Articles

The Economic Status of the Elderly

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Augmented by public programs such as Social Security and Medicare, incomes of the elderly in the United States have grown more rapidly during the last several decades than have the incomes of other groups, so that on average the elderly are at least as well off as the nonelderly. Not all elderly, however, have done as well: widows, in particular, have high poverty rates. The economic prospects of the elderly during the next few decades are good because of the large work force from the baby-boom cohort. In the distant future a large fraction of the population will be elderly, which will probably lead to a deterioration in their economic status. Today, the main problems center on the distribution of economic resources among the elderly and on uncertainties such as costs of medical care.

FOR MANY YEARS A LARGE FRACTION OF THE ELDERLY IN the United States were poor. Encouraged by growing national income after the Great Depression, society established programs such as Social Security, Supplementary Security Income, and Medicare and Medicaid, which transferred resources to the elderly and increased their incomes. The elderly are particularly vulnerable to uncertainty. For example, many elderly could not recover from an income loss by working or from a large medical expense by borrowing against future labor earnings. The programs reduced uncertainty by stabilizing a large part of their incomes and by providing medical insurance. No other group has been protected against uncertainty to the same extent.

The elderly population has increased rapidly, and it is expected to continue to grow. The percentage of the U.S. population 65 and older was 4% in 1900, 11% in 1980, and is projected to rise to 23% by 2060. The rate of increase in the old-old (85 and above) should be even greater, from a small fraction of a percent in 1900, to 1% in 1980, to 5% by 2060. Should the economic resources of the elderly prove to be inadequate in the future, the ability of society to respond as it has in the past will be constrained by these demographic changes. It is important, therefore, to assess the economic status of the elderly and to make an informed estimate of what it will be in the future (*1*).

Income of the Elderly

Economic status is the measure of the consumption opportunities available to an individual or household (*2*). Although, as discussed below, the correspondence between income and economic status is far from perfect, income is the most widely used measure of economic status. Therefore, I first present data on the incomes of the elderly (aged 65 and older) with the goal of answering these questions: Have the incomes of the elderly been increasing? Have their incomes been increasing faster than the incomes of the noneldely? Are their incomes higher than the incomes of the nonelderly?

Real incomes (incomes after the effects of inflation have been removed) of the elderly grew both absolutely and relative to the rest of the population during the last 20 years. For example, in 1970 average income of households headed by an elderly person was $13,907, which was 54% of the average income of all households; in 1987 it was $17,827, 63% of average household income (both dollar figures measured in 1983 prices) (*3, 4*). Incomes increased even as work effort and earnings dropped. For example, the labor force participation rate of elderly males fell from 33.1% in 1965 to 16.3% in 1987; the participation rate of elderly females fell from 10.0 to 7.4%. Incomes of the working-age population also increased during the past 20 years, but the gain has come from increased work (mainly from an increase in two-worker households) rather than from an increase in the rate of pay (*5*): the participation rate of the entire population rose from 58.9 to 65.9% between 1965 and 1987.

This improvement in income has been found by a number of researchers (*6–9*), but its interpretation as a measure of the trend in economics status is less clear. Because households of the elderly are smaller than other households, it is hard to compare household income levels to arrive at a measure of economic status. No accounting is made of fringe benefits, which are an important part of the earnings of the nonelderly, of income-in-kind, of taxes, and of misreporting of income. Income and relative income after adjusting for these omissions are shown in Tables 1 and 2.

After adjusting for inflation and household size, the incomes of the elderly increased substantially in real terms and increased faster than the incomes of the nonelderly (Table 1) (*10*). By 1984 the incomes of the elderly were 84% of the incomes of the nonelderly. Among the elderly the incomes of the old-old (>84 years) are the lowest. This is due in part to historical reasons: they had lower lifetime earnings than the 65- to 84-year-old group, and, therefore, lower lifetime savings; they contributed less to Social Security, so their Social Security benefits are lower; and few would have had private or government pensions. Their incomes had the largest rate of increase. One would expect this trend to continue as the younger, more wealthy cohorts age.

Income comparisons depend in an important way on the method of adjusting for household size and on other adjustments to income (Table 2). The entries are the ratios of elderly income to nonelderly income. The first line of the table gives ratios of money income, which is the sum of earnings, pensions, Social Security benefits, investment income, business income, and so forth. It is what most people would call their income. The second line, augmented income, accords roughly with what economists would call income. It adds in nonmoney income, which is the value of employee benefits, and income-in-kind such as housing and Medicare, and subtracts

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Table 1. Real incomes of the elderly and nonelderly adjusted for household size (*6*, p. 14).

