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Historical Redistribution Under the Social Security Old-Age and Survivors Insurance and Disability Insurance Programs

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I. Summary

This study is the third in a series of studies that use comprehensive Social Security administrative data on past earnings and benefits by year, age, gender, and race to analyze historical redistribution across those characteristics under the Social Security program. In contrast to previous analyses examining historical redistribution by cohort, race, and gender under the Social Security program, this series of studies uses a variety of administrative data sources that permit the identification of *all* historical taxes and *all* historical benefits associated with the Old-Age and Survivors Insurance (OASI) program and the Disability Insurance (DI) program. As such, this series of studies avoids the use of "hypothetical individual" methods or other simplifying assumptions to fill in the substantial amount of missing historical administrative data on the computerized administrative data files used in previous analyses. This series of studies also considers the full complement of OASI and DI benefits rather than the much more limited set of beneficiary types that have been included in previous analyses. Also in contrast to previous analyses of historical redistribution under the Social Security program, this series of studies includes the income taxation of benefits in calculating the balance between all accumulated historical taxes and benefits for various race, gender, and cohort groups under the OASI and DI programs.

The first study in this series focused on the DI program, the second study on the OASI program, and the present study focuses on the combined Old-Age

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and Survivors Insurance and Disability Insurance (OASDI) programs taken together. Specifically, the present study examines historical lifetime redistribution to date across and within cohorts born through the year 1927, combining and extending the results of the previous two studies, for which less historical data were available. Redistributional estimates incorporating the additional data confirm the results of the earlier studies—relative lifetime redistributional outcomes to date under the DI program have generally been much more favorable for "Other Races" than for "Whites;" have generally been more favorable for females than for males in most, but not all, of the cohorts considered; and accumulated benefits have generally exceeded accumulated taxes by substantial margins for all but the *earliest* birth cohort groups. In contrast to outcomes under the OASI program, accumulated net transfers to date for very early birth cohorts have generally been negative under the DI program taken by itself, although the size of these negative net transfers is relatively small.

Under the OASI program, estimates incorporating the additional data available in this analysis confirm that the earliest birth cohorts have received large accumulated net transfers to date; that females, as a group, have experienced substantially higher accumulated benefit/tax ratios and internal rates of return to date than their male counterparts in these cohorts; and that the "Other Races" group fared better by these measures than the "White" race group in most of the cohorts considered. In contrast to conclusions warranted by comparable earlier research, however, differences by race in the accumulated benefit/tax ratios estimated in this series of analyses under the OASI program are sensitive to the

choice of the interest rate series and cohort grouping and differ sharply between males and females under some of the interest rate assumptions considered.

Because the OASI program is much larger than the DI program, redistributional results for both programs combined are dominated by the OASI results, but amplified and tempered in some instances by outcomes under the DI program. The size of the accumulated net transfer to date for these cohorts under the combined OASDI programs is impressive, but the accumulated OASDI benefit/tax ratio and real internal rate of return to date fall over these early cohort groups, primarily reflecting the expected pattern under a pay-as-you-go social insurance retirement program. However, the relatively large sizes of the accumulated benefit/tax ratios to date under the DI program for the latest cohorts included in this analysis do lead to different qualitative outcomes for a number of race, gender, and cohort groups under the combined OASDI programs than under the OASI program taken by itself.

The pattern of relative outcomes by gender across these early cohorts also differs between the OASI and DI programs. The generally more modest and mixed results by gender across birth cohort groups under the DI program are overwhelmed by the strength of the relative female advantage under the larger OASI program. As a result, females as a group have fared much better to date in a relative sense under the combined OASDI programs than their male counterparts under all of the interest rate assumptions considered in this analysis. Similarly, the relative female advantage in the OASDI benefit/tax ratio to date declines consistently across the birth cohort groups under all of the interest rate

assumptions considered, following the corresponding pattern in the OASI program taken by itself.

The generally more modest favorable treatment to date on average of "Other Races" relative to "Whites" in most of these cohort groups under the OASI program is reinforced by the generally substantial relative advantage of "Other Races" within each birth cohort group under the DI program. The combined results under the OASDI programs taken together, however, suggest that relative outcomes across race groups, while generally more favorable for "Other Races" than for "Whites" in most of the cohorts considered, still exhibit some sensitivity to the choice of redistributional measure and interest rate series. The race differentials in the OASDI accumulated benefit/tax ratios to date also differ sharply between males and females under some of the interest rate assumptions.

II. Introduction

An important feature of the Social Security program is the expectation that workers or their families will both pay taxes and receive benefits over the course of their lifetimes.[1] This feature makes it important to analyze the lifetime redistributional[2] effects of the program across program participants who differ in various characteristics of policy interest. Such analysis can help determine if intended differential treatment is effective and to identify any areas of unintended differential effects.

