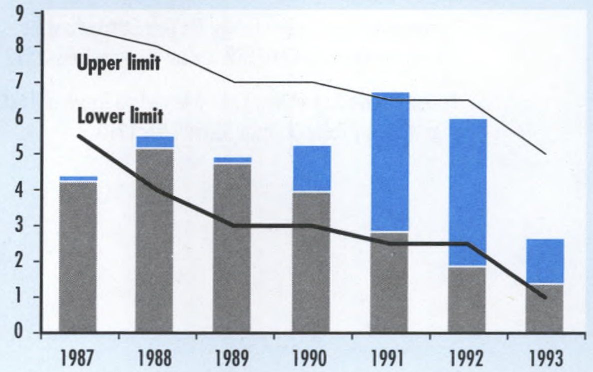


Figure 10 highlights the effect of M2 control errors on the latter part of the sample period. The graph includes the upper and lower limits for the FOMC's announced M2 growth targets along with actual M2 growth and what M2 growth would have been absent control error. The chart shows that in 1991-93, M2 growth adjusted for control error was near the upper range of the FOMC target range, as opposed to actual M2, which languished near the bottom of the target range. The former was suggestive of the relatively strong economic recovery that developed in 1994, whereas actual M2 growth was not. Thus, adjusting M2 growth for the control errors can often provide a better policy indicator than the unadjusted data, which can make policy appear more inflationary or disinflationary than it is.

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Appendix

TIME-VARYING COEFFICIENTS

The time-varying coefficient model that generates the short-run forecasts is

(1) $y_t = X_{t-1}\beta_t + e_t$

(2) $\beta_t = \beta_{t-1} + v_t$

$v_t \sim Normal(0, \boldsymbol{Q}),$

where y is the dependent variable and X_{t-1} is a vector of explanatory variables. With time-varying coefficients, equation 1 (in the first section) will be estimated using the Kalman filter under the assumption that the state variables, β_t, follow random walks. In a short-run forecasting context, the assumption that the coefficients follow random walks suggests that people need new information in order to change their view about the relationships among variables. The innovations, v, to the coefficients are assumed to be uncorrelated, so the covariance matrix $\boldsymbol{Q}$ is diagonal.

The errors in equation 1, e_t, have time-varying volatilities in that their variance is assumed to switch between a low and high level according to a first-order Markov process.[1]

$$e_t \sim Normal(0, h_t)$$
$$h_t = \sigma_0^2 + \left(\sigma_1^2 - \sigma_0^2\right) S_t$$
$$S_t \in \{0,1\}$$
$$\sigma_1^2 > \sigma_0^2$$

$$\text{Probability}(S_t = 1 | S_{t-1} = 1) = p$$
$$\text{Probability}(S_t = 0 | S_{t-1} = 0) = q.$$

By construction, this model allows for two sources of forecast error: error in predicting the value of the coefficients and the heteroskedastic random disturbance.[2] In a model with time-varying coefficients,

(3) $y_t = X_{t-1}\beta_t + e_t,$

and the one-step-ahead forecasts are

(4) $y_{t|t-1} = X_{t-1}\beta_{t|t-1}.$

Thus, the forecast errors have two components and equal

$$X_{t-1}\left(\beta_t - \beta_{t|t-1}\right) + e_t.$$

If the variance of

$$\left(\beta_t - \beta_{t|t-1}\right) \equiv R_{t|t-1} \text{and var}(e_t) \equiv \sigma_e^2,$$

the one-step-ahead forecast error variance is

(5) $H_t \equiv H_{1t} + H_{2t} = X_{t-1}R_{t|t-1}X'_{t-1} + \sigma_t^2.$

The first component (H_{1t}) is called the variance due to time-varying parameters (TVP); the second (H_{2t}) is simply the variance of the random disturbance, e_t. Inferences regarding the relative sizes of the two sources of forecast error variance play an important role in updating the coefficients. Using the Kalman filtering equations, it can be shown that the forecast $y_{t+1|t}$ can be written as

(6) $y_{t+1|t} = X_t\beta_{t|t-1} + Z_t\eta_{t|t-1},$

where X_t are the explanatory variables, $\eta_{t|t-1}$ is last period's forecast error (and is thus the new information available), and Z_t is proportional to

$$\frac{H_{1t}}{H_{1t} + H_{2t}}.$$

If H_{2t} is large relative to H_{1t}, observers would attribute less of a forecast error to a change in coefficients; rather, they would believe that it was likely to have been an outlier. A large value of H_{2t} then implies that last period's forecast error will play a relatively small role in determining next period's forecast.

[1] Further details on time-varying coefficient models with heteroskedastic errors are in Kim (1993).

[2] Kim (1993) discusses the specific form the Kalman filter takes for this model and the evaluation of the likelihood function, which is maximized with respect to (σ_0^2, σ_1^2, p, q, $\boldsymbol{Q}$), where $\boldsymbol{Q}_{ii} = \sigma_{vi}^2$.

Adam M. Zaretsky is an economist at the Federal Reserve Bank of St. Louis. Cletus C. Coughlin is associate director of research at the Federal Reserve Bank of St. Louis. Heather Deaton and Thomas A. Pollmann provided research assistance. The authors would like to thank Dennis Coleman and E. Terrence Jones for providing us with the data, and Erica Groshen and Joseph Terza for comments on earlier drafts.

