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THE INCIDENCE OF MEDICARE

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ABSTRACT

The Medicare program transfers more than $200 billion annually from taxpayers to beneficiaries. This paper considers the incidence of such transfers. First, we examine the net tax payments and program expenditures for individuals in different lifetime income groups. We find Medicare has led to net transfers from the *poor* to the *wealthy*, as a result of relatively regressive financing mechanisms and the higher expenditures and longer survival times of wealthier beneficiaries. Even with recent financing reforms, net transfers to the wealthy are likely to continue for at least several more decades. Second, we consider the insurance value of Medicare in providing a missing market for health insurance. With plausible parameter values, our simulations suggest that low-income elderly benefitted more than the dollar flows would suggest. Including this insurance value implies that, on net, there is faint redistribution from the highest income deciles to the lowest income deciles. We also consider the likely distributional impact of several proposed reforms in Medicare financing and benefits.

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I. Introduction

As the primary source of health insurance for the elderly population, Medicare is a major component of social insurance in the United States. The program has also become an increasingly important component of the wealth of the elderly. Spending in fiscal year 1996 was approximately $200 billion, and by 2004 Medicare is predicted to account for 22 percent of total Federal (non-interest) expenditures. Despite its importance, however, little is known about Medicare's consequences for redistribution. As a result, even less is known about the distributional implications of Medicare reforms currently under consideration. In this paper, we develop a theoretical and empirical framework to understand the incidence of the Medicare program, and the distributional consequences of Medicare reforms.

One reason for the limited attention to redistribution in Medicare may be the apparent simplicity of the question. Unlike Social Security, the Medicare entitlement is essentially the same for all elderly. This entitlement consists of "hospital insurance," financed by payroll taxes, and "supplemental insurance," financed largely by general tax revenues. Because high-income households tended to pay more in both payroll taxes and other taxes over their lifetimes, this financing system would appear to provide an increasingly important source of lifetime redistribution to lower-income households. For example, using data on tax payments and per-capita Medicare expenditures, Vogel (1986) calculated that in 1980, the ratio of average Medicare expenditures to accumulated taxes paid into Medicare was three times higher for Medicare enrollees with low lifetime incomes than for high-income enrollees.

Such calculations do not account for some important determinants of the value of a social insurance program for medical care. First, lifetime Medicare expenditures and hence the lifetime value of the program may be greater for higher-income beneficiaries, both because higher-income individuals incur more expenditures at a point in time and because they tend to live longer.[1] Second, Medicare may have additional value through its provision of health insurance options that might not have existed if health insurance were provided by private, competitive markets. For example, prior to the adoption of Medicare, a far larger fraction of low-income elderly were uninsured than high-income elderly. The low insurance rate may have resulted from fewer opportunities to obtain private insurance because of worse adverse selection problems. On the other hand, Medicare may be less valuable to low-income elderly because too generous insurance would lead to overconsumption of medical care.

We develop a two-part framework for considering these issues. We begin by calculating lifetime expenditures for the elderly in Medicare, using comprehensive Part A (hospital) and Part B (outpatient and physician) insurance claims data from

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[1] The implications of income-related survival differences have been considered for the Social Security system; for example see Hurd and Shoven (1985), Garrett (1995), Pattison (1995), and Lillard and Panos (1995). However, no studies have used a lifetime perspective to evaluate Medicare progressivity.

1990 for a random sample of approximately 1.4 million elderly Medicare beneficiaries. We match these data with Census information on income at the zip code level, to compare Medicare expenditures and mortality experience across income groups. We analyze lifetime taxes using the Panel Study of Income Dynamics (PSID), which allows us to track, for representative individuals, their entire accumulated Medicare payments since 1967 — essentially the entire life of the Medicare system — including general federal tax revenues and the employer component of the payroll tax.

This detailed accounting of Medicare expenditures and taxes allows us to calculate the lifetime transfers associated with Medicare. Not surprisingly, we find substantial levels of intergenerational transfers in the Medicare system; for our baseline parameters, the average transfer for a representative couple aged 65 in 1990 is estimated to be more than $30,000. We also find substantial differences in Medicare expenditures associated with income; the difference in expenditures between the top and bottom income deciles is almost 40 percent for beneficiaries aged 85 and over. These income-based differences are primarily the result of more intensive use of physician and ambulatory services by wealthier beneficiaries. Over a lifetime, such inequalities are exacerbated by differences in survival across income groups. We also find that high income wage-earners pay substantially more in lifetime tax revenue. However, for the cohort of beneficiaries who turned 65 in 1990, the income-related differences in lifetime expenditures exceed the income-related differences in lifetime taxes: intragenerational transfers are largely *from* lower-income *to* higher-income households. Recent reforms in Medicare financing will reduce the regressivity of transfers for future cohorts, but transfers from lower- to higher-income households are likely to continue. Our simulations for the 1945 birth cohort indicate that, even after these financing reforms have been in place for many years, Medicare will provide only limited financial redistribution from the very highest to the very lowest deciles.[2]

We also analyze the value of Medicare from the standpoint of expected utility, to assess the insurance value of this social insurance program beyond the financial flows. This component of our analysis is necessarily more speculative, but it does suggest that Medicare may be particularly important in completing missing insurance markets for the low-income elderly. Including such utility-based adjustments in our analysis suggests a larger redistributional role for Medicare, again from the top income deciles to the bottom few deciles.

Finally, we use our analytic framework to provide a preliminary distributional analysis of several proposed reforms in Medicare. We illustrate how a more comprehensive theoretical and empirical foundation for evaluating the incidence of Medicare could influence ongoing debate about the fairness of Medicare reform.

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[2] We limit our attention to just the Medicare program. Assessing the overall redistributional impact of additional government programs that interact with Medicare, such as Medicaid and federal tax policy more generally, is beyond the scope of this paper.

II. A Framework and Preliminary Evidence for Medicare Incidence Analysis

Like Social Security and virtually all existing health insurance plans, Medicare is financed largely on a "pay as you go" basis. Since its inception in 1966, Medicare Part A, insurance for hospital care and some alternatives to hospitalization,[3] has been financed by a payroll tax on wages. The Part A payroll tax rate is 2.9 percent today, half levied on the employee and half on the employer. Medicare Part B, insurance for physician and outpatient services, is financed partly by beneficiary premiums that cover one-fourth of expenditures, but primarily by general Federal tax revenues. Because Medicare tax payments, especially payments for Part B, are related to an individual's income over their working life, an individuals' overall contribution to Medicare financing clearly increases with lifetime income. Recent reforms such as removing the cap on taxable earnings for the hospital insurance payroll tax have lessened regressivity in Medicare financing.

However, lifetime payments by current beneficiaries have never come close to financing their lifetime expenditures. Individuals who were 65 or over in 1966 were clearly better off with the program, since they contributed no payroll taxes and relatively little general tax revenue and premiums to its financing. But the subsequent rapid growth in Medicare expenditures coupled with the largely "pay as you go" nature

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[3]Medicare Part A insurance also covers one-time hospice benefits, skilled nursing and rehabilitation hospital stays after an acute hospitalization, and home health care. Part A's rapid expenditure growth and relatively low payroll tax rate compared to Social Security are the causes of the projected depletion of the Medicare Part A Trust Fund within the next several years.

of its financing has led to substantial intergenerational transfers to all subsequent cohorts of beneficiaries (Vogel, 1986). Auerbach, Kotlikoff, and Gokhale (1992) find that such intergenerational transfers will remain substantial under current financing rules, if the high real growth in Medicare expenditures per beneficiary continues.

If Medicare expenditures did not vary across groups with different lifetime incomes, these analyses of intragenerational and intergenerational transfers associated with Medicare financing would be sufficient for understanding Medicare's distributional implications. But considerable evidence indicates that Medicare expenditures are correlated with lifetime income. Using 1968 survey data, Davis and Reynolds (1975) found that Part B expenditures were twice as high for high-income Medicare beneficiaries compared to those in the lowest income category. These differences appeared to decline during Medicare's first decade: Link, Long, and Settle (1982) found that, between 1969 and 1976, the ratio of (standardized) hospital days for high versus low income enrollees fell from 1.56 to 1.17, with this latter ratio statistically insignificant. Analyzing more recent data, however, the Physician Payment Review Commission (1992) again documented somewhat larger differences in medical expenditures between low- and high-poverty areas. Few of these studies analyzed all types of Medicare expenditures, but they consistently show income-related differences in Medicare-covered services. Evidence from other countries suggests that these income-based differences are not entirely the result of financial barriers to health care. Even under the National Health Service in Great Britain, expenditures *per occurrence of an illness* were 35 percent more among higher-income groups in England (LeGrand, 1982, p. 26).[4] Because health problems tend to be more common among the poor, controlling for health status would tend to strengthen any simple correlation between income and Medicare expenditures.

In addition, considerable evidence indicates that higher income is associated with lower mortality (Kitagawa and Hauser, 1973; Menchik, 1993; Preston and Taubman, 1994, Pappas, 1995). While economic development has been associated historically with large improvements in life expectancy (e.g., Fogel, 1994), differences in *relative* income within a country appears to be a strong source of differences in life expectancy today (Smith and Eggers, 1992, Duleep, 1995).

The association of higher lifetime income with both higher Medicare expenditures at a point in time and greater longevity imply that the net redistributional transfers as a result of Medicare may be considerably smaller than Medicare's financing rules would suggest. In the next section, we develop a comprehensive framework for assessing net transfers resulting from Medicare taxes and expenditures, accounting for all of these factors.

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[4] Gornick et al. (1996) has documented large differences in the use of preventive services by healthy individuals, as well as in the use of intensive treatments for common illnesses, among Medicare beneficiaries. Also, Gittelsohn, Halpern, and Sanchez (1991) matched Maryland hospital discharge data with census zip code information to find pronounced correlations between income and race in surgical procedures. The correlation with income for most elective procedures (e.g., bypass surgery, joint replacement) was positive, while the correlation with income for intensive procedures to treat disease complications (e.g., amputations for diabetes) was negative.