The present study uses Social Security administrative data on past earnings and benefits by year, age, gender, and race to analyze historical

redistribution under the combined Old-Age and Survivors Insurance and Disability Insurance (OASDI) programs. The study examines the relationship between the OASDI taxes paid and benefits received *to date* (through 1999) for early cohorts (born through the year 1927) as a whole and for specific race and gender groups within those cohorts.[3] In appendices to this paper and in some of the discussion in the main text, updates on the relationship between taxes paid and benefits received *to date* for this expanded group of cohorts and incorporating several additional years of data are also provided for the DI and OASI programs considered separately.[4]

The phrase "to date" is emphasized here because no cohorts have experienced the OASDI programs over a full potential life span. Cohorts born in 1940, for example, when monthly benefit payments first began under the OASI program, were only age 59 in 1999, the last year of historical data available for this analysis. The lifetimes of many of the earliest birth cohorts affected by the OASDI programs are now largely complete, however, so the historical data do provide a fairly complete picture of the programs' treatment of these cohorts over the portion of their lifetimes that the programs were in existence.

Relatively few studies of lifetime redistribution by cohort, race, and gender under the Social Security program have been based on historical administrative data. A more common approach is to construct lifetime tax and benefit profiles for hypothetical workers varying by characteristics of interest such as birth cohort, race, gender, earnings level, and family composition. The generality of hypothetical worker outcomes is typically limited, however, because critical inputs to the analyses (such as the shapes of the earnings profiles, ages at

labor force entry, labor force participation patterns, unemployment spells, disability periods, changes in family status, mortality rates, and changes in beneficiary status) for the hypothetical cases are not realistically differentiated by the same characteristics of interest represented in the results. In short, results for hypothetical workers are not generally representative of the groups they are intended to represent.

Given adequate data and analysis, of course, it is possible to construct synthetic tax and benefit streams that are actually representative of particular groups of workers, at least within certain constraints. The more detailed the worker categorizations, however, the more deficient available data sources and the more difficult the attendant analyses become. Regardless of the care that is taken, there is always the possibility that some characteristic that affects analysis outcomes has not been modeled appropriately or estimated accurately.[5]

Despite their own limitations, then, studies based solely on historical outcomes across characteristics of policy interest are important, since the results of such studies are untainted by the use of hypothetical individual methods or simplifying assumptions to fill in missing historical data. Because the present study uses administrative data identifying actual program outcomes, the results are not subject to many of the limitations of the hypothetical worker approach. Differences across race and gender groups in the types of lifetime experiences noted above that affect redistributional outcomes are implicitly incorporated into the administrative tax and benefit data and reflected in the analysis results. These administrative tax and benefit data, of course, accurately reflect all of the changes in tax and benefit provisions that have occurred under the program since its

inception. In addition, the present study uses a variety of administrative data sources to identify *all* historical benefit types under the OASDI programs, in contrast to previous redistributional analyses that have considered only a much more limited set of beneficiary types.

The exclusive use of historical data for analyzing lifetime redistribution under the Social Security programs has its own limitations, of course. There is still a lack of sufficient years of historical data to analyze the full lifetime effects of the Social Security programs on successive birth cohorts, and historical results are not necessarily indicative of future outcomes. In addition, the administrative tax and benefit data used in this analysis prevent the differentiation of redistributional outcomes by characteristics other than birth cohort, race, and gender. These data also prevent the present study from isolating the differential treatment of the birth cohort, race, and gender groups while controlling for associated differences in other characteristics of interest, such as earnings levels; that is, while the present analysis describes the differential historical treatment of specific birth cohort, race, and gender groups, the analysis is unable to identify the extent to which this differential treatment would persist in the absence of certain other differences observed historically between the groups.

In the remainder of this paper, section III discusses the previous research that is most closely related to the present analysis. Section IV describes the methods used to develop the redistributional estimates that are presented in section V. Section V presents lifetime redistributional results to date for early birth cohorts as a whole and for specific race and gender groups within those

cohorts under the OASDI program. Section VI adds some concluding thoughts about the contribution of the analysis to the literature.

III. Previous Research

A summary of results for the previous two studies in this series (Leimer 1998, 2003) that analyze historical redistribution under the OASI and DI programs considered separately is provided above in the Summary section of this paper. Results for the OASI and DI programs considered separately but incorporating the expanded set of birth cohorts and additional years of historical data available for the present analysis are presented in appendices to this paper, but are generally consistent with the results presented in the previous two studies in this series.

In addition to the previous two studies in this series, a number of other studies have used administrative data to examine historical lifetime redistribution by cohort, race, and gender under the Social Security program. Of these other studies, the most closely related to the present analysis are Freiden, Leimer, and Hoffman (1976), Hurd and Shoven (1985), and Duggan, Gillingham, and Greenless (1993), which all examined outcomes under the OASI program. The relative redistributional results found in these other studies are generally consistent with the results found for the OASI program in the present series of analyses. The most notable differences occur in racial differentials under the OASI program, which are estimated to be somewhat smaller in the present series of studies than the differentials that can reasonably be inferred from these other studies. These differences in relative racial outcomes may be due in part to the more comprehensive accounting of historical taxes and benefits in the present

series of studies, but there are also important differences in assumptions and methods, especially in the allocation of secondary benefits,[6] that may account for the differences in results. See Leimer (2003) for a complete discussion of the differences between these studies.