Age	Mean income (1982 dollars)			Change (%) 1967–1984
	1967	1979	1984	
<65	13,322	16,393	16,825	26
≥65	9,134	11,813	14,160	55
65–69	11,095	13,703	16,496	49
70–74	9,127	11,727	14,401	58
75–79	7,640	10,847	12,617	65
80–84	6,927	9,752	11,469	66
≥85	6,571	9,064	11,825	80

taxes. The entries by column show how income ratios vary as the method used to adjust for household size varies. The columns labeled "household" have no adjustment; they are just the ratios of household income. "Per capita" has the ratios of income per person; "poverty scale" uses the size adjustment implicit in the government poverty scale (*10*); and "adult equivalents" is based on a size adjustment estimated from the consumption patterns of households of different sizes and compositions (*11*). The main difference between "adjusted income" and "income" is a correction for the underreporting of income.

Did the elderly have higher incomes in 1979 than the nonelderly? The answer depends on the income measure and the adjustment to income. Because augmented income is more inclusive than conventional income, it is a better measure of economic resources. In my view the household entries are too low, and the per capita entries too high; at least conceptually, the adult-equivalent entries are superior to the poverty-scale entries (*12*). According to augmented income adjusted for adult equivalents but not for underreporting, the average income of the elderly was about 4% higher than the average income of the nonelderly in 1979 (Table 2). A further adjustment for underreporting raises this to 28% (*13*). My conclusion would be that elderly were at least as well off as the nonelderly in 1979, and possibly better off. It should be recognized, however, that none of the income measures are universally accepted, so other conclusions are certainly possible.

Although this kind of detailed information is not available for later years, we can get an idea of the changes since then by applying the rates of income growth from Table 1. According to Table 1, between 1979 and 1984 income of the nonelderly grew by 3%, and that of the elderly by 20%. If all the incomes that underlie the ratios in Table 2 grew at the same rate, all the ratios could be updated to 1984 by multiplying the entries by 1.20/1.03 = 1.17. This is probably appropriate for conventional income because the components of conventional income in Table 2 are the same as the components in Table 1. Therefore, one would estimate the adult equivalent income ratios in 1984 to be 0.98 (income) and 1.25 (adjusted income). As far as augmented income is concerned, the updating factor of 1.17 is probably somewhat large because, whereas the nonmoney components of income grew, there is no reason to think they grew differentially in favor of the elderly. If one assumes that the nonmoney components grew for both the elderly and nonelderly at the same rate as average income over all households, one can calculate the updating factor for augmented income to be 1.16 (*14*). This factor applied to the augmented income, adult equivalent entries in Table 2 produces income ratios of 1.21 for income and 1.48 for adjusted income in 1984. According to these estimates of income ratios, which range from 0.98 to 1.48, one would conclude that by 1984 the elderly were at a minimum as well off as the nonelderly, and possibly substantially better off.

Many people would be surprised by the growth in incomes over the high inflation period of the 1970s and early 1980s because it is generally thought that the elderly live on fixed incomes which are vulnerable to inflation (*15*). In fact, the elderly do not live on fixed incomes, and, except for the wealthy elderly, they are not particularly vulnerable to inflation because their most important sources of income (fully measured as in augmented income of Table 2) are indexed to inflation (*16*). The indexed components of income include Social Security benefits, which since 1975 have been indexed to the consumer price index (CPI), imputed income from housing (a larger fraction of the elderly own homes than of the nonelderly), imputed income from Medicare and Medicaid, and earnings. These catagories plus miscellaneous indexed earnings account for about 75% of total income. The inflation-sensitive components include interest income, dividend income, and private pensions. Because these components are concentrated among a small fraction of wealthy elderly, the typical elderly person has even more of his income indexed than these averages suggest, and, therefore, is not especially vulnerable to inflation.

Social Security benefits have been an important factor in raising the incomes of the elderly. In part, benefits grew because the Social Security contributions of workers grew: according to the Social Security law an individual's benefits increase with his contributions. But, in addition, between 1969 and 1973 the Social Security benefit schedule (the schedule that relates Social Security contributions to benefits) was increased by Congress by about 30% in real terms; that is, even had Social Security contributions remained constant, benefits would have increased by 30%. The increase in contributions and the increase in the benefit schedule together caused Social Security benefits to increase rather substantially, especially from 1967 to 1979: real average Social Security benefits measured in 1982 dollars were $2,575 in 1967, $4,520 in 1979, and $5,148 in 1984 (*6*). By 1979 Social Security benefits accounted for 36% of cash income of the elderly and 57% of the cash income of the middle income quintile (elderly households whose incomes fall between the 40th and 60th percentiles of the income distribution). Social Security has become an important component of average income; for the elderly whose incomes are below the median it is by far the most important component.