However, the resulting estimates of the "accounting" value of Medicare may not capture an important part of the net value of Medicare as a social insurance program to different income groups. As Bernheim (1987) has argued in the context of annuity benefits, actual benefits paid to income groups may not be a very accurate guide to the cost of an equivalent insurance policy in the absence of a social insurance program. Policies such as a fairly-priced, annuitized medical insurance program may simply not exist because of adverse selection, liquidity constraints, and other reasons. As a result, the completion of an insurance market may have far more value in reducing uncertainty about lifetime consumption and well-being for risk-averse individuals than the accounting value of the program might suggest. For example, the 1964 Congressional testimony of Edwin Daly, MD, of the Group Health Association of America, summarized the opportunities for purchasing insurance past age 65:

> The present HIP [Health Insurance Plan of Greater New York] annual premium rate for its medical care program for a person enrolled prior to 65, is $57.80 and the Blue Cross Insurance is $55.80. If that person then remains in HIP-Blue Cross, he [continues to pay those premiums after age 65 for] both medical and hospital coverage... These are community rates, and reflect the average costs of young people, middle age people, and old people.
>
> But the present Blue Cross rates for a person coming in after he is 65 jump up to $129.60 a year. That is Blue Cross [hospital coverage] alone and is available only if that person is found medically acceptable. Blue Cross does not take them all, they take a few.... (U.S. Congress, 1964, p. 181-182)

The enormous difference in premiums for the same hospital coverage between the elderly who continued in a community-rated plan and those who wished to enroll individually in Blue Cross, even with a screening medical exam, is consistent with a substantial problem of adverse selection. The limited availability of group insurance plans to the low-income elderly probably made this problem particularly onerous for them.[5] All of these considerations suggest that the insurance may have been much more valuable than its accounting value suggested.

Evidence of the wide gulf in insurance coverage across income groups is shown in Table 1. In 1962, less than 40% of elderly households among the lower third of the income distribution held any health insurance, compared to three-fourths of households in the upper third of the income distribution. Particularly for lower-income individuals, these policies were not very generous: most of them capped not only the dollar amount of

Table 1: Shares of Elderly Households with Health Insurance, 1962

Income Tercile	Couples	Single Males	Single Females
Lowest	42%	15%	31%
Middle	66%	31%	42%
Highest	80%	64%	66%

Source: Appendix G, "Services for Senior Citizens," Special Committee on Aging, Hearings, U.S. Senate 1631 (88th Congress), 1964.

[5] In the early 1960s, most (80%) of privately-employed urban workers were covered by some type of hospital insurance, with coverage rates and insurance generosity highly correlated with income. Approximately 60% of firms continued such plans for their retirees, but most of these offered either less generous coverage, required the retirees to pay more of the premium out of pocket, or both (National Insurance Conference Board, 1964).

coverage provided per hospital day or per physician visit, but also the total days and visits that would be covered (Epstein and Murray, 1967).

There are other explanations as well for the minimal coverage levels among the low-income elderly. A universal insurance program forces lower-income beneficiaries who probably have lower demands for insurance to pool with individuals who have higher demands. Health care spending resulting from generous insurance could be worth much less than its costs to low income recipients. In his Congressional testimony, Dr. Daly noted

> We have many enrollees who upon attainment of age 65 become ineligible to continue under group enrollment and no longer have part or all of their premiums paid by an employer or welfare fund. We urge every one of these people to keep their insurance, that this is the time they need it most. Yet at this time, when they need it most, two out of three of these people drop their health insurance. They simply cannot afford to go on at a time when their income is reduced, to pick up the full cost of health insurance which previously had been paid for all or in part by the employer. This really is tragic. (U.S. Congress, 1964, p. 182)

That is, community rating may have led to more insurance than the low-income elderly generally wanted. Thus, because Medicare provided more generous insurance than did most private plans, it might also have led to inefficiencies related to the overconsumption of medical care, because of the in-kind nature of the transfer.[6]

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[6] Dr. Daly's testimony is also consistent with myopia in individuals' financial planning: they may not have appreciated the value of continuing the insurance plan into old age. Elderly with lower incomes may also have believed that essential health care would be provided by welfare or some other means, and thus rationally opted out of purchasing health insurance (e.g., Hubbard, Skinner, and Zeldes, 1995). Prior to Medicare, the Kerr-Mills program provided some medical assistance for the elderly with illnesses. However, its

We explore these issues in more detail below, with a few caveats. While we can measure use of services and monetary benefits, we cannot easily measure the value of the health consequences of the additional health care resulting form insurance. Although we defer a detailed analysis of this difficult question for later research, considerable evidence suggests that the marginal value of many intensive services in Medicare is low.

We also do not consider several other issues related to the incidence of Medicare. We evaluate tax incidence from the standpoint of personal taxes paid only, and not the ultimate incidence on households of other taxes that contribute to general Federal revenues and hence Part B financing (LeGrand, 1978). Such considerations would probably reduce estimated progressivity (for example see Fullerton and Lim, 1993). In addition, because Medicare now comprises close to 2 percent of GDP, it may have had important "supply-side" consequences for the distribution of income. Since 1966 and into the 1990s, growth in total compensation for workers in the health care industry has been substantially greater than for workers in other industries. Because health care workers have historically been relatively highly-paid, these supply-side effects have probably favored higher-income households. Thus, accounting for supply-side factors and the incidence of non-

availability varied considerably across states. For example, in February 1964, only 369 elderly people in Florida received any assistance (Merriam, 1964). Hospitals also provided some charitable care for the impoverished elderly, but Dr. Daly also testified that such programs were limited in scope and not reliably available.

personal taxes would probably suggest that Medicare is even less progressive than our analysis indicates.

Finally, it is important to recognize that some aspects of the social value of a universal health insurance program like Medicare may be difficult to capture in conventional incidence analysis. Many economists and philosophers have argued that equity in the medical treatment received for a given health problem, or the participation of all members of society in a single insurance program, is a socially valuable outcome in itself (see, e.g., Fuchs, 1986, and Sen, 1994). Such arguments are implicitly or explicitly based on social welfare functions in which equality across individuals with different incomes in actual treatment for a health problem, or at least in insurance coverage for treatment, is valued in itself.

III. The Distribution of Medicare Expenditures and Taxes

In this section, we describe our methods for conducting an accounting analysis of the intragenerational and intergenerational redistribution in the Medicare program. We estimate the present discounted value of Medicare benefits and the present accumulated value of taxes paid into the Medicare system for various lifetime income groups. The difference between them is defined to be the net transfers, positive or negative, from the Medicare system. If individuals could forecast their health demands perfectly, and if insurance did not lead to the consumption of medical care not worth its resource cost, then this accounting exercise would provide a reasonably complete foundation for evaluating Medicare incidence. Because demand for health care is not completely predictable and because health insurance may lead to the consumption of too much medical care, however, this accounting analysis does not capture the insurance value of Medicare to different income groups, an issue we revisit after our accounting exercise below.

III.1. An Accounting Framework

We use a program accounting identity that distinguishes intergenerational and intragenerational transfers:

$$\begin{aligned} PV(\text{Benefits})_{ik} = \; & PV(\text{Taxes paid})_{ik} \\ & + PV(\text{Within-Cohort Redistribution})_{ik} \\ & + PV(\text{Between-Cohort Redistribution})_{ik} \end{aligned}$$

for the kth beneficiary group within cohort i. By definition, within-cohort redistributions sum to zero across the $k = 1,\ldots,K$ groups.[7] By describing the intergenerational transfer as a *constant amount* for each person in the cohort, we can identify the within-cohort redistribution as the difference between the actual transfer and the average transfer across all income groups.

For a 65-year-old in group k in 1990 ($i = 1925$ birth cohort), the present value of benefits are given by

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[7] An alternative approach is to calculate rates of return. This approach is sometimes used in the social security literature (e.g., Garrett (1995), Panis and Lillard (1995)), but rate of return estimates do not readily convey the net value of a program (see, e.g., Rosen, 1995).

$$PV(Benefits)_{ik} = \sum_{j=1990}^{2015} \omega_{ijk} M_{ijk} \left(\frac{1+g}{1+r} \right)^{j-1990} \quad (1)$$

where j denotes year (equivalent to age), ω_{ijk} is the fraction of cohort members in group k surviving to year j based on age-specific survival rates, M_{ijk} is the cross-sectional level of medical spending for group k in year j, and g is the real growth in Medicare expenditures. Because of sparse data, we do not calculate Medicare benefits past age 90.[8] We focus this empirical analysis on the cohort turning 65 in 1990. We use cross-sectional data on mortality and expenditures for elderly cohorts in 1990 to estimate ω_{ijk} and M_{ijk}. We assume that income-specific mortality rates will remain constant, and that differences in Medicare expenditures by age and income group will also remain at 1990 levels.[9]

Next, we consider the present accumulated value of taxes paid to finance Medicare. An individual's total allocated tax payments into the Medicare system are given by:

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[8]Note that truncating Medicare expenditures at 90 is likely to cause an overestimation of Medicare progressivity, since more high-income beneficiaries survive to age 90 and also have higher death rates (with associated high expenditure levels) after age 90.

[9]We intend to model differential survival and expenditure trends across income groups in a future paper. Some evidence suggests that income-related differences in survival have increased in recent years (Pappas et al., 1993); our preliminary analyses also suggest that expenditure differences may have increased as well.

$$PV(Taxes)_k = \sum_{j=1966}^{1990} \left\{ \left[\min(E_{jk}, MAX_j)\tau_j^m + \psi_j T_{jk} \right] \prod_{s=j}^{1989} (1 + r_s + \delta_s) \right\} + \sum_{j=1991}^{2015} \left[(\psi_j T_{jk} + P_j)\,\omega_{jk} \right] \left(\frac{1+g}{1+r} \right)^{j-1990} \quad (2)$$

The first term in the first bracket measures the Medicare Part A component of the payroll tax, where τ_j^m is the proportional Medicare payroll tax in year j. In earlier years, the payroll tax rate was only 0.7 percent, with modest caps on taxable earnings (MAX_j). In 1971, for example, the maximum limit for Medicare taxes was $7800 in earnings, and during some this period as many as 40% of covered workers exceeded the maximum amount. The second term allocates total household Federal tax payments T_{ijk} (exclusive of payroll taxes) into Medicare Part B, based on the fraction ψ_i of total Federal expenditures devoted to Medicare Part B in the year. Because Medicare Part B accounted for a much smaller share of Federal expenditures in Medicare's early years than it does today, these tax contributions have also increased for more recent cohorts of beneficiaries. We explore the consequences of payroll tax changes for "steady-state" Medicare progressivity below.

These payments are accumulated at the nominal rates of interest paid on U.S. government debt held by the Social Security Administration, r_i, *plus* the fraction of people in that cohort who died in year j, δ_j.[10] This extra interest rate term reflects the

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[10] We use data on mortality rates for 5-year age intervals from the 1990 Life Tables (U.S. Government, 1995, Table 6) among males and females combined.

fact that Medicare is an annuity, so that the taxes paid into the system by the now-dead members of that cohort should be included in as part of revenue contributed by that cohort.[11] Finally, the third term in equation (5) measures taxes paid after age 65, which includes the present (annuity) value of Part B premiums, assumed to grow at the rate g along with Medicare expenditures, plus the Medicare share of any future federal income tax payments, assumed constant at its 1990 level of 5.9 percent.