IV. Method

The approach adopted in this analysis is similar to that used in the two earlier studies in this series (Leimer 1998, 2003). Social Security administrative data were used to develop estimates of the total OASDI taxes paid and OASDI benefits of all types received by persons of each race, gender, and single year of age for the years 1937–1999, where 1937 was the first year of the OASI program and 1999 was the last year of historical data available for this analysis. Taxes were first collected and monthly benefits first paid under the DI program in 1957. As in the first two studies in this series, the present analysis focuses on program outcomes for race and gender groups within and across cohorts born in a given calendar year (individual-year cohorts) or cohorts born in selected calendar year ranges (cohort groups).

Data Constraints

The administrative data used in this analysis imposed a number of constraints. The first concerns the allocation of secondary benefits to specific age, race, and gender groups. The present analysis assigns such benefits to the birth cohort, race, and gender group to which the dependent or surviving beneficiary belongs;[7] this approach is referred to in this analysis as the "individual-specific" approach.

An alternative approach, referred to in this analysis as the "worker-account" approach, would allocate such benefits to the age, race, and gender group of the insured worker on whose account the benefits are paid. These two alternative approaches offer different perspectives on the redistributional effects of the program—each approach has advantages and disadvantages depending on the specific question being addressed. Because the administrative benefit data and tax data sources used in the present analysis (and in the previous studies in this series) are not linked to each other on an individual-record basis, however, they permit the use of the individual-specific approach but not the worker-account approach.[8] If the data underlying future redistributional analyses allow, it would be informative to present redistributional results under the alternative approaches to identify more precisely the differences in results that the approaches can imply across various characteristics of interest, including race and gender. Such comparisons should also provide insight into some of the differences in results between this series of analyses and comparable previous research.[9]

The second constraint imposed by the use of Social Security administrative data relates to the race variable, which has a number of problems.[10] One of these problems arises because the form that the Social Security Administration (SSA) uses to collect race information has changed over time. Prior to November 1980, the form allowed only three responses to the race question, corresponding to "White," "Black," and "Other." Beginning in November 1980, the race question was expanded to allow five race/ethnic responses: "White (not Hispanic)," "Black (not Hispanic)," "Hispanic," "Asian or Pacific Islander," and "American Indian or Alaskan Native." This five-way

race/ethnic classification does not map cleanly into the prior three-way race classification, yet both classifications are represented in the administrative tax and benefit data underlying this analysis. The administrative race information for early race question respondents is based on the three-way classification, while the race information for race question respondents since 1980 is based on the five-way classification.

The full sequence of benefit tables used in this analysis collectively support only two race categories over the full analysis period, 1937–1999; these two categories are referred to in this study as "White" and "Other Races."[11] The White category consists of persons coded as White under the old SSA race code, persons coded as White (not Hispanic) under the new SSA race code, and persons coded as Unknown under either the old or new SSA race codes.[12] The Other Races category consists of persons coded as Black or Other under the old SSA race code and persons coded as Black (not Hispanic), Hispanic, Asian or Pacific Islander, or American Indian or Alaskan Native under the new SSA race code.

The Hispanic category under the new SSA race code is included in the Other Races category because that is how the category is grouped in the benefit tables underlying this analysis. This creates an additional problem, however, because the administrative race information for most present beneficiaries is still based on the original three-way classification, and most persons of Hispanic origin appear to be coded as White under the old SSA race code.[13] As such, most Hispanics or Latinos in this analysis are probably represented in the White race category, despite the grouping of those classified as Hispanic under the new SSA race code with Other Races. Because the new SSA race codes were not

introduced until late 1980, those classified as Hispanics under the new SSA race codes are more likely to be concentrated in cohorts younger than the early cohorts considered in this analysis.

Another problem associated with the race variable is that the benefit data underlying this analysis include an inconsistency in the race classifications beginning in 1992. Specifically, some of those erroneously coded as other or unknown in the benefit data for previous years were reclassified to specific race groups in the benefit data for 1992 and later years. The apparent net effect of this reclassification was to increase somewhat the share of benefits allocated to the White race category relative to the Other Races category beginning in 1992, implying that the Other Races share of benefits is probably overstated to some extent in the summary benefit tables for some of the years prior to 1992.[14]

Allocation of Payroll Taxes

The allocation of payroll taxes in this analysis assumes full backward shifting of the employer portion of the payroll tax to workers in the form of lower wages. Although there is disagreement among economists about the incidence of the payroll tax, full backward shifting is by far the most common tax incidence assumption in analyses of the redistributional effects of the Social Security program.[15]

The aggregate OASDI payroll taxes paid by persons of each race, gender, and age in each year from 1937 through 1999 were derived from a combination of Continuous Work History Sample (CWHS) data files.[16] These files contain information on annual Social Security taxable earnings for a sample of all Social