An Introduction to the Theory and Estimation of a Job-Search Model

Adam M. Zaretsky and Cletus C. Coughlin

In a dynamic labor market, the process by which people find new jobs is important not only to the individuals themselves but also to policymakers and scholars. This process has attracted increased attention in recent years because of, among other things, announcements by major corporations of large layoffs, technological changes that have resulted in relatively more high-skilled jobs, the alleged effects of changes in trade legislation on the location of business activity, and the high levels of unemployment in Western Europe. Policymakers have been attempting to design training and other programs that would help match an individual's skills with the requirements of potential employers.[1] Job-search models offer some solutions by considering factors that determine individuals' wage demands and, therefore, their prospects for finding an acceptable job offer. Job-search theory takes concepts from static labor market analysis and uses them in an intertemporal setting. It attempts to describe the problems faced by unemployed individuals and to propose strategies for making optimal employment decisions.

To introduce the job-search process, we describe a simple model focusing on the search behavior of an unemployed individual. The worker is assumed to be looking for a job, but may encounter unsuitable offers. In this model, the unemployed individual's decision to accept or reject an offer is reduced to a comparison of the expected benefits from an additional search with the expected costs.

We then introduce a regression model that consists of two equations: one focusing on the individual's probability of reemployment and the other on the individual's expected wage upon employment. Heckman's sample-selection model forms the basis for the statistical analysis because simple regression analysis does not account for the truncated wage information about people who are not presently working and, therefore, leads to biased inferences of the determinants of wage offers.

To illustrate the job-search model, we utilize survey data collected by the St. Louis Economic Adjustment and Diversification Committee from a sample of approximately 1,200 former McDonnell Douglas employees laid off because of defense spending cuts. This survey was the first analysis in the United States that tracked the reemployment history of laid-off defense workers. The illustration highlights the effects that variables such as occupation, education, sex, tenure at McDonnell Douglas and unemployment insurance have on the chance of reemployment and prospective wage offers.

JOB-SEARCH THEORY BACKGROUND

Job-search theory models individuals' decisions of whether to participate in the labor market and whether to change or leave jobs. To convey the major points of the job-search process, we present a simple model that focuses on the basic search behavior of an unemployed worker.[2] The worker is assumed to be looking for a job but, lacking perfect information, may encounter unsuitable offers before finding a job. Each time the unemployed worker receives a job offer, he decides whether to accept the offer based on a previously determined set of criteria. These criteria are extremely important in the decision-making process and are the subject of our investigation.

[1] See Katz (1994) for an evaluation of active labor market policies.

[2] The following discussion uses a model that can be found in Devine and Kiefer (1991, chapter 2). For additional background information, see Lippman and McCall (1976).

Underlying Assumptions

The worker receives job offers that include the wage, hours, benefits and working conditions of the position. For simplicity, however, we assume that the decision to accept or reject the job is based solely on the wage offer. We further assume that hours from all offers are fixed, making "wages" and "earnings" interchangeable. Setting hours equal to one allows w to signify both wages and earnings.

The worker does not know which firm will offer a particular w. He is aware, however, of the general characteristics of the labor market. Offers represent independent realizations from a wage offer distribution with finite mean and variance. Specifically, wage offers have a cumulative distribution $F(w)$ and probability density $f(w)$ that are known to the worker. If the worker does not have an expectation of the types of offers made by particular firms, a *random search* occurs, where independent draws from F are made without recall—once a job is passed over, it can never be returned to.[3]

We assume the worker's income remains constant during the spell of unemployment. This allows for a constant opportunity cost, against which he bases the accept/reject decision. If the individual is risk-neutral, income and utility are equivalent, and we can investigate the individual attempting to maximize the expected present discounted value of income. To facilitate the analysis, we also assume the discount rate, r, is known and constant. In addition, the individual keeps the accepted job forever, implying that he lives forever. Hence, the present discounted value of a job paying w is w/r. This final assumption is not too drastic as long as the discount rate is greater than zero and retirement (or death) is not too close.

These assumptions lead to the worker being equally well-off during the entire unemployment spell. Because income during unemployment never diminishes, utility while unemployed remains constant and no signal about the length of the unemployment spell is offered to a prospective employer. Thus, the newly unemployed person and the person who has been unemployed much longer face the same job prospects. Because each offer received represents an independent draw from the distribution, the worker's accept/reject decision does not depend on the duration of the unemployment spell.

An Optimal Search Strategy

If the worker accepts the offer w, the present value of income received in this and all future periods is w/r. If the worker rejects the offer, the expected present value of income will equal the expected present value of unemployment income received until an acceptable offer is received, plus the expected present value of the income from the acceptable offer. This expectation does not depend on the offer currently being rejected but does depend on the distribution of offers F.

Because the value of employment, w/r, is an increasing function of the wage offer, there must be values of w for which employment is an attractive option; otherwise, the worker would never enter the labor market. There must also be values of w for which employment is not an attractive option; otherwise, the first wage offer would automatically be accepted. Therefore, a wage must exist at which the value of employment equals the value of unemployment. This wage is known as the reservation wage, w^R, and represents an optimal strategy for an individual to follow in this model, because at this wage the marginal cost for an additional search equals the marginal gain from an additional search. Therefore, the individual should accept employment only if the wage offer is at least as great as the reservation wage, or continue searching.

This analysis represents a much-simplified model of the job-search process. By allowing for a cutoff date for receipt of unemployment income, or by introducing finitely lived individuals, we would quickly complicate the model. Each of these changes generates a reservation wage that declines rather than stays constant with duration. This decline occurs in the former from the expectation of income reduction or loss, and in the latter from decreasing the time over which a higher wage would accrue if one waits for a higher wage. By maintaining a constant-reservation

[3] If the worker does have an expectation of the types of offers made by particular firms, he can perform a *systematic search* without recall by sampling offers from F, where F now represents a cumulative distribution of the ranked wage offer distributions from each individual firm. Under a systematic search, each firm can only be sampled once; otherwise, the firm with the best offer distribution would be sampled repeatedly. In addition, because the individual now knows the individual offer distribution of each firm (hence, the ranking), he must choose a reservation wage for each firm according to its rank in the sample.

wage hypothesis, an offer rejected today will also be rejected at any time in the future. Thus, sampling without recall is implied, and the duration of the unemployment spell is unimportant to the decision.