III.2. Data and Methods for Estimating Medicare Transfers

To estimate differences in Medicare expenditures by demographic group and income, we compiled data on all services covered by Medicare (inpatient, outpatient, and physician) for a random 5% sample of 1990 elderly Medicare beneficiaries, approximately 1.5 million individuals. We matched these data by residential zip code and black or nonblack race to 1990 Census data on average zip code income by race, and the distribution of income within the zip code, complied by a marketing research firm (CACI). Based on the zip-level average income data, we divided our entire sample of Medicare beneficiaries into income deciles, and computed differences in average expenditures and mortality risks across these deciles for specific demographic groups based on age (65-69, 70-74, 75-79, 80-84, 85+) and gender. We describe our dataset creation in more detail in the Data Appendix.

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[11] This point was made by Hurd and Shoven (1985). Note that in this analysis we account for differential survival from age 65 only. To the extent that survival rates to age 65 differed in the same direction as subsequent survival rates -- that is, with wealthier individuals dying at older ages -- this simplification implies that we are overstating progressivity.

The consistency of zip-based average income measures for evaluating the association of income with use of medical care and mortality has been explored in many previous studies (see, Geronimus, Bound, and Neidert, 1996, for an excellent overview). Estimates may be biased in both directions. On the one hand, individual-level reports of current income are noisy measures of lifetime income due to reporting errors and random income shocks; income estimates averaged over populations at the zip-code level helps eliminate the resulting downward bias from measurement error. On the other hand, correlations between average income and other individual-level variables such as race within zip codes may lead to residual biases in estimates of both effects. In addition, income effects may be biased upwards if any unmeasured variables such as education are correlated with income, or if additional "neighborhood effects" are associated with a neighborhood's income composition.

In a recent study using Medicare claims data linked to individual survey responses for a sample of Medicare beneficiaries, Gornick et al. (1996) found that individual-level income measures generally suggested a more pronounced relationship between income and use of medical services compared to zip-level measures, though the differences were small for most types of medical services. Thus, though competing biases exist, previous studies do not suggest that our estimates of the association between income and Medicare expenditures are significantly biased upwards. Moreover, for purposes of incidence analysis at the level of lifetime-income cohorts, a pure causal effect of income is not appropriate.

Because zip-level measures do not remove the effects of variables such as education or geographic access to medical services that are correlated with income, they may be particularly well suited for determining the "unadjusted" association between lifetime income and Medicare expenditures.

III.3. Mortality Rates by Income Decile

Figure 1 presents mortality odds ratios for women, for selected age groups. The ratios were calculated as the ratio of people who died during 1990 divided by the number of people enrolled as of January 1, 1990.[12] Among the youngest elderly, the risk of death is one-third lower for the highest income decile compared to the lowest decile. However, at more advanced ages, the income-mortality relationship reverses: women aged 85 and over in the highest income

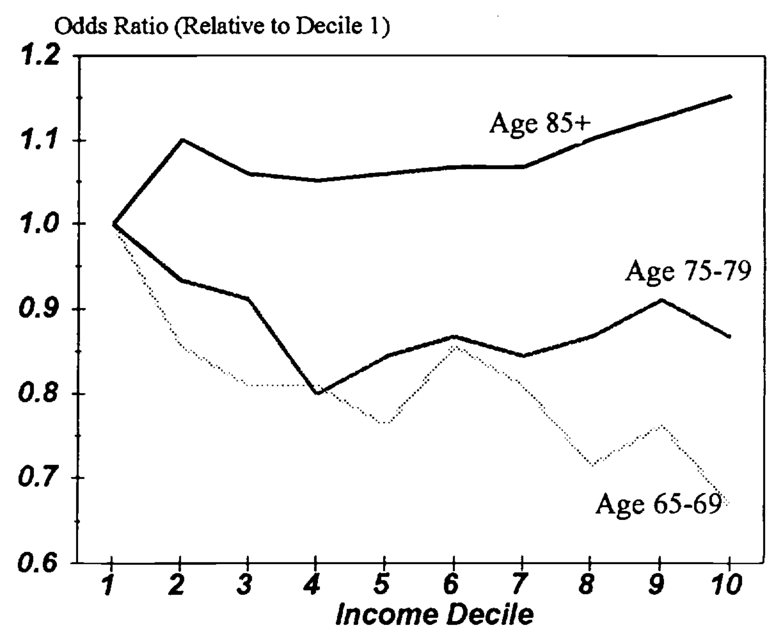

Figure 1: Odds Ratio for Mortality Among Women, 1990
Selected Age Groups. Baseline mortality rate at Decile 1: 2.1 percent for age 65-69, 4.5 percent at age 75-79, and 11.8 percent at age 85+

[12]The complete set of mortality rates for women and men is presented in Appendix Tables B.5 and B.6.

decile are at *higher* risk of death compared to lower deciles. This relationship, also reported in some previous studies of mortality for blacks and nonblacks, is consistent with the selection arising from differential mortality at earlier ages: low-income elderly who survive to age 85 or beyond are a relatively healthy group compared to the oldest-old with higher incomes.

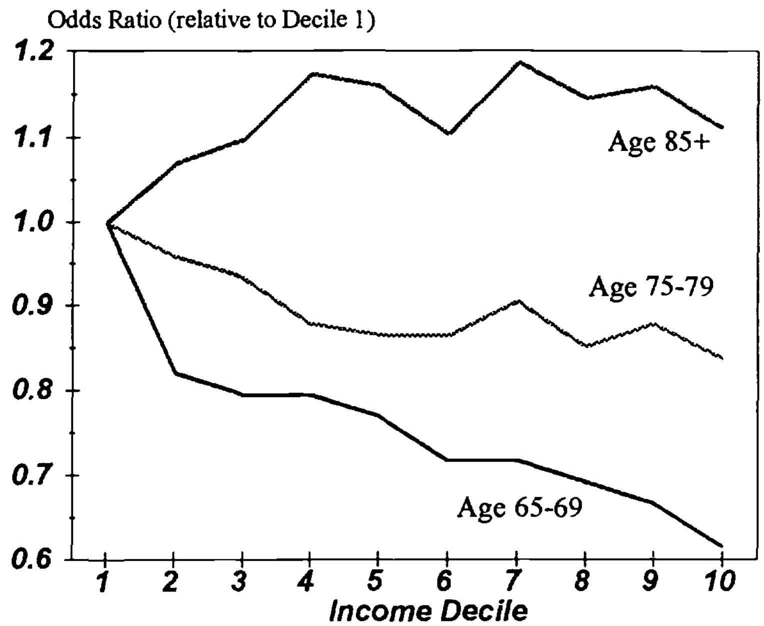

Figure 2: Odds Ratio for Mortality Among Men, 1990
Selected Age Groups. Baseline mortality rate at Decile 1: 3.9 percent for age 65-69, 7.4 percent at age 75-79, and 14.4 percent at age 85+

A more pronounced pattern holds for men, shown in Figure 2. For men aged 65-69, the mortality risk for the highest-income decile is 40 percent lower than the risk for the lowest-income decile. Mortality risks are somewhat higher for males aged 85 and over in the highest deciles, though the relative risk in the highest decile is somewhat lower compared to women. Thus, we find quite different patterns of mortality risks across income groups, with large mortality differences arising among the younger elderly. The risk reversal that occurs at age 85 and beyond does not eliminate the overall positive association between income and life expectancy at Medicare eligibility: life expectancy from age 65 is over two years greater in the highest compared to the lowest income decile.

III.4. Medicare Expenditures by Income Decile

Figure 3 (and Table B.1 in Appendix B) presents total Part A and Part B Medicare expenditures per enrollee in 1990 for men, by age group. These estimates are computed by adding up Medicare expenditures for each individual on covered inpatient services, outpatient services, other ambulatory services, and physician services. Total Medicare expenditures increase steadily with age then level off after age 80: Medicare spending for the oldest-old (age 85+) is more than double the spending for the younger elderly, aged 65-69. Within each age group, there is a pronounced correlation between income and Medicare expenditures, particularly for older groups. For men aged 65-69, expenditures in the top decile are only 8% higher than in the bottom decile, but the expenditure difference increases to 37% (over $1000) for those aged 85 and above.

Figure 4 (and Table B.2 in the Appendix) presents analogous results for women. For all age groups, there is a mild U shape to the relationship between income and expenditures: expenditures for women in the lowest decile are slightly higher than expenditures in the near-poor deciles. Once again, there is little difference in expenditures across age groups for the youngest elderly — expenditures are actually slightly higher in the lowest income groups — but the correlation between income and expenditures strengthens at older ages. Women aged 85 and over in the top decile had expenditures that averaged around 15 percent ($500) more than women in the lowest decile, and over 20 percent more than women in the third decile.

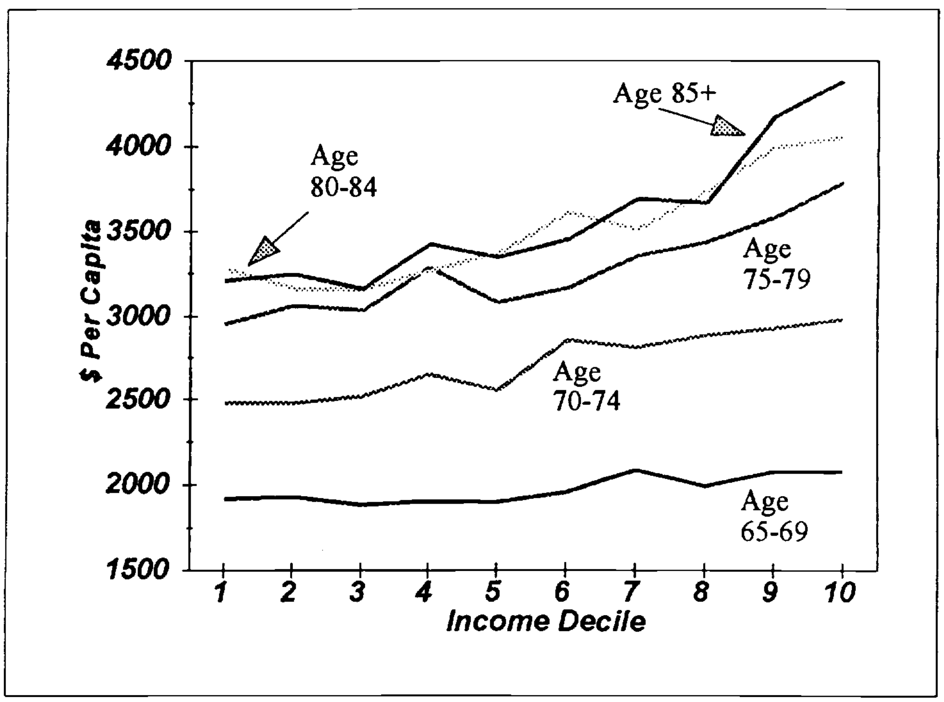

Figure 3: Average Medicare Spending for Men, 1990
(N = 541,707)