Although average incomes can provide broad generalizations about the economic status of a group, they reveal nothing about the distribution of income. One measure of the distribution is the official government poverty rate, the fraction of a population whose incomes fall below the poverty level. The level, which is indexed to the CPI, varies with household composition and with the age of the head of the household (*17*). As shown in Table 3, the poverty rate of the elderly has fallen sharply, and in 1984 was actually lower than the rate of the nonelderly. (It has remained lower through 1987, but it is not shown because the detail by age is not available.) The poverty rate of all the elderly age groups improved, although the rate of the old-old is still high. One would expect the oldest to have the highest poverty rates because they have lived beyond their life expectancies; thus, they have had to spread their lifetime economic resources over more years. Furthermore, because of the long-term rising trend in incomes, the oldest would have had lower lifetime earnings than 65- to 84-year-olds, resulting in their having fewer resources during retirement.

Even though the poverty rate of the elderly has fallen to the rate of the rest of the population, income distribution among the elderly still remains a matter of social concern. First, a substantial fraction of the elderly has incomes only marginally above the poverty level: although this group might not be in poverty as officially measured, they are "near poor." Furthermore, this group is particularly vulnerable to economic misfortune because their money incomes are too high to qualify them for social programs which would protect

Table 2. Income comparison: ratios of the incomes of the elderly to the nonelderly in 1979 (*35*).

Income measure	Income				Adjusted income			
	Household	Poverty scale	Adult equivalents	Per capita	Household	Poverty scale	Adult equivalents	Per capita
Money income	0.52	0.64	0.84	0.90	0.66	0.82	1.07	1.16
Augmented income*	0.65	0.80	1.04	1.14	0.79	0.99	1.28	1.40

*That is, money income plus employment benefits and income-in-kind less taxes.

them; yet their own incomes and assets are not high enough to provide adequate protection (*18*). Second, elderly widows still have a high poverty rate, 21% in 1986. The rate is partly a consequence of the high mortality rates of men: most of the old-old, who could be expected to have higher poverty rates, are widows. In addition, husbands in poor families die at younger ages than husbands in wealthy families; therefore, among the younger elderly a high fraction of widows will have come from poor families, and will be poor. Finally, when husbands die, part of the family wealth disappears, leaving the widow even less well off (*19, 20*).

Wealth of the Elderly

Income is often used to measure economic status because income statistics are readily available and because for some groups it is an accurate measure. For the elderly, however, income can give a misleading impression of economic status. Consider the retired millionaire who keeps his wealth in cash. His income is zero, yet no one would say that he is poor. He would be expected to spend his cash as he ages, and, if he has no heirs, he would aim to spend all his cash by the time he dies. Therefore, his consumption, which measures his economic welfare, would be high even though his recorded income would be zero. Of course, this is an extreme example, but most elderly would be expected to follow a lifetime plan that would reduce their wealth (*21*). Their consumption each year would be greater than their incomes (causing wealth to decrease); income would understate their economic welfare.

Consumption is difficult to measure because most people only have the vaguest idea of their expenditures during a year. Wealth is easier to measure than consumption, and, because it measures the consumption opportunities of retired persons, in some circumstances it can be used to compare their economic status. It is of little use, however, in comparing the economic status of the elderly and nonelderly because most of the wealth of the nonelderly is in their future earning capabilities, which are not observable. Even if we had a complete measure of wealth, comparison of the economic status of individuals of different ages would be difficult. For example, who is better off: a 60-year-old with $150,000 in wealth or a 70-year-old with $100,000? Although the 60-year-old has more wealth, he can expect to live more years, so he should spend his wealth more slowly. That is, he should consume a smaller fraction of his wealth each year. To compare their economic well-being in terms of their annual consumption we need to know how fast each will spend the wealth. However, we do not have widely accepted empirical estimates of these rates of wealth decumulation.