Security numbers. The last available version (1977) of the 0.1 percent CWHS file was used to identify the distribution of OASDI payroll taxes prior to 1951, while the 1999 version of the 1 percent CWHS file was used for years from 1951 on.[17] The general approach required the identification of OASDI taxable wages and self-employment income for each valid record in each year. The associated OASI and DI payroll tax payments were then computed using the OASI and DI payroll tax rates and rules for that year, adjusting for potential complications such as multiple employers and the mix between taxable wages and self-employment income.[18] Aggregate OASI and DI payroll tax payments by race, gender, and age in each year were calculated separately for the sample and then adjusted proportionally to sum respectively to the actual aggregate OASI and DI payroll tax liabilities for that year.[19] In effect, then, the sample data were used to define the proportional distributions of aggregate OASI and DI payroll tax liability by race, gender, and age in each year.[20]

Allocation of Benefits

A similar approach was adopted for identifying historical OASI and DI benefit payments, except that summary tables on OASI and DI monthly benefit payments as of year-end by beneficiary type, race, age, and year from issues of the *Social Security Yearbook* and *Annual Statistical Supplement* to the *Social Security Bulletin* were used in place of individual sample data.[21] Individual sample data files derived from administrative records do not contain complete historical benefit records, precluding their use in the present analysis.[22]

This analysis includes all of the lump-sum and monthly benefits paid from the OASI and DI trust funds since the inception of the Social Security program. During the period 1937–1939, only lump-sum payments at age 65 or upon death were made under the 1935 Social Security Act.[23] Monthly OASI cash benefit payments began in 1940 under legislation passed in 1939. Lump-sum death payments continued, but were dwarfed in the aggregate by monthly benefit payments in later years. Monthly DI cash benefit payments began in 1957.

Monthly benefit payments under the OASI and DI programs were treated as falling into one of eight beneficiary categories in this analysis, five categories under the OASI program and three categories under the DI program. The largest beneficiary category by far combines total OASI monthly benefit payments to retired workers, spouses of retired workers, widows and widowers, and dependent parents.[24] The remaining four OASI categories respectively correspond to monthly benefit payments to children of retired workers, children of deceased workers, widowed fathers and mothers, and special age-72 beneficiaries.[25] Within each of the five OASI monthly beneficiary categories, the proportional distribution by race, gender, and age of the corresponding type of benefits from the summary benefit table for that year was used to allocate aggregate benefits paid from the OASI trust fund for that beneficiary category in that year across the race, gender, and age groups.[26] For example, the proportional distribution by race, gender, and age of total benefit payments to retired workers, spouses of retired workers, widows and widowers, and dependent parents in current-payment status at the end of 1988, as derived from the summary benefit table for that year, was used to allocate aggregate benefit payments during 1988 to those combined

beneficiary categories across the corresponding race, gender, and age groups.[27] In effect, then, this approach assumes that the proportional distribution by race, gender, and age of OASI benefits in current-payment status at year-end is representative of the corresponding proportional distribution of aggregate benefit payments during the year within each of the five OASI monthly beneficiary categories.

An analogous approach was applied to allocating DI monthly benefits to race, gender, and age groups over the 1957–1999 historical period covered by this analysis during which DI benefits were paid. The three DI beneficiary categories correspond to monthly benefit payments to disabled workers, spouses of disabled workers, and children of disabled workers. Within each of these monthly beneficiary categories, the corresponding type of benefits from the summary benefit table for that year was used to allocate aggregate benefits paid from the DI trust fund for that beneficiary category in that year across the race, gender, and age groups, using the same approach as followed for the OASI benefit categories. Again, this approach assumes that the proportional distribution by race, gender, and age of DI benefits in current-payment status at year-end is representative of the corresponding proportional distribution of aggregate benefit payments during the year within each of the three DI monthly beneficiary categories.[28]

Income Taxation of Benefits

These estimates of historical OASI and DI benefits were adjusted to reflect a portion of the income taxation of Social Security benefits that began in 1984. A large portion of the proceeds from the income taxation of OASI and DI benefits

are returned to the respective trust funds as a transfer from general revenues. Over the long run, then, this portion of benefit income taxation liabilities can be viewed as an income source required by the trust funds to fully finance legislated OASI and DI benefits.[29] In this context, the "financial balance" principle (that is, the principle of comparing benefits and taxes in the context of an essentially self-financed system) requires that even redistributional estimates gross of income taxation in general include an adjustment for the portion of benefit income taxation revenues returned to the trust fund.[30] In the present analysis, this is accomplished by defining the total OASI and DI tax liability for each cohort, race, and gender group as the sum of their OASI and DI payroll taxes plus that portion of their OASI and DI benefit income tax liability that is ultimately returned to the OASI and DI trust funds, respectively.[31]

Accurately identifying the incidence of benefit income taxation across the race, gender, and age groups in each year would require much more information than was available in the source data used in this analysis. Consequently, the effective rate of benefit income taxation was assumed to be constant across the race, gender, and age categories in any given year. In each year from 1984 on, the effective benefit income taxation rate was identified from Department of the Treasury estimates of the aggregate income tax liability in that year accruing from OASI and DI benefits that were ultimately transferred back to the respective trust funds.[32] The assumption of identical effective benefit taxation rates across the race, gender, and age categories introduces potential biases into the analysis. The actual effective benefit taxation rate will tend to be higher, *ceteris paribus*, for

groups with higher earnings and taxable income, but this effect appears to be relatively small for the early cohorts included in this analysis.[33]

Interest Rate Series

Three alternative interest rate series are used in this analysis to accumulate OASDI taxes and benefits over time; these three series correspond to a nominal rate equal to the rate of inflation (a zero real interest rate), the rate of return earned on OASDI trust fund assets, and the total rate of return to an index of large company stocks.[34] The tables and most of the discussion in the main body of this paper are based on the OASDI trust fund rate series. Tables containing OASDI redistributional measures based on the other two interest rate series are presented in Appendix A (Tables A–1 through A–4).