The sources of these substantial differences in expenditures, especially at advanced ages, are not relevant for understanding the "accounting" incidence of Medicare. However, understanding the sources of the differences may be relevant for evaluating the role of Medicare in achieving some of the other social goals outlined above, such as fostering more equal treatment of health problems across income groups, and may provide insights for our analysis of the insurance value of Medicare to different income groups. For these reasons, we review several possible explanations for the observed pattern of income-related expenditure differences.[13]

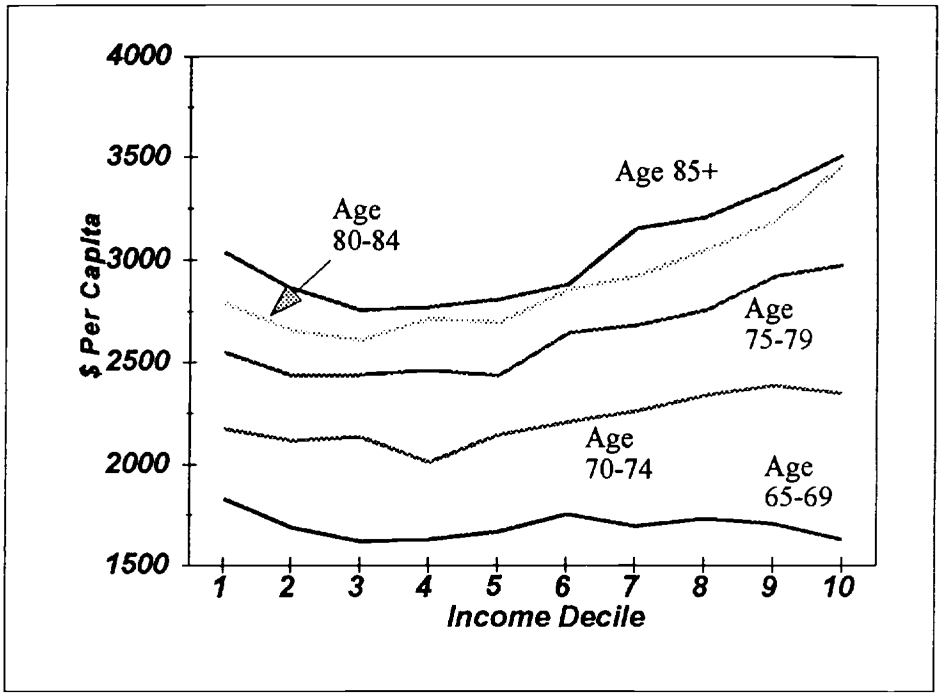

Figure 4:Medicare Spending for Women, 1990

One possible cause is differences in costs of living. Average income levels tend to be higher in high-cost metropolitan areas, leading to higher medical

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[13]One cause of a spurious correlation between income group and expenditures is differences in age distributions within each age group-income cell, particularly at advanced ages. In fact, even in the over-85 cells, the age distribution varies only slightly across income groups, and expenditures do not rise much with age beyond age 80 anyway.

expenditures for any given set of services. Survival could also be greater in more urban areas with more intensive services available, causing the observed correlation. Adjusting for both income levels and Medicare expenditures using a regional price index the GPCI,[14] resulted in only a minor reduction in the progressivity of total Medicare spending.

Another possible cause for the positive correlation between income and expenditures is the generosity of supplemental "Medigap" insurance coverage that provides some insurance for copayments, deductibles, and other medical expenses not covered by Medicare. Lower income groups hold less Medigap insurance (Short and Vistnes, 1992), and the resulting lower generosity of their insurance package would be expected to reduce utilization independent of income (see, e.g., Bodenheimer, 1992). However, the General Accounting Office (1991) estimates that over 85% of elderly beneficiaries are covered either by a private supplemental insurance policy or by Medicaid. Thus, while differences in private and public Medigap coverage might help explain the slightly higher expenditures for women in the lowest decile compared to the near-poor, Medigap coverage is probably nearly

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[14]The geographic practice cost index (GPCI) is currently used by the Health Care Financing Administration to adjust reimbursement for "reasonable" geographic differences in production costs. This price index uses non-medical professional salaries, costs of practice (e.g., office rental) and malpractice insurance costs to measure price differences at the level of MSAs and state-specific non-MSAs (e.g., in rural areas). See Zuckerman, Welch, and Pope (1990).

complete in the higher income deciles where much of the expenditure differences arise.

The emergence of a progressively stronger correlation between income and expenditures with advancing age suggests that medical treatment near the end of life may be an important contributing factor. At lower ages (65 to 69), mortality rates are much higher among lower-income Medicare beneficiaries. Medicare spending is high on average near death (Lubitz and Riley, 1993), so that the higher death rate tends to elevate average spending for the entire income group. Accounting for income-related differences in health status by age would probably result in a much stronger relationship between income and expenditures. For example, in a regression analysis (not reported) that controls for mortality differences, there is a positive correlation between income and Medicare spending at *all* ages, particularly among men.

Further evidence for this hypothesis comes from differences across income groups in the types of expenditures incurred. Most of the observed difference in expenditures arises from physician and ambulatory services. For example, for males age 85 and over, average physician/ambulatory reimbursements per enrollee range from $1130 for the lowest income decile to $1705 for the top income decile (see Table B.3). The positive correlation between income and physician/ambulatory spending is also evident for women (Table B.4) although the extent of the income effects are less dramatic. This difference in turn appears to result from fewer physician and ambulatory encounters for lower-income patients, and more hospital visits for intensive elective surgical procedures (e.g., knee replacement) that are associated with heavy use of specialist physicians. In other research, we have documented large differences in treatment intensity and expenditures across income groups for elderly patients with heart attacks (Skinner, Rabin, Smith, and McClellan, 1996).

The fact that lower-income individuals tend to use fewer, less intensive Medicare services for treating a given health problem suggests the existence of either a positive income elasticity of demand for health care under Medicare, or income-related barriers to use of care. We return to this issue in Section V when we consider the utility-based model of health insurance and medical care.

III.5. Lifetime Medicare Taxes by Income Decile

We use the Panel Study of Income Dynamics to estimate differences in lifetime Medicare taxes across income groups. In calculating lifetime taxes for the cohort age 65 in 1990 (those born in 1925) we restrict the sample to households (married or single) aged 60-69 in 1990 which had remained intact since 1982. (We use the 10-year cohort to increase the size of the sample, and then correct for differences in average taxes paid for the younger sub-cohort aged 60-63 versus the older sub-cohort aged 67-69.) To accumulate total taxes paid since program implementation in 1966, we include both the husband and wife's earnings back to 1967.[15] Federal

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[15] Family structure is allowed to change prior to 1982; if we had restricted the sample to one in which there had been no change, it would have been highly unrepresentative. So it is possible that a previous spouse's earnings from (say) 1972 could be factored in calculating

taxes paid by the head and spouse are reported (at least since 1970) in the PSID; these are used to attribute federal taxes paid into the Medicare system.[16] Actual rates of return earned in the Social Security trust fund were used to accumulate individual accumulated tax payments. We use average money income between 1984-88 as our measure of "permanent income" for the purpose of creating income deciles.

Finally, we must make some estimates of future taxes paid into the Medicare system by beneficiaries. We assume that Part B premiums grow at the rate of 2.5% real per annum, which is a conservative growth rate compared to Medicare's recent experience. For the cohort turning 65 in 1990, we must estimate future tax payments for 1991-2015. To do this we assume that taxes paid in 1990 would be continued to be paid through 2015; payments were discounted at the rate of 3 percent (the real rate of interest) plus a 3 percent assumed mortality rate.[17] We then attribute 5.9 percent of these tax payments as being attributed to Medicare; this is the 1990

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total taxes paid for the circa-1990 couple. Implicitly, we are assuming that the current spouse earned the same at her job in 1972 as did the previous spouse. For single female households, we counted earnings as spousal earnings if the household had been married prior to 1982, for single male households, we counted just head's earnings. (The convention in the PSID is to count the male as head.)

[16] The 1970 taxes paid are used to impute previous years' federal taxes paid, although the share of total government spending going to Medicare in those days was small indeed.

[17] We assume a 3 percent mortality rate for purposes of computational ease. Because Medicare's share of federal tax revenue is relatively small, changing the mortality rate (or making it vary by age or income) has a very small impact on the results.

fraction of the federal contribution to Part B divided by total tax revenue. These future tax payments are relatively small.

III.6. The Net Distribution of Medicare Expenditures

The estimates of survival and expenditure effects form the basis of our calculations of the net accounting transfers associated with Medicare. The individual estimates of Medicare tax payments are not directly comparable to the zip-code-level estimates of Medicare expenditures by income group, because the latter consist of averages over a distribution of actual income values within zip codes.[18] However, Census data permit determination of the distribution of households across income ranges in each zip code. For example, households with income levels between $15,000 and $25,000 comprise the interval between the 26th percentile and the 45th percentile of the income distribution averaged across all zip codes.[19] We match this category to households in the corresponding part of the income distribution (26th-45th percentile) in the PSID sample, to construct synthetic zip code populations. For example, if 20 percent of households in zip code 41414 have income between $15,000 and $25,000, we give PSID households with incomes in the 26th to 45th

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[18] In particular, deciles constructed based on individual-level income measures show much larger differences in average income than deciles based on zip-code average incomes. For example, the first decile based on individual-level income rankings for the PSID households had an average income of $7,955, compared to an average income of $19,540 in the first decile for Medicare zip-based expenditure measures, because some residents of even low-income zips have high incomes. Similarly, among the top decile, average PSID income is $127,517 compared to just $59,585 for average income in the top zip-level decile.

[19] Formally, this is the average fraction of people in this income category in all zip codes, weighted by the distribution of Medicare enrollees.

percentile a weight of .20 in constructing the average taxes paid in the zip.[20] We then average over the within-zip income distribution to derive the average taxes paid for the entire zip-level income decile.

Because Medicare data are reported at the individual level (but sorted by household income), and the PSID data are reported by household, we must make one final adjustment to the PSID tax data. We allocate household taxes for married couples to individuals simply by splitting the accumulated taxes equally between husband and wife.[21] In measuring average benefits and taxes within each income decile, we weight by the relative share of males and females. Not surprisingly, females comprise a larger fraction of the lower income deciles. In sum, the income decile categories reported below do not correspond to individual income rankings, but rather to rankings of zip-code-level neighborhoods.