Despite the difficulties in interpreting wealth data, they provide a valuable supplement or alternative to income data. Table 4 shows estimates of average wealth and the composition of wealth from the Retirement History Survey (RHS), a representative sample of the elderly, most of whom were 68 to 74 in 1979. The table is meant to give a rough idea of what total economic resources were shortly after retirement, so it includes the estimated wealth-value of future incomes flows. The estimated wealth-value is called the expected present value; it answers the question, "How much wealth is equivalent to a specified expected future flow of income?" For example, the RHS sample had annual Social Security benefits of $3,590 in 1979. From the Social Security law, and given assumptions about interest rates and mortality rates, one can calculate that the Social Security system will pay over the lifetimes of the households in the RHS about $44,000 (discounted to 1979) on average. This is the average wealth-value of Social Security in the RHS sample.

The most speculative entry in the table is the wealth-value of Medicare and Medicaid. It is the cost of a medical insurance policy that would pay the part of expected Medicare and Medicaid benefits that is now paid by the government. It is counted as an asset because the government, in essence, is expected to transfer the wealth-value to each elderly person over his or her remaining lifetime (*22*).

Average total wealth was about $142,800 in 1979. Is, say a 71-year-old with this level of economic resources well off? No definitive answer can be given because we do not know how fast the person will spend the wealth. But to get an idea consider a 71-year-old man who has 15 years to live and can invest at an annual rate of interest (adjusted for inflation) of 5%. Suppose he chooses to consume all of his wealth in equal amounts over 15 years. What would his annual consumption be? It would be $13,532 in 1979 dollars or $20,704 in 1987 dollars. According to Table 1, this is somewhat above the income level of 70- to 74-year-olds in 1979, and substantially above the income levels of 80- to 84-year-olds, but it includes an income flow from housing and from Medicare and Medicaid and excludes earnings. Of course, equal consumption levels in each of the 15 years are probably not the optimal consumption path for a 71-year-old. (Suppose the individual lives to be 87?) Furthermore, the analysis is more complicated for a couple because they should take into account their joint and separate life expectancies. Nonetheless, the sustainable consumption levels give the same impression as the income levels discussed earlier: a representative group of the elderly seems reasonably well-off.

The composition of wealth shows that financial wealth (stocks and bonds, savings accounts, and cash), which is what most people call savings, is not nearly as important as other kinds of economic resources. Only 16% of wealth is financial wealth. Many would probably find the small amount of financial wealth at retirement rather surprising, but apparently most households do not save much in this form. The sum of the first three rows in Table 4 represents savings at the household level; the other rows represent saving done on behalf of the household by employers, in the case of pensions, and by government. Only 43% of the saving is done at the household level. Just why households save so little is not known, although some economists would say that it is precisely because of the saving done on behalf of the households: households react by reducing their own saving.

Social Security and Medicare and Medicaid account for about 43% of wealth. Considerable credit for the strong financial status of the elderly is due to these programs. The transformation of their economic status is a major success of public policy.

The discussion has been about average wealth, but the distribu-

tion of economic resources across households is certainly a matter of public concern. Here the conclusions are less optimistic. The last two columns of Table 4 give wealth and the composition of wealth over the lowest wealth decile (*23*). Average wealth is just $34,500, only about 24% of the average over all deciles. This wealth level would finance annual consumption over 15 years of $3,248. Even this probably overstates economic status because $11,900 of the wealth is from Medicare and Medicaid, but it is highly unlikely that someone so poor would be willing to pay that much for access to the Medicare and Medicaid system (*24*). The conclusion is that for the RHS population average economic resources seem adequate, but a significant fraction has almost no assets beyond their claims to public programs.

The high end of the wealth distribution is not shown in Table 4 because the RHS is not a good data set for estimating the wealth of the very wealthy. Wealth is highly concentrated, so special surveys that oversample the wealthy are needed. The 1983 Survey of Consumer Finances (SCF) is such a survey, and, although it does not have the fully inclusive wealth measures of the RHS, it can give a better idea of wealth concentration (*25*).

Among the elderly, 49% had less than $50,000 in wealth in 1983 (*26*). Because the wealth measure includes housing equity, this figure confirms the findings in the RHS that many elderly retire with little financial assets. Fourteen percent had more than $250,000; 7% more than $500,000, and 3% more than $1 million. Mean wealth was $250,000, yet median wealth was just $52,000. The ratio of median to mean is 0.21, which indicates a high degree of wealth concentration. Among the nonelderly the ratio is 0.23, indicating somewhat less concentration. These results confirm substantial heterogeneity among the elderly.

Table 3. Poverty rates in the United States for three different years (*6*, p. 19).