As indicated above, updated tables displaying measures of redistribution under the OASI and DI programs considered separately are also included in appendices to this paper. These tables update the results in Leimer (1998, 2003) by including additional cohorts and years of data. Appendix B (Tables B–1 through B–7) presents updated results for the OASI program; the three interest rate series used in the accumulated net transfers and benefit/tax ratios to date in these appendices are the zero real interest rate, the effective rate of return to the OASI trust fund, and the total rate of return to large company stock series. Similarly, Appendix C (Tables C–1 through C–7) presents updated results for the DI program; the three interest rate series used in the accumulated net transfers and benefit/tax ratios to date in these appendices are the zero real interest rate, the

effective rate of return to the DI trust fund, and the total rate of return to large company stocks.[35]

The appropriate interest rate series to use in analyzing the Social Security program, of course, depends on the particular question being addressed.[36] Using the historical interest rates at which the OASDI program was actually able to transform funds over time, for example, can be interpreted as identifying *ex post* redistribution from an OASDI program perspective. Specifically, if the interest rates actually experienced by the OASDI trust funds are used, the accumulated value of lifetime benefits less taxes for each cohort, race, and gender group reflects the cost to the OASDI trust funds of providing those net transfers. That is, it reflects the amount by which the trust funds would have been larger as of a selected valuation date had the net transfers not occurred.[37] Alternatively, the three interest rate series used in this analysis might be interpreted from an individual (or "money's worth") perspective. From an individual perspective, the OASDI trust fund rate series might be interpreted as a proxy for a government bond rate series.[38] The zero real interest rate series might be interpreted as incorporating an overall downward adjustment from a government bond proxy series over the historical period to account for various risk-reducing characteristics of the Social Security program.[39] In contrast, the large company stock series might be interpreted from an individual perspective as providing a comparison with a private investment alternative that has exhibited both higher risk and higher return, on average, than a government bond proxy series over the historical period.[40] The variety of interest rates and redistributional measures included in this analysis, then, are intended to facilitate comparison with previous

analyses and to increase the range of questions to which the results can be applied.

Administrative Costs

As a final note, the redistributional measures presented in this paper do not adjust for the costs of administering the program; that is, some of the taxes collected have been used to cover the expenses of administering the program, which necessarily creates an imbalance between taxes and benefits.[41] Analogous, and potentially higher, expenses would be associated with private alternatives to the retirement saving, annuity, survivors, and disability insurance features of the OASDI program.[42] Reported benefit/tax ratios less than one, or benefit-tax differences less than zero, then, do not by themselves suggest that the corresponding program participants were net redistributional losers from a program perspective[43] or that the participants failed to receive their money's worth under the program from an individual perspective.[44]

V. Analysis

This section presents results on the estimated lifetime redistribution to date under the OASDI program across and within specific cohorts born through the year 1927. Although the historical treatment of each cohort under the OASDI program is identified through 1999, the program has not been in existence sufficiently long for any individual birth cohort to have participated in the program over a full potential life span.

Typical Life Cycle Net Transfer Patterns

Nevertheless, a sense of typical patterns of treatment under the program over the life cycles of individual birth cohorts can be garnered by piecing together the treatment of different cohorts who have experienced the program at different points in their life cycles. Chart 1 displays the aggregate annual OASDI real net transfer flows experienced by selected decennial year birth cohorts at various points in their life cycles; that is, for a given cohort, this chart plots aggregate annual OASDI benefits less taxes, adjusted for inflation, at each age across all cohort members. For example, aggregate annual net transfers for the cohort born in 1920 are shown for ages 17 through 79, corresponding to the calendar years 1937–1999 during which the OASDI programs have been in existence and for which data are available in this analysis.[45]