To randomize the receipt of wage offers, we introduce a Poisson process with arrival rate δ, where δ represents the frequency of arrival. The probability of receiving at least one offer in a short interval, h, is $\delta h+o(h)$, where $o(h)$ is the probability of receiving more than one offer in the interval and

$$\lim_{h\to 0}\frac{o(h)}{h}=0.$$

The worker still receives one offer at a time, but the amount of time between offers is not necessarily constant.

To formalize, let V^u represent the worker's value of unemployed search under a constant-reservation wage hypothesis. Offers are independently and identically distributed, and the offer distribution and arrival rates are both known and time-invariant. This value is defined implicitly by

$$(1)\quad V^u=\frac{1}{1+rh}bh +(\delta h)\frac{1}{1+rh}E_w\left[\max\left\{V^e(w),V^u\right\}\right] +(1-\delta h)\frac{1}{1+rh}V^u+o(h)K.$$

The first term on the right-hand side is the present discounted value of the net unemployment income, b, over the interval h. The second term is the probability of receiving an offer in h, multiplied by the expected discounted value of following an optimal policy if a wage offer w is received, where $V^e(w)$ represents the present value of accepting that offer. The third term is the probability of not receiving an offer in h, multiplied by the present discounted value of the search income. The last term is the probability of receiving more than one offer in h, where K denotes the value of the optimal policy when more than one offer is received. Under a Poisson process, the last term goes to zero in the limit.

The present value of accepting an offer w in this model is

$$(2)\qquad V^e(w)=\frac{w}{r}.$$

Because $V^e(w)$ is continuous and increasing in w, while V^u does not depend on the wage offer, the optimal strategy for a worker is a time-invariant reservation wage policy: Accept w if $w\geq w^R$, where w^R, the reservation wage, is the minimum acceptable wage for the worker. It is defined by equating the expected present value of employment with the expected present value of a continued search. That is,

$$(3)\qquad V^e(w^R)=\frac{w^R}{r}=V^u.$$

Substituting equations 1 and 2 into 3 yields:

$$(4)\quad \frac{w^R}{r}=\frac{1}{1+rh}bh +(\delta h)\frac{1}{1+rh}E_w\left[\max\left\{\frac{w}{r},\frac{w^R}{r}\right\}\right] +(1-\delta h)\frac{1}{1+rh}\frac{w^R}{r}+o(h)K.$$

Solving for w^R/r and taking the limit as $h\to 0$, this optimality condition may be written as

$$(5)\qquad w^R=b+\frac{\delta}{r}\int_{w^R}^{\infty}(w-w^R)f(w)dw.$$

Finally, by evaluating this integral and rearranging terms, a more intuitively appealing equation for the reservation wage emerges:

$$(6)\quad (w^R-b)=\frac{\delta}{r}\left(E_w\left[w\middle|w\geq w^R\right]-w^R\right)\left[1-F(w^R)\right],$$

where

$$(7)\qquad E_w\left[w\middle|w\geq w^R\right]=\frac{\int_{w^R}^{\infty}wf(w)dw}{\int_{w^R}^{\infty}f(w)dw}$$

and

$$1-F(w^R)=\int_{w^R}^{\infty}f(w)dw.$$

The left side of equation 6 is the marginal cost of rejecting an offer equal to w^R and continuing to search. The right side represents the discounted expected marginal gain from continuing to search, multiplied by the Poisson probability that an acceptable offer is received. In other words, the right side is the discounted expected marginal revenue from an additional search. Thus, the reservation wage is the wage rate that equates the discounted expected marginal revenue from a search with the marginal cost of a search, and equation 6 represents the optimal stopping rule for the search.

This definition of the reservation wage contrasts with the definition of a reservation wage in a static, deterministic model of labor supply. In the latter, a reservation wage represents a set of preferences determined solely by supply-side factors (the level of non-labor income, fixed costs of labor market entry, and the marginal utility of leisure) without regard for demand-side factors. Search theory's definition of a reservation wage explicitly and necessarily relies on the distribution of wage offers, a demand-side component, as well as supply-side factors. In addition, the reservation wage depends on the arrival rate of offers, a variable relying on the behavior of both firms and the individual. Specifically, in the search model,

$$w^R = w^R(b, r, \delta, \mu), \tag{8}$$

where μ is the mean of the wage offer distribution.

Because of the importance placed on the reservation wage in this model, we want to investigate how changes in the exogenous variables in equation 8 affect it. To understand the intuition, we use equation 6 to describe these effects.

Suppose b, the level of fixed unemployment income net of search costs, increases. This decreases the marginal cost for an additional search while keeping all else constant. The left side of the equation is now less than the right side, implying that the cost for an additional search is less than the expected gain from the search. Thus, the worker, attempting to maximize expected income, increases his reservation wage so that marginal cost will once again equal expected marginal gain, restoring the optimal stopping condition. An increase in either the arrival rate of offers δ or the mean of the wage offer distribution μ produces a similar response because both cause the marginal gain from an additional search to increase (analogous to a decline in the marginal cost).

Suppose, on the other hand, the discount rate r increases. Keeping all else constant, this change decreases the expected gain from an additional search, making it less than the marginal cost. Now, the worker will decrease his reservation wage until the marginal cost once again equals the expected marginal gain, thereby equating margins at the new discount rate to restore the optimal stopping condition.