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[20]That is, let $\omega_m(z)$ be the share of households in zip z with income in a relative range indexed by m=1,...,M. Then our estimate of average taxes paid in zip are

$$\Sigma_m \, \omega_m(z) \cdot T_m,$$

where T_m is the present value of average Medicare taxes paid by PSID households in relative income range m. We stratify on a relative basis (i.e., the household's percentile in the income distribution) because our sample of people in their early 60s have higher average income levels than the population averages. For example, the "less than $15,000" classification in the Census data corresponds to the bottom 26 percent; in the PSID data this represents households with income less than $21,788. Corresponding numbers for $15-25,000 (Census) are 21,788-32,955 (PSID); for $25-35,000 (Census), $32,955-43,002 (PSID); for $35-$50,000 (Census), $43,002-60,929 (PSID); for $50-75,000 (Census), $60,929-83,874 (PSID); and for $75,000+ (Census), $83,874+ (PSID). In other words, the distribution of the PSID income measures is about $7-8,000 greater than the distribution of the Census measures.

[21] We recognize the potential for bias because households are ranked by household income and not by some type of household-equivalent scale. We also recognize that splitting tax payments in two is somewhat arbitrary. Fortunately, husbands and wives are always counted in the same income decile on both the expenditure and the tax side.

Decile	Lifetime Taxes Paid (000)	Benefits (000)	Net Medicare Transfers ($ 000)			
			Base Scenario	Growth Rate of 1%	Growth Rate of 4%	Progress. Part B Premiums
1	15.9	32.7	0.0	0.5	-0.6	1.3
2	16.9	32.9	-0.7	-0.2	-1.2	0.5
3	17.5	33.0	-1.3	-0.8	-1.8	-0.2
4	18.0	33.6	-1.1	-0.8	-1.5	-0.2
5	18.6	34.5	-0.9	-0.7	-1.2	-0.3
6	19.0	35.9	0.1	0.2	0.1	0.5
7	19.7	36.8	0.3	0.2	0.6	0.3
8	20.5	38.5	1.2	0.8	1.7	0.7
9	21.6	39.5	1.2	0.6	1.9	-0.2
10	23.5	41.3	1.0	0.1	2.2	-2.6
Avg. Intergenerational Transfer			16.8	12.6	21.8	14.8

Table 2: Medicare Taxes, Benefits, and Net Transfers, for the 1925 Cohort. All numbers are on a per capita basis. The assumed growth rate in Medicare spending is 2.5% annually in real terms; alternative figures are presented for 1% and 4%.

Some representative calculations of net transfers from Medicare are reported in Table 2, with an assumed interest rate of 3 percent and a real growth rate for

Medicare spending per person of 2.5 percent.[22] Accumulated Medicare tax payments, in Column 1, show a positive correlation with income, although the lifetime incidence of the tax is still largely regressive. For all deciles, taxes are much smaller than expenditures: the average intergenerational transfer associated with the Medicare program for this cohort is $16,800 per person (or for $33,800 per couple). Column 3 and Figure 5 show that net transfers *within* the cohort flow largely from low income to high income households. People in the top income decile receive $1,000 more in Medicare benefits than the bottom income decile, and $2,300 more than the third income decile. Thus, while Medicare tax payments are larger for the top income decile ($7600 higher in present value), lifetime differences in Medicare expenditures are even larger ($8,600 higher). Differences in life expectancy are an important part of this transfer

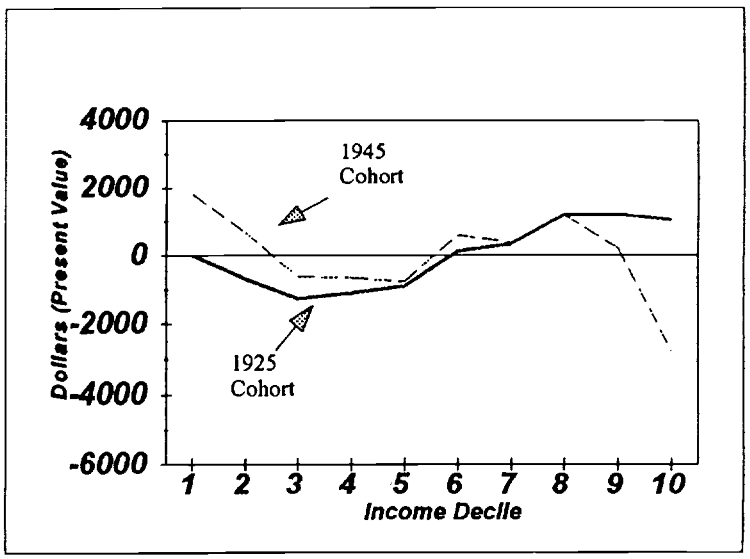

Figure 5: Intragenerational Transfers for the 1925 and 1945 Cohorts

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[22]This growth rate is smaller than recent Medicare expenditure growth, and smaller than that assumed by the Health Care Financing Administration Office of the Actuary for its Medicare expenditure projections. As we describe in more detail below, a higher growth rate is associated with greater intergenerational transfers (see Auerbach, Kotlikoff, and Gokhale, 1992) and intragenerational transfers, since the income-related differences in Medicare expenditures are larger.

from low- to high-income households. When we assume identical mortality rates across all income deciles at the population average, there is a net transfer of $1,900 from the top to the bottom income decile.

The results are sensitive to the assumed rate of growth in Medicare spending. When we assume a lower real growth rate of 1 percent in expenditures and Part B premiums, there is less within-cohort redistribution, while the intergenerational transfer declines to $12,000. When we assume real growth in Medicare expenditures and premiums of 4 percent, a rate more consistent with Medicare expenditure growth in recent years, the net transfers from poor to rich are larger. Those in the top income decile receive $2,800 more in net transfers than the bottom income decile. The 4 percent growth rate amplifies the disparities in Medicare spending among those age 80 and over, and also increases the net intergenerational transfer.

The reverse-transfer effects of Medicare may be transitional. The 1925 birth cohort paid Medicare taxes for only part of their working lives, and they faced the recent increases in Medicare taxes for only a few years prior to retirement. Future generations will have larger and more progressive contributions to Medicare, both through increased contributions from federal tax payments to the Part B program, and through uncapped Part A payroll taxes. To determine the extent to which Table 2 is driven by transitional effects, we consider the redistributional impact of Medicare for the cohort born in 1945, which turns 65 in 2010. This cohort has paid Medicare taxes since they were age 21, and for much of their working lives will be subject to the higher payroll taxes (2.9 percent of earnings without a cap, the 1990 rate) and the higher contributions from general tax payments. To capture potential growth in future federal tax spending, we assume that the share of federal spending devoted to Medicare Part B grows by 2.5 percent annually until 2010, when the share is just under 10 percent of tax revenue.

For this simulation, we accumulate actual tax payments (1966-90) at the actual Medicare interest rates. Obviously, we must make some assumptions about earnings for the years 1991-2010 to determine future tax payments for this period. We use household earnings in 1990 as the starting point, and, based on the AR(1) model of log earnings estimated in Hubbard, Skinner, and Zeldes (1994), simulate future earnings for 1991-2010 for each household in the PSID sample. To reflect differences in earnings by education groups, we assume a 1 percent real growth rate in earnings for high school dropout, a 1.5 percent growth rate for high school graduates, and a 2 percent growth rate for college graduates.[23] We also assume continued real growth in Medicare spending (and part B premiums) of 2.5 percent, stable mortality rates, and no further changes in Medicare financing mechanisms.

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[23] For the purposes of calculating federal tax payments, we need to know money income, not earnings. We assume the ratio of earnings to money income for each household remains constant over time; this allows us to infer money income from earnings in each year. We then predict federal tax payments in future years based on estimated federal taxes explained by a cubic function of age; these are used to infer the individual contributions to the Part B program through general tax revenues.

Table 3 (and Figure 5) shows the results of this simulation. Intergenerational transfers are predicted to fall to only $1,100 for this cohort; this decline obviously depends crucially on the assumed growth rate in Medicare spending. However, the intragenerational transfers are only slightly more progressive than for the 1945 cohort. For most income deciles (the third through ninth), there remains a net transfers from lower- to higher-income households, because the absolute expenditure divergence between high- and low-income households grows as Medicare expenditures grow.

Decile	Steady-State Taxes Paid (000)	Benefits (000)	Total Transfers (000)
1	50.1	52.6	1.4
2	52.1	53.5	0.3
3	53.6	53.8	-0.9
4	54.6	54.8	-0.9
5	55.9	56.1	-0.9
6	57.0	58.6	0.5
7	58.5	60.0	4.2
8	60.4	62.8	1.4
9	63.1	64.7	0.6
10	68.7	67.7	-2.0
Avg. Intergenerational Transfer			1.1

Table 3: "Steady-State" Medicare Taxes, Benefits, and Net Transfers for the 1945 Cohort, Circa 2010. For all years beyond 1990, we use 1990 tax rates and financing rules.

Our results suggest that, even as Medicare slowly approaches a "steady state" of lifetime contributions under current financing rules, it will provide little redistribution from high- income to low-income households. We have tried to minimize any potential biases toward this conclusion in our methods. Our methods do not account for lower survival rates to age 65 in the lowest income deciles, for the net supply-side transfers to relatively highly-paid workers in the health care industry, for the larger share of wealthy elderly surviving past age 90, or for Medicare expenditure growth rates comparable with those of the last decade. Accounting for any of these factors would probably result in larger estimates of net transfers from low- to high-income households.

While this accounting exercise provides some important insights about transfers associated with Medicare, it does not account for the insurance effects of the program. As we have argued above, Medicare's insurance value may be considerably higher for lower-income beneficiaries, who would probably face greater adverse selection problems in private insurance markets. On the other hand, the policy may lead to more overconsumption of medical care than they would prefer. We turn to these issues in the next section.

IV. A Welfare-Analytic Approach to Valuing Medicare Benefits

IV.1. A Model of the Value of Medicare with Risk Aversion and Imperfect Insurance Markets

To what extent do net Medicare transfers describe the valuation of Medicare to individuals in different income groups? The net utility value of Medicare is equivalent to its accounting value only when the utility function is linear in consumption and medical care, implying risk neutrality and perfect substitutability between medical care consumption and other goods.[24] The accounting analysis does not capture the effects of risk aversion or the in-kind nature of the Medicare transfer.

We use a two-period simulation model to consider both the intrinsic value of Medicare in providing insurance coverage that might not have been available otherwise, and the intrinsic utility cost of health care overconsumption from more generous insurance. This simulation model requires a method for valuing consumption smoothing in the presence of uncertain health problems, and the value of health care expenditures. Suppose that there are two periods, e.g., a period of old age with uncertain health status, and a current period in which health insurance and savings decisions are made. Expected utility is

$$U = U(C_1, M_1) + \frac{\pi_b U^b(C_{2b}, M_{2b}) + \pi_g U^g(C_{2g}, M_{2g})}{1 + \delta} \tag{3}$$

[24] Demonstration of this point using the CRRA utility model are available from the authors on request.

where C_i denotes consumption in period i, M_{ik} measures total medical spending in period i with health state k = g (good) or k = b (bad). There are three possible health outcomes in period 2: death with probability π_d, bad health with probability π_b, and good health with probability π_g. The rate of time preference is given by δ. The utility function in period 2, U^k, may be specific to health status; in particular, the value of a given level of M is greater in the bad health state than in the good health state. To simplify the problem, we assume that medical expenditures in period 1, M_1, are predetermined and hence can be dropped from separate consideration in the model, although C_1 and hence savings will be a choice variable.