This chart illustrates the typical life cycle pattern of aggregate net transfers under the OASDI program for any given birth cohort, assuming the individual-specific allocation of secondary benefits. At the earliest ages, prior to entry into the labor force, the cohort as a whole experiences positive net transfers as some members receive benefits as children of retired, deceased, or disabled workers. As the cohort attains typical labor force entry ages, the aggregate OASDI taxes paid by working cohort members begin to offset and eventually outweigh aggregate child and early adult benefits, and aggregate net transfers under the OASDI program become negative, on balance. OASDI net transfers to the cohort as a whole tend to remain negative over most of the high labor force participation ages, as the taxes paid by working cohort members continue to outweigh the benefits received by cohort members who receive OASDI benefits as disabled

workers, dependents of disabled or retired workers, survivors, and possibly early retirees. As the cohort ages, disability incidence rates tend to increase and eventually rise to levels sufficient for aggregate DI benefits to outweigh the aggregate DI taxes paid by working, nondisabled, cohort members—for DI benefits and taxes considered alone, this switchover back to positive DI net transfers for the cohort as a whole typically occurs around age 50 (see Leimer 1998). This trend toward positive aggregate net transfers as the cohort ages is reinforced by benefits under the OASI program after the age at which cohort members become eligible for retirement and other old-age benefits—after that age, OASI net transfers as a whole tend to become positive once again, with aggregate OASI benefits outweighing the aggregate OASI taxes paid by cohort members who continue working (see Leimer 2003). Results for the combined programs are dominated by the larger OASI program, with OASDI net transfers as a whole tending to become positive again after the age at which cohort members become eligible for retirement and other old-age benefits. Aggregate OASDI net transfers for the cohort begin to decline later in the retirement period, as mortality claims more cohort members.

The same pattern of aggregate net transfers by age is evident in Chart 2, which displays the cross section of aggregate annual OASDI net transfers by age in selected years, adjusted for inflation; that is, for a given year, this chart plots aggregate annual OASDI benefits less taxes, adjusted to 1999 dollars, at each age across all program participants in that year. In Chart 2, then, the graph of aggregate net transfers for a particular year reflects a different birth cohort at each age.

Aggregate Net Transfers by Cohort

The estimated net effect of the aggregate benefits and taxes experienced to date by cohort groups born through 1927 is shown in the "Accumulated net transfers through 1999" section of Table 1, where the OASDI benefits less taxes experienced historically by members of each cohort group are accumulated through 1999 using the interest rate earned on OASDI trust fund assets. The absolute sizes of the accumulated aggregate net transfers to the various cohort, race, and gender groups, of course, depend on the sizes of the groups as well as on the relative balance between accumulated taxes and benefits for each group.

The youngest of the cohorts included in Table 1 (the 1927 birth cohort) had attained age 72 in 1999, the last year of historical data available for this analysis. As such, the tax histories for these cohorts are largely complete, but substantial benefit payments remain for the youngest cohorts. Nevertheless, the size of the accumulated net transfers to date for these cohorts is impressive, primarily reflecting the large transfers that a pay-as-you-go social insurance retirement program grants to early cohorts. The accumulated OASDI net transfer from the start of the program through 1999 to all of these cohorts combined was over $10.4 trillion,[46] evaluated as of year-end 1999 using the interest rate earned by the OASDI trust fund. Appendix Tables A–1 and A–2 respectively provide the corresponding estimates of accumulated net transfers to date for the various race, gender, and cohort groups using the zero real interest rate series and the total rate of return to large company stocks series.

The estimates shown in Table 1 suggest that the accumulated OASDI net transfer to date is positive for all of the race and gender groups in all of these

early cohorts when evaluated using the interest rate earned by the OASDI trust fund, except for males of both race groups in the 1923–1927 cohort group. The estimates in Table 1 also indicate, however, that the 1923–1927 cohort group as a whole received positive net transfers to date using the OASDI trust fund interest rate, reflecting a net redistribution from males to females within the cohort group. As shown in Appendix Table A–1, all race and gender groups in all of the cohort groups considered are estimated to have received positive OASDI net transfers to date under the zero real interest rate assumption. When the generally higher total rate of return to large company stocks series is used,[47] however, accumulated historical taxes exceed accumulated historical benefits for several more of the race and gender groups in cohorts born after 1910, as shown in Appendix Table A–2.

As noted above, the "to date" estimates through 1999 in Table 1 exclude part of the expected taxes and substantial portions of the expected benefits yet to be experienced by some of the younger cohorts represented in the table. To get a feel for the size of these remaining net transfers, the aggregate benefit and tax streams for each of the cohorts represented in Table 1 were extended through age 120 in what is referred to here as a "mortality extension" simulation.[48] This relatively simple extension (1) assumes that real average benefits and taxes over all surviving members of each cohort remain constant after 1999 and (2) applies mortality rates by age, race, and gender from the 1990 decennial Census to simulate the surviving population of each cohort through age 120. While capturing the major effects of mortality on the cohort benefit and tax streams, the resulting estimate of net transfers is still likely to be biased downward to some

extent. Average real benefits over all surviving cohort members is actually likely to increase over time due to program provisions affecting survivors (for example, a surviving spouse's benefit generally exceeds one-half of the couples' prior combined benefit) and the likely positive correlation between size of benefit and survival probabilities.[49] Also, the actual mortality rates experienced by these cohorts beyond 1999 are likely to be lower than those applicable to 1990. Similarly, average real earnings and taxes across all surviving cohort members is actually likely to decline substantially over time due to lower labor force participation rates at older ages; this effect is likely to overwhelm the probable positive correlation between size of earnings and survival probabilities at those ages.