To formalize the above explanations, we can generate the following derivatives by differentiating the optimality condition in equation 5:

$$\frac{dw^R}{db} = \frac{r}{r + \delta\left[1 - F(w^R)\right]} \in (0,1), \tag{9a}$$

$$\frac{dw^R}{dr} = -\frac{1}{r}\frac{E_w\left[w \middle| w \geq w^R\right] - w^R}{\left[1 + \dfrac{r}{\delta\left[1 - F(w^R)\right]}\right]} < 0, \tag{9b}$$

$$\frac{dw^R}{d\delta} = \frac{E_w\left[w \middle| w \geq w^R\right] - w^R}{\delta + \dfrac{r}{\left[1 - F(w^R)\right]}} > 0, \tag{9c}$$

and

$$\frac{dw^R}{d\mu} = \frac{1}{1 + \dfrac{r}{\delta\left[1 - F(w^R)\right]}} \in (0,1). \tag{9d}$$

These results reinforce the intuitive explanations given above for how the reservation wage changes as the individual variables change.

The Duration of the Unemployment Spell[4]

Estimating the duration of the unemployment spell is possible with a knowledge of the offer distribution because this distrib-

[4] Heckman and Singer (1984) and Kiefer (1988) provide additional background information about duration analysis.

ution governs the stream of offers received. We begin by labeling the conditional acceptance probability as $\phi(w^R)$, where[5]

$$(10) \quad \phi(w^R) = \int_{w^R}^{\infty} f(w)dw = 1 - F(w^R).$$

Multiplying $\phi(w^R)$ by the probability of receiving an offer in the short interval h, $\delta h + o(h)$, we can define the probability that a received offer leads to employment. We label this as γh, where

$$(11) \quad \gamma h = [\delta h + o(h)]\phi(w^R).$$

Dividing equation 11 by h, and taking the limit as $h \rightarrow 0$, we arrive at

$$(12) \quad \gamma = \delta \phi(w^R),$$

which represents the probability of reemployment, or escape rate, of the worker.[6] This escape rate does not depend on calendar time because neither the acceptance strategy nor the distribution from which offers are drawn rely on it. The model, therefore, has direct implications for the distribution of the durations. The implied distribution is exponential.

Suppose T denotes the duration of a completed spell of unemployment with cumulative distribution function $\Psi(t)$ and probability density function $\psi(t)$. The probability that a received offer leads to reemployment can now be stated as

$$(13) \quad \gamma h = \Pr\left(t < T \le t + h \middle| T > t\right) = \frac{\psi(t)h}{1 - \Psi(t)}.$$

Furthermore, the probability that the spell of unemployment will last until at least t can be expressed as follows:

$$(14) \quad S(t) = 1 - \Psi(t) = e^{-\gamma t}.$$

$S(t)$ is known as a survivor function and can be derived from the postulates of the Poisson process. From this, we can find the density function of T,

$$(15) \quad \psi(t) = \gamma e^{-\gamma t},$$

which is an exponential distribution with parameter γ. The expected length and variance of a duration, given this distribution, will be

$$(16) \quad E(T) = \frac{1}{\gamma} \quad Var(T) = \frac{1}{\gamma^2}.$$

With some manipulation, we can examine how the escape rate reacts to changes in the exogenous variables. Using equations 9a-d and the definition of γ in equation 12, we find that

$$(17a) \quad \frac{d\gamma}{db} = \delta \frac{\partial \phi}{\partial w^R} \frac{\partial w^R}{\partial b} < 0,$$

$$(17b) \quad \frac{d\gamma}{dr} = \delta \frac{\partial \phi}{\partial w^R} \frac{\partial w^R}{\partial r} > 0,$$

and

$$(17c) \quad \frac{d\gamma}{d\mu} = \delta \left[\frac{\partial \phi}{\partial w^R} \frac{\partial w^R}{\partial \mu} + \frac{\partial \phi}{\partial \mu} \right] > 0,$$

where

$$\frac{\partial \phi}{\partial w^R} = -f(w^R).$$ [7]

The right side of 17c is positive because we know from 9d that the increase in the reservation wage due to the increase in the mean of the offer distribution is less than the increase in the distribution itself.

As expected, the probability of reemployment increases with increases in both the discount rate and the mean of the offer distribution, and declines as the fixed unemployment income net of search costs goes up. How this escape rate reacts to changes in the arrival rate of offers is more complicated because, as the following shows, the sign on the derivative is indeterminate:

$$(18) \quad \frac{d\gamma}{d\delta} = \underset{(+)}{\phi(w^R)} + \underset{(-)}{\delta \frac{\partial \phi}{\partial w^R} \frac{\partial w^R}{\partial \delta}} \gtreqless 0.$$

Equation 18 shows that a change in the arrival rate of offers affects both the wage offer distribution and the reservation wage. Because these effects cause opposite outcomes, we are uncertain about the sign of the derivative. Nevertheless, an evaluation of the parts of the derivative shows that the sign of $d\gamma/d\delta$ hinges

[5] Because we know that the conditional acceptance probability depends on the mean of the wage offer distribution as well as the reservation wage, we should express it as $\phi(w^R, \mu)$. Kiefer and Neumann (1979) and Mortensen (1986), however, have shown that one wage offer distribution can be expressed as a translation of another. More precisely, a cumulative distribution function, G, is said to be a translation of another, F, if there exists a constant κ such that $G(w + \kappa) = F(w)$, for all w. This is a moment-preserving shift of the distribution. For $\kappa > 0$, the translation is to the right, and G is formed by shifting F uniformly to the right a distance κ.

[6] Often, the escape rate is referred to as a hazard rate.