Age	Percentage in poverty		
	1967	1979	1984
<65	11.8	11.1	14.5
≥65	28.1	15.1	12.4
65–69	21.9	12.2	9.4
70–74	25.8	13.4	11.5
75–79	33.8	17.9	13.7
80–84	38.2	19.4	17.7
≥85	38.9	22.7	18.5

Table 4. Average wealth (in thousands of 1979 dollars) and distribution of wealth of 1979 Retirement History Survey sample. Wealth estimates are based on 6,610 observations from the survey; farm families and farm wealth are excluded (*16*, p. 140).

Wealth category	All		Lowest decile	
	Wealth	Percent	Wealth	Percent
Housing	26.7	19	1.4	4
Business and property	11.6	8	1.1	3
Financial	22.5	16	0.7	2
Pensions	18.0	13	1.6	5
Welfare and transfers	2.3	2	3.6	10
Medicare and Medicaid	17.7	12	11.9	34
Social Security	44.0	31	14.2	41
Total	142.8	100	34.5	100

Future Economic Status of the Elderly

It is a useful simplification to say that in 20 years the elderly will be composed of two groups: those who have recently retired and those who will retire within 20 years. The first group has economic resources that are, with some adjustment for the passing of 10 years, approximately given in Table 4. Their major assets are claims on Social Security, Medicare and Medicaid, housing, financial assets including business and properties, and pensions. On average, they have enough assets that, under stable economic conditions, their economic status should remain adequate as they age. The major uncertainties affecting their assets are the stability of the Social Security system and Medicare and Medicaid, the value of housing, the rates of return on financial assets, and the inflation rate. Conditional on an adequate performance of the economy, the ability of the Social Security system to pay benefits according to the current law is practically certain over the next 20 years (and, in fact, much beyond 20 years). In that Social Security benefits are indexed, the part of economic status due to Social Security should remain constant as the recently retired age.

The future of the Medicare and Medicaid system is much less certain. Benefits per person have grown more rapidly than the CPI, and unlike the Social Security retirement program there is no cap on total Medicare and Medicaid costs. Even with adequate economic growth, the capacity and desire of the nonelderly to finance this continuing expansion is doubtful. Cuts in the program will have some adverse effect on economic status, but at least during the next 20 years it is unlikely to be substantial.

The movement of the baby-boom generation into its prime consumption years should keep the prices of housing up for the next 20 years. If the elderly wish to reduce their holdings of housing to finance other types of consumption as they age, the market for their houses should be good. Similarly the value of their financial assets should remain high because the baby-boom generation can be expected to purchase assets to save for their own retirements. Inflation will affect the value of pensions because most pensions are in fixed dollars, which decrease in value with inflation. It is useless to speculate about the future course of inflation, but even if it were to be high, the average holdings of pensions are not large enough to cause a great impact.

It is much more difficult to predict the economic status in 20 years of those who are now, say, 45. Although their claims on Social Security and Medicare and Medicaid will be roughly the same as those of 65-year-olds today (with the uncertainties about Medicare and Medicaid that have been discussed), we do not know what their private assets will be at retirement. The main private assets are homes, financial assets, and pensions. It seems reasonable to assume that this age group will accumulate housing wealth at least as fast as the older generation and reach retirement with as much housing wealth. As far as the other two components are concerned, we do know that today very little saving takes place at the household level (*27, 28*). Should this low saving rate continue, average financial wealth will not be much greater than the financial wealth of today's 65-year-olds. The one component that may increase substantially during the next 20 years is pensions: coverage and levels are increasing rapidly, and one can expect pensions changing from a small component of post-retirement resources to a major component. For example, one study predicts that when today's 40-year-olds reach age 67 they will have about as much income from pensions as they will have from Social Security benefits (*29*). Today the 67-year-olds have only about half as much.

Given reasonable economic growth, then, we could expect that in 20 years the retirement-age elderly will have economic resources that are somewhat greater than those of retirement age today, but not substantially greater. After retirement, however, they will face an economic environment that, as viewed today, will not be nearly as

stable as that faced by today's 65-year-olds. This is due in part to the uncertainty of forecasting economic growth rates far into the future. But it is also due in part to the age distribution of the population. Because much of the population that will be alive 20 years from now has already been born, and because mortality and fertility rates change rather slowly, one can make a pretty good forecast of the population distribution. Today about 3.3 workers support each Social Security beneficiary; in 2010 about 2.9 workers will support each beneficiary. More importantly for today's 45-year-olds, the ratio is forecast to decline to 1.9 by 2030 (*30*). With fixed Social Security tax rates, Social Security benefits relative to incomes of the nonelderly will fall. The aim of the 1983 Social Security law changes, however, was to keep Social Security constant in absolute terms, not in relative terms; this can be done for the next 50 years if the economy grows at a reasonable rate. Should economic growth be substantially lower than the official forecasts, however, further adjustments in the system will be required.