The effect of this "mortality extension" simulation on each cohort's remaining lifetime taxes and benefits was to increase total OASDI accumulated payroll plus benefit income taxes (relative to the "to date" estimates, both using the OASDI trust fund interest rate) by about 2.0 percent for the 1923–1927 cohort group, 1.2 percent for the 1917–1922 cohort group, 0.6 percent for the 1911–1916 cohort group, and 0.2 percent for the 1904–1910 cohort group, with rapidly declining increases under 0.1 percent for the earlier cohort groups. Accumulated gross OASDI benefits increased by much larger percentages, of course, under this "mortality extension" simulation—about 37 percent for the 1923–1927 cohort group, 15 percent for the 1917–1922 cohort group, 5 percent for the 1911–1916 cohort group, and 1 percent for the 1904–1910 cohort group, with rapidly declining increases for the earlier cohort groups.

The combined effect of the "mortality extension" simulation on accumulated OASDI net transfers over the entire simulated lifetimes (through age 120) of the early cohorts considered in this analysis is illustrated in the "mortality extension" lifetime net transfers section (the last, shaded, column) of Table 1, where the accumulated values of benefits less taxes across all persons in each cohort group are evaluated as of year-end 1999 using the OASDI trust fund interest rate. It is evident from this column that the "mortality extension" simulation has very little effect on the earliest cohorts, as expected, but accumulated OASDI net transfers for the youngest cohort group (1923–1927) increase from $24 billion to $521 billion between the "to date" estimates (through 1999) and the "mortality extension" lifetime estimates in Table 1.[50] Again, even these simulated lifetime estimates are likely to be biased downward, as discussed above, and do not include any adjustment for the costs of administering the programs.

The quantitative results presented in this paper for the "mortality extension" lifetime simulation should not be given the same weight as the much more authoritative "to date" estimates. The "mortality extension" simulation was undertaken primarily to (1) provide a feel for how full lifetime outcomes might differ from the "to date" estimates which are the focus of this analysis and (2) ensure that the relative within cohort redistributional results presented in the "to date" tables are not qualitatively sensitive to reasonable extensions over complete cohort lifetimes. In fact, the "mortality extension" simulation had no effect on the main qualitative conclusions concerning relative outcomes for the various race and gender groups for any of the redistributional measures included in this paper.

Specific relative outcomes for the various race and gender groups under the "mortality extension" simulation are indicated in endnotes throughout this paper.

Internal Rates of Return by Cohort

One measure of the relative balance between the taxes and benefits experienced to date for the various groups is the internal rate of return.[51] As shown in Table 2, the estimated OASDI real internal rate of return to date (through 1999) falls rapidly over these early cohorts, from nearly 30 percent for the cohort group born prior to 1885 to about 2.7 percent for the cohort group born from 1923 through 1927. The last column of Table 2 indicates that the lifetime OASDI real internal rate of return under the "mortality extension" simulation fell from nearly 30 percent to (a likely conservative estimate of) about 4.4 percent over the same cohort groups. Again, the relatively large internal rates of return to date estimated for these cohorts primarily reflect the large transfers that a pay-as-you-go social insurance retirement program grants to early cohorts.

The internal rate of return to date for females under the combined OASDI program is substantially higher than that for males in all of the cohort groups, with absolute differences ranging from about 5 percentage points for the 1923–1927 cohort group to about 43 percentage points for the pre-1885 cohort group. Although the internal rate of return to date for Other Races falls a bit short of the corresponding rate for Whites in the pre-1885 cohort group by about 0.3 percentage points, the internal rate of return to date for Other Races exceeds that for Whites in all of the subsequent cohort groups by substantially larger margins, with differences ranging from about 0.7 percentage points to 1.3 percentage

points. Looking at the individual race and gender groups, the internal rates of return to date for Other Races males exceeded those for White males in all of the cohort groups, with differences ranging from about 0.7 percentage points to 2.0 percentage points; in all but the pre-1885 cohort group, the rates to date for Other Races females exceeded those for White females, with differences ranging from about 0.2 percentage points to 1.4 percentage points. Disaggregating further to the level of individual (single year) birth cohorts,[52] the real internal rate of return to date for Whites exceeded that for Other Races in only 1 of the 43 individual cohorts born in the 1885–1927 range. There was also only one individual cohort in that range for which the internal rate to date for White males exceeded that for Other Races males and only 4 of the 43 cohorts for which the internal rate to date for White females exceeded that for Other Races females. By this measure, then, both Other Races males and females in these cohorts have generally experienced more favorable outcomes than their White counterparts, with the gender differential dominating the race differential.