[7] Equation 17c is derived by using the translation of F described in footnote 3.

critically on the magnitude of $\partial w^R/\partial\delta$ (which is positive by equation 9c) because all other terms are constants. Thus, the more responsive the reservation wage is to the arrival rate, the less likely it is for the worker to escape unemployment. These derivatives allow us to predict how a change in each of these exogenous variables, ceteris paribus, affects the expected duration of an unemployment spell. In addition, by knowing the escape rate, we can determine from equation 16 what the expected duration should be. Any increase in the escape rate should decrease the expected duration, which one can confirm by a quick examination of 16.

AN ECONOMETRIC MODEL

Having laid down a basic theoretical foundation, we would now like to describe Heckman's sample-selection regression model as one method to obtain results consistent with the theory. Because we do not observe unaccepted wage offers, the data are truncated and a selection bias exists that this model accounts for by including a regressor for the truncation. The model uses the knowledge that observed wages are offers that satisfied the job seeker's acceptance criteria—that is, the accepted wage was greater than the individual's reservation wage—along with the observed wage itself in a two-step regression that generates consistent estimates.

We use Kiefer and Neumann's (1979) adaptation of the sample-selection model, in which the ith individual's wage offer, w^o, is

$$(19)\quad \ln w_i^o = x_i'\beta + \varepsilon_i^o \quad \varepsilon_i^o \sim N(0,\sigma_o^2),$$

where the vector $x_i' = (x_{1i},\ldots,x_{ki})$ contains all of the worker and labor market characteristics that affect wage offers. The individual's reservation wage is determined by

$$(20)\quad \ln w_i^R = z_i'\alpha + \varepsilon_i^R \quad \varepsilon_i^R \sim N(0,\sigma_R^2).$$

The z_i's are worker and labor market characteristics that determine the individual's reservation wage. Because theory suggests that reservation wages depend on the mean of the wage offer distribution and the costs of searching, all variables in x_i' must be contained in z_i'. Therefore, it is assumed that the error terms are jointly distributed as bivariate normal with a covariance of σ_{oR}. The converse, that all z_i' are in x_i', is not true. For example, marital status affects the costs of searching but not the mean of the wage offer distribution and, thus, is in z_i' but not x_i'.

We have shown that individuals become reemployed if and only if the wage offer is at least as great as the reservation wage. Then, if $A_i \equiv \ln w_i^o - \ln w_i^R$, from 19 and 20, we have:

$$(21)\quad \begin{aligned} A_i &\equiv x_i'\beta - z_i'\alpha + \varepsilon_i^o - \varepsilon_i^R \\ &= x_i'\beta - z_i'\alpha + \varepsilon_i \end{aligned}$$

with

$$\varepsilon_i \sim N(0,\sigma_o^2 + \sigma_R^2 - 2\sigma_{oR}).$$

Wages are observed only for individuals whose $A_i \geq 0$; therefore, the distribution of observed wages is truncated. Heckman (1976, 1979) has shown that in this instance $\ln(w_i^o)$ is distributed with:

$$(22)\quad E\left[\ln(w_i^o)\,\middle|\,A_i \geq 0\right] = x_i'\beta + \rho\sigma_o\lambda_i\,,$$

$$(23)\quad Var\left[\ln(w_i^o)\,\middle|\,A_i \geq 0\right] = \sigma_o^2\left((1-\rho^2) + \rho^2(1+\tau_i\lambda_i - \lambda_i^2)\right),$$

where:

$$(24a)\quad \lambda_i = \frac{f(-\tau_i)}{1-F(-\tau_i)}\,,$$

$$(24b)\quad \tau_i = \frac{x_i'\beta - z_i'\alpha}{\sigma}\,,$$

$$(24c)\quad \rho = \frac{\sigma_o^2 - \sigma_{oR}}{\sigma_o\sigma}\,,$$

$$(24d)\quad \sigma = (\sigma_o^2 + \sigma_R^2 - 2\sigma_{oR})^{\frac{1}{2}},$$

f and F are the standard normal density and distribution functions, respectively, and "λ_i," known as the inverse Mill's ratio, is a decreasing function of the probability that an observation is selected into the sample.

If we knew τ_i and, hence, λ_i, Heckman (1979) shows that we could estimate the parameters of this equation as

$$(25) \quad \left[\ln(w_i^o) \middle| A_i \geq 0\right] = x_i'\beta + \rho\sigma_o \lambda_i + \varepsilon_i$$

using generalized least squares (GLS). GLS is used because ordinary least squares (OLS) leads to unbiased but inefficient estimates of β and $\rho\sigma_0$. Because we do not know λ_i, it must be estimated and its fitted values used as regressors in 25 on the selected subsample. Heckman also shows that these fitted values can be estimated consistently using probit analysis for the full sample on a normalized form of equation 21. A_i, however, is unobservable. We observe only whether an individual is reemployed or not. Therefore, the probit is estimated using an indicator variable, d_i, as follows:

$$(21') \qquad d_i = \frac{x_i'\beta - z_i'\alpha}{\sigma} + \frac{\varepsilon_i}{\sigma}$$

$$w = \tau_i + \frac{\varepsilon_i}{\sigma},$$

where

$$d_i = 1 \textit{ iff } A_i \geq 0, \quad d_i = 0 \text{ otherwise},$$

and τ_i is as in 24b.

DATA DESCRIPTION AND ANALYSIS

The St. Louis County Economic Council conducted an automated telephone survey of former McDonnell Douglas employees who were laid off between September 1990 and January 1991. Although there were 1,198 respondents to this survey, only 1,174 were usable for our analysis.[8] Twenty-four observations were discarded because either vital information was missing or there was a discrepancy between the reemployment response and the wage-at-new-job response. Of the remaining 1,174 observations, 456 had found full-time employment (more than 35 hours per week) at the time of the survey in September 1991. A respondent was considered reemployed only if the job was full-time. Therefore, respondents who were working part-time (at most 35 hours per week) at the time of the survey were considered still searching for full-time employment.