The budget constraint is

$$\begin{aligned} C_{2g} &= (Y - P(Y) - C_1)(1+r) - \alpha M_{2g} - P_2 \\ C_{2b} &= (Y - P(Y) - C_1)(1+r) - \alpha M_{2b} - P_2 \end{aligned} \tag{4}$$

where Y is the present value of labor earnings and retirement income less medical care costs in the first period, that is,

$$Y = Y_1 + \frac{Y_2}{1+r} - M_1. \tag{5}$$

The model also assumes a single-dimensional measure of the generosity of insurance, given by a coinsurance rate α. The insurance premium paid in the first period is given by P(Y). Under Medicare, the insurance "premium" paid through payroll and general taxes is related to income. Under voluntary private insurance markets, premiums may depend on both income and individual health risk, although in this model we assume community rating. Premiums paid in period 2, for example Medicare Part B premiums, are denoted P_2 and are paid conditional on surviving to the second period. The interest rate, accumulated over the length of a period, is given by r. In equations (3) through (5), we have suppressed income subscripts for clarity.

To obtain a tractable form of equation (5), we assume a displaced CRRA utility function written as

$$U = C_1^{1-\gamma} + \frac{\left[\pi_b\left(C_{2b}^{1-\gamma} + \mu_b\left(M_{2b}-\Gamma_b\right)^{1-\gamma}\right) + \pi_g\left(C_{2g}^{1-\gamma} + \mu_g\left(M_{2g}-\Gamma_g\right)^{1-\gamma}\right)\right]}{1+\delta} \qquad \textbf{(6)}$$

where μ_k reflects the relative value of medical spending in health state k, Γ_k is the "necessary" medical spending for state k, and γ is the Arrow-Pratt measure of relative risk aversion.

The endogenous variables in the optimization problem are consumption in period 1, and second-period consumption and health care expenditures in the good and bad states of health. By reducing the coinsurance rate α, an insurance program can increase expected utility by reducing the consumption uncertainty associated with the bad state in period 2. Because M is a choice variable, however, the lower coinsurance rate may also lead to moral hazard that is reflected in a higher lifetime program cost. Finally, by allowing for differences in health status and life expectancy across income groups, the model can also capture the notion that high income households may experience more demand for an annuity program such as Medicare because of their risk of living longer and their higher demand for medical care if ill.

We use this model to calculate the "insurance value" of Medicare for high- and low-income groups, compared to a private-market alternative. We do not model the extent of adverse selection and moral hazard explicitly; rather, we take the extent of the non-Medicare insurance market as given and consider its value based on plausible parameter assumptions.[25] Thus, the net value of Medicare is determined by the extent to which the additional insurance permits better consumption smoothing and influences the average value of health care received relative to its cost for each population group.[26]

Since M_2 and C_2 are chosen at the same time (given health status), the first-order condition for optimal health care expenditures is $M_{2k} = C_{2k}[\mu_k/\alpha]^{1/\gamma} + \Gamma_k$. This first-order condition allows one to substitute out M_{2k} in equation (4), which means that equation (6) can be used to express C_{2k} solely in terms of the choice variable C_1.

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[25] One extension of this model would be to allow for prospective differences in health risks or tastes within income groups (to account more richly for the likely extent of adverse selection in the absence of insurance) and a more complete model of equilibrium coverage in the absence of a social insurance program.

[26] We do not include intergenerational transfers for Medicare financing in this model. Such transfers can be viewed as shifting P(Y) and P_2 by a constant amount. To the extent that the transfers would not occur in the absence of Medicare, the greater utility value of income for lower-income households implies that they would increase the relative value of Medicare to lower-income households.

However, the solution cannot be expressed in closed form, so it must be simulated subject to the parameter values discussed below.

One limitation of using a parametric utility function is the necessity of specifying the crucial parameters determining risk aversion and the valuation of medical care relative to consumption. We cannot use the measures of health care expenditures from the accounting exercise, since medical care expenditures are determined endogenously within the utility-based model. We focus on parameters of the utility function and the budget constraint that match pre-1965 data and existing empirical evidence reasonably well. We also discuss extensions of our results that simulate insurance values with present-day medical technology.

IV.2. Estimation of the Utility-Based Model

We now present illustrative utility-based calculations of the costs and benefits of Medicare using the displaced CRRA utility function. To help identify parameter values for this analysis, we draw on two surveys of the elderly prior to Medicare: a Social Security Administration survey conducted in 1963 (Epstein and Murray, 1967), and a survey by the National Center for Health Statistics fielded in the second half of 1962 (NCHS, 1964a,b).

Before Medicare, only 39% of married elderly couples in the bottom third of the income distribution were covered by hospital insurance (NCHS, 1964b, p. 12). For the median elderly person, insurance paid about 75% of total hospital bills (Epstein and Murray, 1967), so we assume that on average, 29% (.39·.75) of every dollar in medical care expense is paid by some form of insurance.[27] For married couples in the top third of the income distribution (income > $4000), coverage rates for hospital insurance were about 68 percent. Assuming again that 75 percent of expenses are covered by insurance yields an average coverage rate of 51 percent.

Our model also involves consideration of the distribution of medical expenditures by income group and health status. Epstein and Schwartz (1967, Table 11.4) report that 17 percent of the elderly population reported themselves to be in poor health. We use average spending of those in the top 17 percent of the distribution to characterize the expenses of those in the poorest health.[28] Epstein and Schwartz also provided measures of the health care spending distribution by the lowest- and highest-income terciles (p. 366). For the high-income group, average medical spending in 1990 dollars (adjusted by the GDP deflator) is $6518 for

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[27] For simplicity, we assume a representative individual rather than some individuals with insurance and others without insurance. In addition, the 75 percent coverage rate is likely to be too high for the generosity of insurance coverage at the margin, particularly among lower income groups. Health insurance policies at the time were often limited by nominal spending caps of as little as $5 per day. See U.S. Congress (1964), in particular the statements of Walter M. Foody, Jr., Vice President of the Continental Casualty Co. (page 26).

[28] We did this by taking midpoints of the discrete spending categories; the mean of the $2,500 and up category was assumed to be $2,750. Of course, this calculation supposes that those in the poorest health are also those who spend the most money, thus biasing upward the estimate of health care spending by those in poor health. However, the numbers reported in Epstein and Murray (1967) are out-of-pocket expenses, thus biasing results downward. (The NCHS studies are for total expenditures.)

households with the top 17 percent of medical expenditures, and $1277 for the remaining 83 percent.[29] For the low-income group, expenditures are $4743 for households with the top 17 percent of medical expenditures, and $683 for the remaining households.

Finally, to characterize the life-cycle choice of consumption and medical care, we require a measure of lifetime income Y. Roughly one-third of households had income in excess of $4,000 in 1963, while roughly one third had incomes below $2,000. To adjust for the fact that variation in income in 1963 probably exceeded variation in lifetime income (and also reflected age differences), we use $4000 and $2000 as illustrative values of income for the high- and low-income groups during their retirement. We assume income during working years is twice retirement income: $Y_1 = 2Y_2$.

We parameterize the model based on fitting pre-Medicare data and on reasonable values for preferences about medical care and risk aversion. Because the Γ parameters simultaneously determine price and income elasticity given γ, we cannot fit the observed data exactly. We set $\Gamma_b = 4025$ and $\Gamma_g = 230$ so as to replicate as best as possible the observed spending among the low income pre-Medicare group. These values imply average price elasticities of about 0.2 and average income elasticities of 1.0, which are roughly consistent with empirical

[29] The "good health" expenditures are calculated by subtracting the estimated "poor health" expenditures, appropriately weighted, from average spending for the entire income group.

estimates among people with less than full coverage (e.g., Manning et al., 1987). We assume $\mu = .00025$ for both health states, and γ, the Arrow-Pratt measure of relative risk aversion, is set equal to 3, a value consistent with other studies (Hubbard, Skinner, and Zeldes, 1994).

The choices for medical care expenditures and for second-period consumption

	Pre-Medicare			Post-Medicare	
	Health Care Expenditures		Consumption (Period 2)	Health Care Expenditures	Consumption (Period 2)
	Actual	Simulated	Simulated	Simulated	Simulated
High income Good Health	1,277	1,813	25,572	3,181	25,134
High Income Poor Health	6,518	5,908	23,566	7,379	24,714
Low Income Good Health	683	684	12,934	1,487	12,651
Low Income Poor Health	4743	4,737	10,067	5,685	12,231

Table 4: Health Care Spending; Empirical Estimates and Model Predictions

in the absence of Medicare are shown in Table 4. Health care spending is less among low-income households, and there is greater variability in C_2 between the good and bad health states. The greater variability reflects the lower insurance coverage in low-income households and the relatively greater importance of health care expenditures in their budget.

This utility-based simulation allows us to evaluate how the high-income and low-income groups are affected by the introduction of a Medicare-type program. We assume a coverage rate of 90 percent for the post-Medicare calculations; even with Medigap policies, some types of medical expenditures have limited coverage or none at all (e.g., nursing home care and drugs). Results are presented in Table 4. There is an increase in spending in both health states.[30] Much of the value of the insurance is to smooth non-medical consumption across the two health states: the variation in second-period consumption declines substantially for low-income households.