The consequences of the change in the age distribution of the population are not limited to the Social Security system. The basic problem is how to allocate the output of the economy between the retired elderly, who are increasing in relative numbers, and workers, who are decreasing in relative numbers. Taxation, which is relied on by Social Security and other public programs, is one solution, but it has limits that arise from the political process. Private pensions also have limits imposed by the need of business to show current profit. Private saving is another solution. It too has limits because to finance their consumption during retirement the elderly need to sell their financial assets to someone. As long as the population is growing, they can sell their assets to an expanding pool of workers who are saving for their own retirements. But the changing age distribution means that the pool of workers who want to buy will be shrinking relative to the pool of the retired who want to sell. To induce each person in the smaller pool to hold larger amounts of assets the prices of those assets will have to fall; that is, the return on the assets will be smaller than anticipated. This argument implies that while the fundamental problem of the age distribution can be alleviated by private saving, it cannot be eliminated.

Conclusion

During most of history, to be old was to be poor. This is certainly no longer the case in the United States. On average the elderly appear to be at least as well off as the nonelderly and possibly better off. Their economic status should be adequate in the near term: the average level of resources should rise gradually as the younger and more wealthy elderly replace the older, less wealthy elderly. However, one should not expect the large improvements of the last 20 years to continue. The currently retired receive much more from the Social Security system than they contribute, but each successive retiring cohort will get smaller windfall gains (*31, 32*). The Medicare and Medicaid system is unlikely to expand. Private saving for retirement at the household level has been weak. Even with some growth in pensions, economic resources at retirement are unlikely to be substantially larger.

Since the establishment of Social Security in 1935, considerable public policy has been aimed at the elderly. Because on average they were not as well off as the nonelderly, the policies transferred resources from the nonelderly to the elderly with limited regard for variation in need among the elderly. Thus, for example, both the wealthy and the non-wealthy elderly have large windfall gains from Social Security and from the Medicare and Medicaid programs (*33*). Now, however, there is little reason for additional transfers based purely on age. New policy should recognize the great range of economic resources among the elderly. Many are poor and can pay for very little, yet many are well-to-do and can pay for the programs that benefit them.

Two general classes of distributional problems remain. The first is that, for reasons that are not well understood, many reach retirement age with few economic resources beyond public programs and possibly housing. Some have always been poor, so their poverty at retirement reflects lifetime poverty. In this case a broad social policy is needed to address the fundamental issue of poverty at all ages. Others have had adequate lifetime incomes, but, either deliberately or in response to unforeseen events, they saved little. Public policy such as programs to encourage saving and insurance programs would reduce poverty among this group.

The second problem is that many reach retirement with assets that seem adequate, yet as they age they fall into poverty. In a group as diverse as the elderly, no single cause is responsible; it is hard to suggest public programs that will not require intergenerational transfers, yet will reduce the incidence of poverty. An important exception is the risk of large medical costs. The addition to Medicare this year of catastrophic medical insurance has eliminated some of this risk, but the risk of substantial nursing home costs remains. In 1984, 42% of the out-of-pocket medical costs of the elderly went to nursing-home expenses, yet only 5% of the elderly were in nursing homes, implying that large expenses were concentrated among a few people, especially among the very elderly (*34*). Because an insurance program to cover nursing-home costs would probably require the universal enrollment of the covered population, even a self-supporting program would have to be government-sponsored, just as the new Medicare insurance program is self-supporting and government-sponsored. A well-designed program would eliminate the last major source of medical cost risk, leading to an increase in the welfare of the elderly without an increase in intergenerational transfers.