The automated telephone questionnaire posed unique difficulties because all of the relevant variables are categorical. Thus, variables normally considered continuous in the labor-supply literature are ordered categories, somewhat complicating our analysis. For example, for the question of tenure at McDonnell Douglas, a respondent would indicate "1" if tenure was two years or less, "2" if tenure was between three years and six years, and so on. This pattern was repeated for the variables of age, wage at McDonnell Douglas and wage at the new job. One issue, then, is to determine the proper strategy for selecting the correct representative response for each variable's categories.

The most obvious strategy is to assign a dummy variable to each category. Hsiao (1983) argues that for a modest number of dummy variables and categories, the loss in explanatory power from using this method is not serious. Interpretation of the coefficients on the dummy variables, however, differs from the standard interpretation of least squares coefficients on continuous variables, and using dummy variables represents a direct loss of information.

Another strategy, discussed in Haitovsky (1973), Hsiao (1983) and Hsiao and Mountain (1985), is to use the midpoint of the category's range as the observed value.[9] Although this method is convenient, the estimates are usually biased, unless the data are uniformly distributed over the category, but the bias can be negligible. In addition, this method does not use all of the available information because it excludes the known endpoints of the categories.

To include the endpoint information and obtain representative values other than midpoints, the variables of age, tenure, wage at McDonnell Douglas and wage at the new job were each regressed as dependent variables against a constant term in a completely censored Tobit model.[10] This procedure uses the method of maximum likelihood together with the specific endpoints of the categories to obtain the fitted values and point estimates. Using this procedure, the data from the telephone survey were projected onto a

[8] This telephone survey may not have been representative of all released workers. Workers were more likely to have been called if they remained in the St. Louis metropolitan area.

[9] Hsiao and Mountain (1985) also discusses the use of categorical variables as dependent variables in a regression.

[10] The authors would like to thank Joseph Terza for suggesting this procedure. See Maddala (1983, pp. 46-9), for a description of it. This is an ordered-response model, of which this Tobit is a special case. Also see Amemiya (1984) for a survey of Tobit models.

Table 1

Values for Categorical Variables

Tenure

μ = 10.2 years
σ = 18.1 years
n = 1,198

Category	Predicted value
tenure ≤ 2	1.0 year(s)
3 ≤ tenure ≤ 6	3.6
7 ≤ tenure ≤ 12	8.4
13 ≤ tenure ≤ 20	15.2
20 < tenure	36.1

Wage at McDonnell Douglas

μ = $14.79/hour
σ = $ 5.51/hour
n = 1,099

Category	Predicted value
wage < 10	$ 8.22/hour
10 ≤ wage ≤ 15	12.40
15 < wage ≤ 20	17.12
20 < wage ≤ 25	22.03
25 < wage	29.08

Age

μ = 39.4 years
σ = 11.8 years
n = 1,189

Category	Predicted value
age ≤ 24	21.1 years
25 ≤ age ≤ 34	29.4
35 ≤ age ≤ 44	38.6
45 ≤ age ≤ 54	48.2
55 ≤ age ≤ 62	57.4
62 < age	69.9

Wage at new job

μ = $13.26/hour
σ = $ 7.08/hour
n = 480

Category	Predicted value
wage < 10	$ 7.06/hour
10 ≤ wage ≤ 15	12.22
15 < wage ≤ 20	17.14
20 < wage ≤ 25	22.13
25 < wage	31.11

distribution, and the Tobit model estimated a representative value for each category. These fitted values were then used as the observed values for the variables in the later analysis. In addition, the Tobit model provides an estimated mean and standard deviation for the projected distribution. Table 1 describes the categorical variables with their fitted values and distributional characteristics.

Table 2 includes the definitions for all variables, including the dummy variables that represent the demographic characteristics of the respondents. Table 3 provides frequency distributions for all variables.[11]

AN ILLUSTRATION

Tables 4 and 5 present the coefficient estimates for the variables commonly used to estimate equations 21′ and 25, the reemployment and wage equations.[12] Rather than discuss each coefficient, we describe how to interpret the results for each equation generally and highlight results for selected values. The inclusion of sets of dummy variables precludes direct interpretation of the results, because the necessary omission of one dummy variable from each category determines a baseline profile against which other results should be compared. For both regressions, the baseline searcher is a single white male, who was a unionized production worker (one of the occupational categories) at McDonnell Douglas with a high school education or less, who has no children and who did not apply for unemployment insurance.[13]

To describe how an individual's probability of reemployment (escape rate) changes as different characteristics are added, the probability for the baseline person needs to be known. Using the coefficients from Table 4 and the calculated means of the non-dummy variables, τ_i can be constructed for the baseline individual.[14] We then evaluate the normal cumulative density function F at this value of τ_i to determine the individual's probability that the next offer will lead to reemployment; for the baseline individual, this probability is 0.6637. In other words, there is about a 66 percent chance that the next wage offer will satisfy the acceptance criteria of a person with the baseline characteristics.

[11] For more detail as to the composition of the data set, see Jones (1991).

[12] We used the sample selection model in LIMDEP Version 6.0 to estimate the equations.

[13] Various interaction terms were tried, but none significantly altered the results.