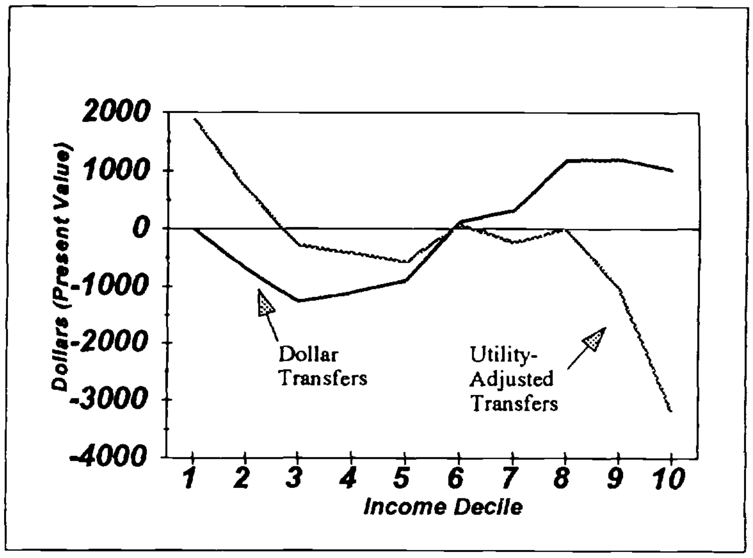

Figure 6: Utility-Adjusted and Unadjusted Intragenerational Transfers for the 1925 Cohort

The annual dollar-equivalent welfare gains of expanded insurance coverage are $240 more than the actual dollar flow for low-income households, or 17 percent more than their total dollar

[30] Among those in poor health in the low income group, the insurance expansion increases expenditures by a relatively modest 20 percent. This is because of the importance of the "nondiscretionary" spending of $4025 in the poor health state. The "discretionary" component, in excess of $4025, more than doubles.

benefits. Among the high-income group, however, the incremental transfers were valued at less than their dollar amount by roughly $670 annually, or 23 percent less than the dollar value of their Medicare benefits. We can use these illustrative calculations to explore the impact of insurance value on our decile-based analysis of Medicare transfers. Each decile includes different proportions of high-, medium-, and low-income households. We assume that middle-tercile households value their Medicare benefits dollar-for-dollar, and we approximate high-income households as those over $50,000 and low-income households as those with income under $15,000. Figure 6 presents these utility-adjusted Medicare transfers by decile. (For comparison, Figure 6 also reproduces the accounting transfers from Figure 5.) The resulting pattern is modestly redistributive from the highest income deciles to the lowest, with little redistribution in the deciles between.

V. Incidence Analysis of Medicare Reform

We have shown that a social health insurance program like Medicare can have important and possibly unintended distributional consequences. Understanding these consequences requires attention not only to financial transfers but to other goals of a social health insurance program, including the completion of missing insurance markets and the social value of a common system of health insurance. To illustrate the relevance of our methods, we briefly consider the intragenerational incidence of two proposed Medicare reforms: progressive premiums for Medicare Part B, and a system of fixed government contributions (vouchers) toward health plan choices.

The typical justification for a progressive Part B premium is based on ability to pay: wealthier beneficiaries can better afford the higher premium, and so should pay it. Our analysis demonstrates an alternative equity-based justification: because Medicare expenditures generally and Part B expenditures especially rise with income, more progressive financing is required to prevent transfers from poor to rich in the program. For example, consider the distributional effects of a plan that doubles Part B premiums for households with incomes in the seventh to ninth deciles (in our PSID analysis, incomes of $50-75,000), and triples premiums among households with incomes in the ninth to tenth deciles (in our PSID analysis, over $75,000).[31] These financing changes cause a 77% percent increase in Part B premiums among the top income decile. The impact of this reform is shown in Table 2 (page 24). This reform causes a modest increase in the redistributive pattern of Medicare expenditures, with a transfer of $3,900 from the top to the bottom income decile and small net transfers elsewhere. Thus, even a fairly substantial increase in the progressivity of Part B premiums would only lead to a limited degree of progressivity in Medicare transfers.

[31]Because elderly households have lower average incomes, these illustrative income limits are higher than those that would be needed to support this financing reform. Moon and Kuntz (1996) consider premium limits that correspond more closely to actual incomes of elderly households. Here, we are interested in illustrating the consequences of reforms for relatively high- and low-income groups in light of our analysis of relative differences in existing Medicare taxes and expenditures.

Other proposed Medicare reforms would affect the generosity of insurance plans available to different income groups, and so would affect redistribution through their impact not only on financing but also on insurance value. One type of reform proposal would give elderly households a fixed subsidy toward the purchase of alternative insurance plans (e.g., Elhauge, 1995). For example, suppose that low-income beneficiaries opt for a less generous plan (e.g., an increased copayment rate to α=.25 from .10 in our illustrative model) and receive a money rebate, and that the higher-income households maintain the same level of coverage. Based on the money-metric measure of utility, this voucher system reduces costs for the low-income group by $270 annually, while reducing utility (in dollar terms) by $150. While this system of fixed subsidies would increase overall utility by providing an (actuarial) rebate of $270, it would also make the distribution of medical care services even more unequal across income groups.[32] If a more equal distribution of medical services is socially valued in its own right, then such reforms would have a cost in terms of increased inequality in medical care and out-of-pocket expenditures. We leave a more detailed analysis of these tradeoffs to later work.

[32]A change to a voucher program would also tend to increase problems of incomplete insurance markets related to health status as well as income, since healthier individuals would also keep the net savings from joining a cheaper plan. A more sophisticated model of insurance market outcomes, beyond the scope of this paper, would consider such effects on market completeness.

VI. Conclusion

We have developed a general framework for assessing the redistributive impact of Medicare and other social health insurance programs. Medicare is an important component of the overall wealth of the elderly, and the program accounts for a large and growing share of the federal budget with enormous unfunded liabilities. A complete understanding of its distributional implications is thus a crucial policy issue. We find that, once differences by income group in Medicare spending and survival rates are accounted for, there is a net flow of benefits from low-income to higher-income individuals in the cohorts that have reached Medicare eligibility to date. This redistribution is especially associated with the Medicare Part B program, which finances ambulatory and physician services. Progressivity is increasing for more recent cohorts, because they will have paid Medicare taxes throughout their working lives and because of recent reforms in Medicare financing. Still, with the exception of the very lowest- and highest-income groups, our results demonstrate that net transfers will still flow from lower- to higher-income beneficiaries even after Baby Boom cohorts reach Medicare eligibility in 2010.

Our transfer analysis is tempered by our conclusion that the utility value of Medicare insurance relative to its dollar value has probably been substantially higher for lower-income households. With reasonable assumptions about preferences, insurance markets for the elderly prior to Medicare provide considerable evidence that the problem of incomplete markets in the absence of a social insurance program is particularly acute for low-income households. As Medicare expenditures continue to rise, however, income-related differences in preferences about the desired generosity of insurance are likely to become more pressing concerns.

Our estimates are only a first pass at the question of the distributional effects of Medicare. For example, we have ignored the impact of insurance itself on changes in health care expenditures through effects on innovation (Weisbrod, 1991), and we have not considered the effects of Medicare-financed health services on health outcomes. It is unlikely that medical care for the elderly would be so intensive and expensive in the absence of Medicare, and it is also unlikely that the survival of the elderly would have improved as much over the past three decades in the absence of the program. We leave these issues for future research on the complex distributional issues raised by major social insurance programs such as Medicare.

References

Aday, Lu Ann, and Ronald M. Andersen, "Equity of Access to Medical Care: A Conceptual and Empirical Overview," Medical Care 19(12) Supplement (December 1981): 4-27.

Akerlof, George, "The Market for Lemons" Quarterly Journal of Economics (1974).

Auerbach, Alan, Jagadeesh Gokhale, and Laurence J. Kotlikoff, "Social Security and Medicare Policy from the Perspective of Generational Accounting," in J.M. Poterba (ed.) Tax Policy and the Economy 6. Cambridge: NBER and MIT Press (1992).

Bernheim, B. Douglas, "The Economic Effects of Social Security: Toward a Reconciliation of Theory and Measurement " Journal of Public Economics 33: 273-304 (1987).

Bodenheimer, Thomas, "Uninsurance in America," New England Journal of Medicine 327(4) (July 23, 1992).

Congressional Budget Office, Restructuring Health Insurance for Medicare Enrollees Washington DC: U.S. Government Printing Office (August 1991).

Culyer, A.J., "The Normative Economics of Health Care Financing and Provision," Oxford Review of Economic Policy 5(1) (1989): 34-58.

Culyer, A.J., Eddy van Doorslaer, and Adam Wagstaff, "Comment: Utilisation as a measure of equity by Mooney, Hall, Donaldson, and Gerard," Journal of Health Economics 11 (1992): 93-98.

Davis, Karen, and Roger Reynolds, "Medicare and the Utilization of Health Care Services by the Elderly," Journal of Human Resources 10(3): 361-77.

Diamond, Peter A., "A Framework for Social Security Analysis," Journal of Public Economics 8 (1977): 275-298.

Duleep, Harriet Orcutt, "Mortality and Income Inequality Among Economically Developed Countries," Social Security Bulletin 58(2) (Summer 1995).

Epstein, Lenore, and Janet Murray, The Aged Population of the United States: The 1963 Social Security Survey of the Aged. U.S. Department of Health, Education, and Welfare (1967).

Elhauge, Einer, "Medi-Choice," The New Republic (November 13, 1995): 24-27.

Fisher, Elliot S., et. al., "Overcoming Potential Pitfalls in the Use of Medicare Data for Epidemiologic Research," American Journal of Public Health 80(12) (December 1990): 1487-90.

Garrett, Daniel, "The Effects of Differential Mortality Rates on the Progressivity of Social Security," Economic Inquiry 33 (July, 1995). pp. 457-475.

Geronimus, Arline, John Bound, and Lisa Neidert, "On the Validity of Using Census Geocode Characteristics to Proxy Individual Socioeconomic Characteristics," Journal of the American Statistical Association 91(434): 529-537 (1996).

Gittelsohn, Alan M., Jane Halpern, and Ricardo L. Sanchez, "Income, Race, and Surgery in Maryland," American Journal of Public Health 81(11) (November 1991): 1435-41.

Goldberg, Kenneth C., et. al., "Racial and Community Factors Influencing Coronary Arterty Bypass Graft Surgery Rates for All 1986 Medicare Patients," Journal of the American Medical Association 267(11) (March 18, 1992): 1473-77.

Gornick, Marian E., Paul Eggers, Thomas Reilly, Renee Mentnech, Leslye Fitterman, Lawrence Kucken, and Bruce Vladeck, "Effects of Race and Income on Mortality and Use of Services Among Medicare Beneficiaries," New England Journal of Medicine 335: 791-799 (1996).

Hadley, Jack, Earl Steinberg, and Judith Feder, "Comparison of Uninsured and Privately Insured Hospital Patients," Journal of the American Medical Association 265(3) (January 16, 1991): 374-379.

Holahan, John, Avi Dor, and Stephen Zuckerman, "Understanding the Recent Growth in Medicare Physician Expenditures," Journal of the American Medical Association 263(12) (March 23/30, 1990): 1658-62.

House, James S., Ronald C. Kessler, and A. Regula Herzog, et al., "Age, Socioeconomic Status, and Health," The Millbank Quarterly 68(3) (1990): pp. 383-411.

Hubbard, R. Glenn, Jonathan Skinner, and Stephen Zeldes, "The Importance of Precautionary Motives for Explaining Individual and Aggregate Saving," Carnegie-Rochester Conference Series on Public Policy 40 (June 1994).

Hubbard, R. Glenn, Jonathan Skinner, and Stephen Zeldes, "Social Insurance and Precautionary Saving," (with R. G. Hubbard and S. Zeldes), Journal of Political Economy (April 1995).