REFERENCES AND NOTES

1. In most of this article, I will discuss "the elderly" as if they were a homogenous group. In fact they are at least as heterogeneous as the rest of the population [J. Quinn, *Rev. Income Wealth* **32**, 63 (1987)].
2. Economic status measures economic resources, not what economists call utility (how well off or happy a consumer judges himself to be). Utility depends both on economic status and on the consumer's preferences or needs. Because preferences are not observed, utility comparisons across individuals cannot generally be made. Any utility comparison between the elderly and nonelderly is especially difficult because tastes or needs are probably quite different along some dimensions. Therefore, I will only discuss economic resources, which can be observed.
3. Bureau of the Census, *Money Income of Households, Families and Persons in the United States* (Current Population Reports Series, P-60, Washington, DC, various years).
4. Before incomes can be compared through time, they must be adjusted for inflation. The consumer price index (CPI), which measures the cost of the consumption bundle of a representative consumer, is typically used for the adjustment. Because the elderly consume a different bundle from the representative consumer, spending more on medical needs and housing, and less on transportation and recreation, the CPI might mismeasure the rate of inflation faced by the elderly. Comparisons of a price index based on the actual expenditure patterns of the elderly with the CPI show, however, that the CPI is an accurate price index for the elderly [B. Bridges and M. Packard, *Soc. Secur. Bull.* **44**, 3 (1981); M. Boskin and M. Hurd, *Public Financ. Q.* **13**, 436 (1985)].
5. In 1987 average adjusted hourly nonagricultural earnings were exactly the same as those in 1967. Thus, during this 20-year period there was no gain in the average reward from working.
6. D. Radner, *Soc. Secur. Bull.* **50**, 9 (1987).
7. R. Clark, G. Maddox, R. Schrimper, D. Sumner, *Inflation and the Economic Well-being of the Elderly* (Johns Hopkins Univ. Press, Baltimore, 1984).
8. M. Hurd and J. Shoven, *Am. Econ. Assoc. Pap. Proc.* **72**, 314 (1982); C. Ross, S. Danziger, E. Smolensky, *Contemp. Polic. Issues* **5**, 98 (1987).
9. T. Smeeding, in *Research in Economic Inequality*, D. Slottje and D. Bloom, Eds. (JAI Press, Greenwich, in press), vol. 1.
10. The size adjustment is based on the official government poverty scales. Its aim is to convert households of different sizes to a common unit. In the poverty scaling a two-person household counts as 1.26 of a one-person household, which recognizes that two people need to spend less than twice what one person must spend. The choice of 1.26, rather than, say, 1.5 is arbitrary.
11. It counts an elderly couple as 1.75 of an elderly single female and as 1.5 of an elderly single male [J. van der Gaag and E. Smolensky, *Rev. Income Wealth* **28**, 17 (1982)].