[14] Using notation from Table 2, we calculate τ_i for the baseline individual from equation 21′ with the following:

$$\tau_{base} = Constant + c_1(\text{AGE}) + c_2(\text{AGE}^2) + c_3(\text{ADVNOTICE}) + c_4(\text{LNWAGE}) + c_5(\text{TENURE}),$$

where c_i is the coefficient estimate from Table 4; therefore:

$$\tau_{base} = 0.998 + (0.006)(39.4) + (-0.000439)(1669.5) + (0.039)(1.04) + (0.005)(2.63) + (-0.013)(10.2),$$

where the numbers substituted for the variables are the variable means. This procedure can be used to calculate τ for any individual i, with the appropriate adjustments for the individual's characteristics.

Table 2

Variable Definitions

Dependents	
LNNUWAGE	natural logarithm of wage at new employment
REEMP	reemployed = 1 if yes; = 0 if no
Independents	
ADVNOTICE	advanced notice of layoff in number of months
AGE	in calendar years
AGE^2	square of AGE
CLERICAL	= 1 if clerical/secretarial employee at McDonnell Douglas; = 0 otherwise
COLLEGE	= 1 if college graduate (bachelor's degree) or less; = 0 otherwise
DATAPROC	= 1 if data processor at McDonnell Douglas; = 0 otherwise
ENGINEER	= 1 if engineer at McDonnell Douglas; = 0 otherwise
FISCAL	= 1 if fiscal employee at McDonnell Douglas; = 0 otherwise
HIGHSCHOOL	= 1 if high school graduate or less; = 0 otherwise
KIDS	presence of children; = 1 if yes; = 0 if no
LNWAGE	natural logarithm of wage at McDonnell Douglas
MARRIED	= 1 if yes; = 0 if no
OTHEROCC	= 1 if none of the other listed occupations; = 0 otherwise
POSTCOLLEGE	= 1 if more than college graduate; = 0 otherwise
PRODUCTION	= 1 if unionized worker at McDonnell Douglas; = 0 otherwise
RACE	= 0 if white; = 1 otherwise
SEX	= 1 if female; = 0 if male
SPSPART	spousal participation in labor force after layoff; = 1 if yes; = 0 if no
TENURE	length of service at McDonnell Douglas in years
UI	applied for unemployment insurance; = 1 if yes; = 0 if no

Knowing τ_{base}, we can now calculate the change in the escape rate because of a change in a characteristic. Greene (1993, p. 639) shows that the change in the escape rate can be determined by multiplying $f(\tau_{base})$, the normal probability density function evaluated at τ_{base}, by the coefficient on the particular variable of interest.[15] For example, suppose the individual of interest was a clerical worker at McDonnell Douglas rather than a production worker (that is, CLERICAL=1 is the only difference between the two workers). The increase in the escape rate because of the added characteristic is:

$$f(\tau_{base})c_j = (0.3649)(0.214) = 0.0781,$$

implying that this individual's escape rate equals

$$0.6637 + 0.0781 = 0.7418.$$

Therefore, this clerical worker's probability that the next received offer will lead to reemployment is about 74 percent. The impact of a change in any other variable in the equation can be calculated analogously.

Predictions of new wages from equation 25 are more straightforward. Realizing that the fitted values from equation 25 are the logarithms of the expected new wages, we need only exponentiate these values to recover the dollar amounts. Based on the coefficients in Table 5 and the means of the relevant variables, the expected new wage for a person with the baseline characteristics is $11.19 per hour.[16] Any changes in particular characteristics result in a deviation from this wage level. For example, the expected new hourly wage for a clerical worker is $12.62. Thus, all else the same, this clerical worker should expect to receive a wage offer that is 13 percent greater than that received by a comparable production worker. The effect of changes in other variables can be calculated similarly.

Although Table 4 shows that few of the variables are statistically significant, the signs on most of the variables are as expected and the χ^2 statistic is significant. For example, we know from equation 17a that increases in unemployment income net of search costs decrease the escape rate. Our coefficient on *UI* is negative, as predicted, and statistically significant. In other words, those who applied for unemployment compensation tended to

[15] This procedure approximates the true change in the probability because the variable we chose to examine is discrete. See Caudill and Jackson (1989).

[16] The logarithm of the new wage for the baseline individual is calculated as follows:

$$\beta'x = \text{Constant} + \beta_1\text{ (AGE)} + \beta_2\text{ (AGE}_2) + \beta_3\text{ (LNWAGE)} + \beta_4\text{ (TENURE)} + \beta_5\text{ (LAMBDA)},$$

where $\beta_5 = \rho\sigma_o$. Thus,

$$\beta'x = 0.416 + (0.005)(39.4) + (-0.0000132)(1669.5) + (0.709)(2.63) + (-0.004)(10.2) + (-0.16)(-0.21795\times10^{-7}),$$

where the numbers substituted for the variables are the variable means. To recover the dollar amount, exponentiate $\beta'x$ to get $11.19.

Table 3

Descriptive Statistics

Age	
≤ 24	4%
25-34	37
35-44	25
45-54	21
55-62	9
≥ 62	3

Kids	
Yes	45%
No	55

Education	
0-12 years	21%
13-16 years	64
17+ years	15

Marital status	
Married	68%
Not Married	31

Occupation	
Production	23%
Engineer	28
Data Processing	10
Fiscal	6
Clerical/Secretarial	12
Other	22

Race	
White	88%
Not White	12

Sex	
Male	71%
Female	29

Tenure	
≤ 2 years	22%
3-6	36
7-12	20
13-20	10
>20	13

Unemployment insurance	
Yes	77%
No	23

Wage at McDonnell Douglas	
< 10 ($/hr.)	17%
$10 \le x \le 15$	36
$15 < x \le 20$	28
$20 < x \le 25$	6
> 25	6
Refused	8

Wage at new job	
< 10 ($/hr.)	39%
$10 \le x \le 15$	28
$15 < x \le 20$	20
$20 < x \le 25$	8
> 25	6

n = 1,198 for all variables except for those in Table 1.

have a lower probability of reemployment and, therefore, a longer duration of unemployment.