Hurd, Michael, and John B. Shoven, "The Distributional Impact of Social Security," in David A. Wise (ed.) Pensions, Labor and Individual Choice. Chicago: University of Chicago Press and NBER (1985).

Kitagawa, E.M, and P.M. Hauser, Differential Mortality in the United States Cambridge: Harvard University Press (1973).

LeGrand, Julian, The Strategy of Equality. London, George Allen & Unwin (1982).

Lillard, Lee, and Constantine Panos, "Socioeconomic Differentials in the Returns to Social Security," mimeo (1995).

Link, Charles R., Stephen H. Long, and Russell F. Settle, "Equity and the Utilization of Health Care Services by the Medicare Elderly," Journal of Human Resources 17(2) (1982): 195-212.

Link, Charles R., and Russell F. Settle, "Medicare and the Disadvantaged Elderly: Objectives and Outcomes," Health and Society 62(4) (1984): 609-656.

Lubitz, James, and Gerald Riley, 1993, "Trends in Medicare Payments in the Last Year of Life," New England Journal of Medicine 331: 1092-1096.

Manning, Willard G., et. al., "Health Insurance and the Demand for Medical Care: Evidence from a Randomized Experiment," American Economic Review 77 (June 1987): 251-277.

Menchik, Paul, "Economic Status as a Determinant of Mortality Among Nonwhite and White Older Males: Or, Does Poverty Kill?" Population Studies 47(3) (1993): 427-36.

Merriam, Ida C., Statement before the U.S. Senate (33-420-64 pt. 1) (1964).

Merlis, Mark, Rural Hospitals, Congressional Reports Service, May 1989.

Moon, Marilyn, and Crystal Kuntz, "Increasing Medicare's Part B Premium," mimeo, The Urban Institute and the Commonwealth Fund (November 1996).

National Center for Health Statistics (NCHS), Medical Care, Health Status, and Family Income Series 10, No. 9 (May 1964a).

National Center for Health Statistics (NCHS), Health Insurance Coverage Series 10, No. 11 (August 1964b).

Olsen, Edgar O., "The Simple Analytics of the Externality Argument for Redistribution," in M.B. Ballabon (ed.) Economic Perspectives: An Annual Survey (Vol. 2). New York: Harwood Academic Publishers (1981).

Olsen, Edgar O., and Diane Lim Rogers, "The Welfare Economics of Equal Access," Journal of Public Economics 45 (1991): pp. 91-105.

Pappas, G., et al., "The Increasing Disparity in Mortality Between Socioeconomic Groups in the United States," New England Journal of Medicine 329: 103-109 (1993).

Pattison, David, "The Distribution of OASDI Taxes and Benefits by Income Decile," Social Security Bulletin 58(2) (Summer 1995).

Physician Payment Review Commission, Report to Congress: Monitoring Access of Medicare Beneficiaries, Washington DC: Physician Payment Review Commission (1992).

Preston, Samuel, and Paul Taubman, "Socioeconomic Differences in Adult Mortality and Health Status," in Linda G. Martin and Samuel Preston (eds.) Demography of Aging (Washington DC: National Research Council and the National Academy Press) (1994)

Rosen, Harvey. Public Finance (4th edition) Irwin Publishers (1995).

Smith, George, and Matthias Egger, "Socioeconomic Differences in Mortality in Britain and the United States," American Journal of Public Health 82 (1992): 1079-1081.

Social Security Administration, U.S. Department of Health and Human Services, Social Security Bulletin: Annual Statistical Supplement 1991. (December, 1991).

U.S. Congress, The 1988 Annual Report of the Board of Trustees of the Federal Hospital Insurance Trust Fund. House Doc. 100-193 (1988a).

U.S. Congress, The 1988 Annual Report of the Board of Trustees of the Federal Supplemental Medical Insurance Trust Fund. House Doc. 100-194 (1988b).

U.S. Congress, Senate Special Committee on Aging (88th Congress) 1631, Private Health Insurance for the Elderly Vol 4 (1964).

Wagstaff, Adam, Eddy van Doorslaer, and Pierella Paci, "On the Measurement of Horizontal Inequity in the Delivery of Health Care," Journal of Health Economics 10 (1991): 169-205.

Vogel, Ronald J., "An Analysis of the Welfare Components and Intergenerational Transfers Under the Medicare Program," in M.V. Pauly and W.L. Kissick (eds.) Lessons from the First Twenty Years of Medicare (Philadelphia: University of Pennsylvania Press, 1988).

Weisbrod, Burton, 1991, "The Health Care Quadrilemma: An Essay on Technological Change, Insurance, Quality of Care, and Cost Containment," Journal of Economic Literature 29: 523-552.

Wennberg, John, and Alan Gittelsohn, "Variations in Medical Care Among Small Areas," Scientific American 246 (1982): 120-129.

Wolfson, M.C., G. Rowe, J.F. Gentleman, and M. Tomiak, "Career Earnings and Death: A Longitudinal Analysis of Older Canadian Men," Journals of Gerontology: Social Sciences 48 (July 1993): S167-79.

Zuckerman, Stephen, W.P. Welch, and Gregory C. Pope, "A Geographic Index of Physician Practice Costs," Journal of Health Economics 9 (1990): 39-69.

Appendix A: Data

Medicare expenditure data. Our data on the survival and Medicare expenditures of the elderly in 1990 was derived from complete Medicare claims records obtained from the Health Care Financing Administration: enrollment (HISKEW) records, Part A hospital (MEDPAR) records, outpatient records, and physician and ambulatory services (BMAD) records. We were unable to obtain claims for home health and hospice services in time for this analysis; in 1990, these services accounted for less than 5% of Part A expenditures. We obtained comprehensive information on deaths from linked Social Security Administration death date data. In theory, our sample comprised 5% of the entire elderly population, since nearly every American becomes for eligible for Medicare at age 65. In practice, the program's coverage is less than complete.[33] Some elderly Americans, particularly the younger elderly, do not register for benefits until they require hospitalization or use of other medical services. Because these individuals will generally file for benefits once they use medical services, it is unlikely that the omitted groups had any consequential medical expenditures. Since failure to enroll appears to be higher in lower-income groups, this restriction may lead to progressivity estimates that are too high in terms of per-capita Medicare expenditures. We have also excluded individuals from our sample who were enrolled in HMOs, comprising less than 5% of Medicare beneficiaries in 1990, and those under age 65.

Zip-code income data. Using individuals' zip code of residence, we merged our beneficiary-level expenditure data with Census data on income and the

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[33] Using a similar 5% sample of 1985 beneficiaries, Fisher, et. al. found that the ratio of Medicare enrollees to Census estimates of the national population was .94 for whites and .89 for Blacks. Informal estimates by Health Care Financing Administration staff place Part A enrollment at 95% to 98% of the elderly, with rates near 100% for individuals over age 70.

distribution of income at the zip code level, compiled by CACI. Our Census data included race-specific information on average income as well as the distribution of income within a zip code (e.g., the share of households in the zip code in various income ranges). We were unable to match a small fraction of Medicare beneficiaries (<2%) due to incomplete income reporting; these observations were excluded from further analysis. We also excluded approximately 24,000 observations (1.5%) because they could not be matched to the data on geographic price indices.

Appendix B: Medicare Part B Spending and Mortality Rates, By Age, Sex, and Income Decile

Income Decile	65-69	70-74	Age 75-79	80-84	85+
1	1922	2478	2955	3277	3208
2	1934	2481	3063	3167	3247
3	1885	2519	3039	3159	3164
4	1907	2652	3285	3262	3424
5	1902	2559	3082	3369	3344
6	1958	2860	3168	3613	3450
7	2085	2812	3349	3510	3694
8	1991	2883	3432	3741	3669
9	2075	2927	3582	3992	4169
10	2080	2976	3794	4050	4381

Table B.1: Average Medicare Spending for Men in 1990 (N = 541,707)

Income Decile	65-69	70-74	Age 75-79	80-84	85+
1	1829	2174	2548	2791	3042
2	1686	2113	2432	2656	2862
3	1617	2133	2436	2608	2756
4	1627	2011	2458	2713	2771
5	1664	2141	2434	2696	2805
6	1753	2204	2641	2856	2881
7	1691	2258	2680	2921	3148
8	1732	2336	2754	3046	3207
9	1705	2386	2921	3184	3345
10	1627	2346	2974	3465	3508

Table B.2: Average Medicare Spending for Women in 1990 (N = 806,134)

Income Decile	65-69	70-74	Age 75-79	80-84	85+
1	742	976	1146	1258	1130
2	774	1028	1253	1289	1171
3	764	1039	1243	1283	1176
4	791	1084	1322	1312	1263
5	786	1041	1283	1322	1220
6	822	1210	1370	1503	1338
7	872	1176	1422	1503	1415
8	852	1230	1465	1537	1459
9	887	1242	1506	1680	1559
10	913	1299	1642	1716	1705

Table B.3: Average Part B Medicare Spending for Men in 1990 (N = 541,707)

Income Decile	65-69	70-74	Age 75-79	80-84	85+
1	800	982	1105	1186	1149
2	775	969	1079	1117	1077
3	749	955	1079	1101	1053
4	744	926	1093	1131	1048
5	754	969	1078	1156	1065
6	818	1031	1210	1227	1158
7	803	1061	1222	1278	1233
8	842	1100	1259	1321	1277
9	835	1131	1337	1411	1332
10	846	1176	1406	1511	1439

Table B.4: Average Part B Medicare Spending for Women in 1990 (N = 806,134)

Income Decile	65-69	70-74	Age 75-79	80-84	85+
1	0.039	0.054	0.074	0.101	0.144
2	0.032	0.049	0.071	0.098	0.154
3	0.031	0.047	0.069	0.096	0.158
4	0.031	0.049	0.065	0.107	0.169
5	0.030	0.044	0.064	0.099	0.167
6	0.028	0.047	0.064	0.102	0.159
7	0.028	0.046	0.067	0.097	0.171
8	0.027	0.040	0.063	0.094	0.165
9	0.026	0.039	0.065	0.093	0.167
10	0.024	0.037	0.062	0.093	0.160

Table B.5: Average Male Mortality Rate, by Income and Age, in 1990

Income Decile	65-69	70-74	Age 75-79	80-84	85+
1	0.021	0.028	0.045	0.068	0.118
2	0.018	0.027	0.042	0.062	0.130
3	0.017	0.026	0.041	0.063	0.125
4	0.017	0.025	0.036	0.064	0.124
5	0.016	0.027	0.038	0.064	0.125
6	0.018	0.025	0.039	0.063	0.126
7	0.017	0.024	0.038	0.064	0.126
8	0.015	0.026	0.039	0.064	0.130
9	0.016	0.024	0.041	0.066	0.133
10	0.014	0.021	0.039	0.064	0.136

Table B.6: Average Female Mortality Rate, by Income and Age, 1990