12. In 1980 the households of the elderly had 1.7 persons on average and the households of the nonelderly had about 3 persons. At the same income level individuals in the smaller households could consume more than individuals in the larger households, which implies that for a comparison of economic status household incomes of the elderly should be adjusted upward. The per capita entries are probably too high. Because a child consumes less than an adult, households of the nonelderly have fewer than three adult-equivalent individuals. Therefore, per capita income understates the economic status of the households of the nonelderly.
13. In surveys, the elderly underreport their incomes by much more than other groups (about 37% versus 3%); therefore, the adjustment will increase substantially the incomes of the elderly compared to the nonelderly (*9*).
14. The calculation is based on 5% income growth (*4*, table 5) applied to 1979 taxes and nonmoney income (*9*; table 3), and on 20% and 3% growth in money income of the elderly and nonelderly, respectively.
15. The CPI increased by a factor of 3.11, an annual rate of inflation of 6.7%. This is a high rate by historical standards: during the 17 years before 1967 the CPI increased by a factor of 1.39, an annual rate of just 1.9%.
16. M. Hurd and J. Shoven, in *Horizontal Equity, Uncertainty and Economic Well-Being*, M. David and T. Smeeding, Eds. (Univ. of Chicago Press, Chicago, 1985), pp. 125–172.
17. The poverty level for a single elderly person was $3,479 in 1979, and $4,388 for an elderly two-person household ($5,447 and $6,871 in 1987 dollars). The poverty level is probably far below what most people would think of as poor.
18. T. Smeeding, *J. Policy Anal. Manage.* **5**, 707 (1986).
19. M. Hurd and D. Wise, in *The Economics of Aging*, D. Wise, Ed. (Univ. of Chicago Press, Chicago, 1989), pp. 177–199.
20. R. Burkhauser, K. Holden and D. Feaster, *J. Gerontol.* **443**, S46 (1988).
21. Apparently the elderly do reduce their wealth as they age [M. Hurd, *Am. Econ. Rev.* 77, 298 (1987)].
22. This method of valuing the transfer at market cost is generally used (*7, 9*). This method (or any other) gives measures that are inherently less accurate than measures of financial wealth because the individuals cannot spend the wealth freely. That is, were the individuals given the Medicare and Medicaid wealth shown in Table 4, they might choose not to spend that amount on the medical insurance policy.
23. Average wealth is taken over those households whose wealth is in the bottom 10% of the wealth distribution.
24. A related point is that Medicare and Medicaid wealth is high because medical needs are high. For example, 68% of Medicaid expenditures in 1984 were for nursing home expenses. As discussed above (*2*), one cannot make utility comparisons across individuals, especially if they have different medical needs; but the availability of Medicaid to finance nursing home expenses, should the need arise, makes an elderly individual better off than were Medicaid not available.
25. Wealth in the SCF is assets less debts. It includes housing, property, businesses, and financial assets. It does not include Social Security, pension wealth, or Medicare and Medicaid wealth.
26. R. Avery and G. Elliehausen, *Fed. Reserve Bull.* **72**, 857 (1986).
27. Median household net worth of 45- to 49-year-olds, excluding housing equity, was $11,040 in 1984 (*30*).
28. There is some evidence, however, that saving for retirement has been stimulated by IRAs (individual retirement accounts) [S. Venti and D. Wise, in *Pensions in the U.S. Economy*, Z. Bodie, J. Shoven, D. Wise, Eds. (Univ. of Chicago Press, Chicago, 1988), pp. 9–47].
29. E. Andrews and D. Chollet, in *Social Security and Private Pensions*, S. Wachter, Ed. (Heath, Lexington, MA, 1988), pp. 71–95.
30. Congressional Research Service, *Retirement Income for an Aging Population* (U.S. Government Printing Office, Washington, DC, 1987).
31. R. Burkhauser and J. Warlick, *Rev. Income Wealth*, **27**, 401 (1981).
32. M. Hurd and J. Shoven, in *Pensions, Labor, and Individual Choice*, D. Wise, Ed. (Univ. of Chicago Press, Chicago, 1985), pp 193–216.
33. In the RHS, about two thirds of Social Security benefits are windfall gains. The wealthy have larger windfall gains than the non-wealthy (*31*).
34. U.S. Senate Committee on Aging, *Aging America, Trends and Projections*. (U.S. Department of Health and Human Services, Washington, DC, 1988). Because nursing home expenditures are concentrated among the very elderly, their financing will become an important problem as the population ages.
35. The entries under "income" are taken from Smeeding (*9*, table 5). The entries under "adjusted income, household" are from table 4 (*9*). I calculated the other entries under "adjusted income" by multiplying the corresponding entry under "income" by the ratio of "adjusted income, household" to "income, household." Thus, for example, "adjusted income, poverty scale" is (except for rounding error) 0.64 (0.66/0.52). At the individual level, this procedure is accurate for finding adjusted income for the different household scalings.
36. Support from the National Institute on Aging is gratefully acknowledged.

Observations in Particle Physics from Two Neutrinos to the Standard Model

LEON M. LEDERMAN

The two-neutrino experiment established a relationship between particles, muon and muon neutrino, electron and electron neutrino, which evolved into the standard model of particle physics. The theme of this article is a personal one, which reviews a series of experiments at the Columbia Synchrocyclotron, the Brookhaven Cosmotron, the Alternating Gradient Synchrotron, the CERN intersecting storage rings, the Fermilab 400-gigavolt proton synchrotron, and the Cornell electron storage rings, all of which were important in the evolution of the standard model. In some cases the fermion particles were discovered (the second neutrino ν_μ, b quark); in other cases fields of research were opened (muon spin resonance, neutral kaons and charge-parity violation, dimuons and the Drell-Yan process), which led to further development of the standard model. Finally, the current ignorance about the properties of now three neutrinos is reviewed.

IN THIS ARTICLE I WILL DISCUSS A SEQUENCE OF EXPERIments, which eventually, perhaps even tortuously, contributed to the standard model, that elegant but still incomplete summary of all subnuclear knowledge. This model describes the 12 basic fermion particles, six quarks and six leptons, arranged in three generations and subject to the forces of nature carried by 12-gauge bosons. My own experimental work brought me to such accelerators as the Nevis Synchrocyclotron (SC); the Cosmotron and the Alternating Gradient Synchrotron (AGS) at Brookhaven National Laboratory (BNL); the Berkeley Bevatron and the Princeton-Penn synchrotron; the SC, proton synchrotron (PS), and intersecting storage ring (ISR) machines at CERN (the European Center for

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