This result is consistent with the literature, which has also found a positive relationship between unemployment durations and unemployment insurance.[17] Ehrenberg and Oaxaca (1976), for example, found that durations increased with the receipt of unemployment insurance. Storer and Van Audenrode (1992) also found that durations increased with the receipt of unemployment insurance. In addition, they argued that unemployment spells are not longer because workers collect unemployment insurance benefits; rather, workers collect benefits because their spells are longer.

The coefficient on TENURE is negative and significant in the reemployment equation and negative and insignificant in the wage equation. The negative coefficient suggests that this variable might be proxying for time spent away from the market during employment, which affects the worker's job-search skills. An analogy is the depreciation of an individual's human capital that occurs because of extended periods of non-employment. In this case, the depreciation occurs because the lengthy tenure has made the worker's job-search skills "rusty." This hurts prospects for reemployment because the worker has to spend time relearning how to search in the new environment.

[17] For summaries of this literature, see Layard and others (1991) and Devine and Kiefer (1991).

Table 4

Reemployment Equation (Equation 21′)

Dependent variable: REEMP	Coefficient estimate (t-statistic)
Constant	0.998* (1.97)
COLLEGE	−0.049 (−0.46)
POSTCOLLEGE	0.149 (0.99)
AGE	0.006 (0.24)
AGE^2	−0.439E-03 (−1.46)
MARRIED	0.135 (1.11)
KIDS	0.119 (1.31)
ENGINEER	−0.132 (−1.02)
DATAPROC	0.343* (2.09)
FISCAL	0.102 (0.54)
CLERICAL	0.214 (1.23)
OTHEROCC	−0.135 (−1.00)
ADVNOTICE	0.039 (1.46)
SPSPART	−0.075 (−0.72)
UI	−0.823* (−7.63)
LNWAGE	0.005 (0.55)
RACE	−0.189 (−1.52)
SEX	−0.338* (−3.12)
TENURE	−0.013* (−2.68)
Log-likelihood	−648.13
Restricted log-likelihood	−784.27
$\chi^2_{(18)}$	272.29**
n = 1,174	

* statistically significant at 0.05 level
** statistically significant at 0.001 level

Another interpretation of this coefficient is that long tenure on the job correlates with an individual's decision to leave the labor force after displacement. Although at first glance this explanation seems reasonable, Jones (1991) shows that only 6 percent of the respondents planned to retire.

Receipt of advance notice of the impending layoff increased the escape rate slightly, although its effect was not significant. Recent literature has found mixed outcomes for the effect of advance notice on the probability of avoiding joblessness. Addison and Portugal (1992), for instance, found that white-collar workers' probability doubled with written advance notice, whereas blue-collar workers' probability did not increase and actually declined in some instances. Ruhm (1992) found that all workers with some type of advance notice, whether written or not, had higher probabilities of avoiding joblessness when compared with those who received no notice.

The worker's previous wage at McDonnell Douglas had no role in determining the escape rate, but did play a significant part in determining the worker's new wage. In equation 25, the wage at McDonnell Douglas is probably proxying for productivity that is observable to firms but not fully captured by the other variables in the model. The coefficients on the engineer and data processing occupations are positive and significant, indicating that these workers can expect to receive higher wage offers than their unionized production counterparts.

CONCLUSION

As firms continue to adjust to new technologies and international competition, further rounds of restructuring are possible. More often than not, the restructuring will entail displacement of many workers who will face a labor market in which their skills and experiences are somewhat dated. A knowledge of the determinants of reemployment and wage offers is, therefore, important to both job seekers and policy makers, especially if there is need to adjust or improve the process.

Here, we have sketched a basic model of the job search. Essentially, an individual,

Table 5

Wage Equation (Equation 25)

Dependent variable: LNNUWAGE	Coefficient estimate (t-statistic)
Constant	0.416
	(1.54)
COLLEGE	0.047
	(1.01)
POSTCOLLEGE	0.236*
	(3.64)
AGE	0.005
	(0.41)
AGE^2	−0.132E-04
	(−0.09)
RACE	−0.059
	(−1.11)
SEX	−0.008
	(−0.16)
ENGINEER	0.244*
	(4.71)
DATAPROC	0.211*
	(3.17)
FISCAL	−0.014
	(−0.18)
CLERICAL	0.120
	(1.53)
OTHEROCC	0.139
	(2.48)
LNWAGE	0.709*
	(10.58)
TENURE	−0.004
	(−1.53)
LAMBDA	−0.160*
	(−2.19)
Adjusted R^2	0.43
$F_{(14,441)}$	25.61**
Standard error corrected for selection	0.366
n = 456	

* statistically significant at 0.05 level
** statistically significant at 0.001 level

maximizing expected lifetime income, continues to search until the marginal cost for an additional search equals the discounted expected marginal gain from that search. This is achieved at the reservation wage: A worker will accept an offer if and only if the offered wage is at least as great as the reservation wage. This is a dynamic process in which the reservation wage serves as the optimal stopping condition.

Using data collected by the St. Louis County Economic Council, we estimated this basic model to illustrate what kinds of results can be expected and how they might be interpreted. Using this limited dataset, though, implies that the estimates probably reflect more the specific characteristics of the St. Louis market in the early 1990s than any generalization. Nevertheless, the illustration allowed us to peer into the basic equations that describe the job-search and reemployment activities. In future research, we plan to use this data, along with data from follow-up surveys, to identify the search experiences of those workers laid off from McDonnell Douglas. This information should allow us to make comparisons between predicted and realized wage offers for different categories of workers, thereby providing information about the market and the usefulness of the underlying model.

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