Accumulated Benefit/Tax Ratios by Cohort

Another measure of the relative balance between taxes and benefits for the various groups is the accumulated benefit/tax ratio.[53] The "Ratio of benefit/tax accumulated values through 1999" columns of Table 3 display the ratio of OASDI accumulated benefits to accumulated taxes to date for the various race, gender, and cohort groups, where all values are accumulated through 1999 using the OASDI trust fund interest rate. Appendix Tables A–3 and A–4 present the corresponding results to date using the two alternative interest rate series. The

last column of Table 3 displays the "mortality extension" simulation estimates of OASDI accumulated lifetime benefits relative to accumulated lifetime taxes for the various groups using the OASDI trust fund interest rate. In all of these cases, the accumulated benefit/tax ratio falls over each successive cohort group within every race and gender group, corresponding to the analogous decline in internal rates of return over those cohort groups. In the "mortality extension" simulation, for example, the accumulated benefit/tax ratio across all cohort members declined from 16.364 for the pre-1885 cohort group to 1.365 for the 1923–1927 cohort group using the OASDI trust fund interest rate series.[54]

It is interesting to note the differences between the intercohort pattern of accumulated net transfers and benefit/tax ratios to date under the OASI and DI programs. While OASI accumulated benefit/tax ratios to date decline monotonically across the cohort groups for every race and gender group under each of the interest rate series (Appendix Tables B–4 through B–6), a much different intercohort pattern emerges for the DI accumulated benefit/tax ratios to date (Appendix Tables C–4 through C–6). Specifically, the DI benefit/tax ratios to date are lowest (and below one) for the first two cohort groups (the pre-1885 and 1885–1894 groups) and above one by typically large margins for all of the remaining cohort groups for every race and gender group under each of the interest rate series. Relative outcomes, as measured by the accumulated benefit/tax ratio to date, under the combined OASDI programs (Table 3 and Appendix Tables A–3 and A–4) largely reflect relative outcomes under the OASI program because of its size compared to the DI program. However, the relatively large size of accumulated benefit/tax ratios to date under the DI program for the

later cohorts do lead to a different qualitative outcome in the combined OASDI programs than in the OASI program in a number of race, gender, and cohort groups for which accumulated taxes to date are close to but exceed accumulated benefits to date under the OASI program.[55]

As expected, the accumulated benefit/tax ratio to date for females is substantially higher than that for males within all of the cohort groups in Table 3, although the relative and absolute advantage of females declined monotonically over these cohort groups.[56] While the female share of accumulated OASDI benefits to date within these cohort groups increased from about 42 percent for the pre-1885 cohort group to about 56 percent for the 1895–1903 cohort group, it declined across the remaining cohort groups, ending up at about 47 percent for the 1923–1927 cohort group.[57] In contrast, the female share of accumulated OASDI payroll and benefit income taxes to date increased across all of the cohort groups with the exception of the last cohort group (1923–1927). The total OASDI female tax share to date increased sharply from about 12 percent for the pre-1885 cohort group to about 27 percent for the 1904–1910 cohort group. The rate of increase in the female tax share to date slowed markedly across the next two cohort groups, and the female share declined somewhat between the last two cohort groups, ending up at about 27 percent.

The pattern of relative outcomes by gender across these early cohorts differs markedly between the OASI and DI programs. Under the DI program, the estimates in Appendix Tables C–4 through C–6 indicate that the relationship between male and female benefit/tax ratios to date varies across the cohort groups. For the first two cohort groups (pre-1885 and 1885–1894), the female DI

benefit/tax ratios to date under all three interest rate assumptions exceed those for males by very substantial proportions. The female DI ratios to date under all three interest rate assumptions then fall a bit below those for males for the next cohort group (1895–1903) and are about equal to or slightly below those for males for the next cohort group (1904–1910). The female DI benefit/tax ratios to date under all three interest rate assumptions then exceed those for males in the remaining cohort groups by proportions ranging from 7 percent to 15 percent, depending on the cohort group and interest rate assumption. In contrast, Appendix Tables B–4 through B–6 suggest that female benefit/tax ratios to date under the OASI program are substantially above those for males for all of the cohort groups by proportions ranging from 2.56 to 6.09, depending on the cohort group and interest rate assumption. Under all of the interest rate assumptions, however, this relative advantage of females in the OASI benefit/tax ratio to date declines monotonically over the cohort groups.

The mixed results by gender across cohort groups under the DI program are overwhelmed by the strength of the relative female advantage under the larger OASI program, with the net result that females as a group have fared much better to date under the combined OASDI programs than their male counterparts. Specifically, female benefit/tax ratios to date under the combined OASDI programs exceed those for males under all three interest rate assumptions by proportions ranging from 2.34 to 6.07, depending on the cohort group and interest rate, as indicated by the estimates in Table 3 and Appendix Tables A–3 and A–4. Similarly, the relative and absolute female advantage in the OASDI benefit/tax ratio to date declines monotonically over the cohort groups under all three interest

rate assumptions. Relative gender outcomes under the OASDI programs would also tend to be less favorable for females under a worker-account allocation of secondary benefits compared to the individual-specific allocation of secondary benefits adopted in the present analysis.

The race differentials in Table 3 are not as pronounced as the gender differentials, but share some of the characteristics of monotonicity in relative changes across cohort groups. The Other Races accumulated benefit/tax ratio to date increases monotonically relative to the White ratio across the cohort groups, for example, with the Other Races ratio ranging from about 7 percent below the White ratio for the pre-1885 cohort group to about 18 percent above the White ratio for the 1923–1927 cohort group under the OASDI trust fund interest rate assumption. While the Other Races share of accumulated OASDI payroll and benefit income taxes to date within these cohort groups has increased monotonically from about 4.4 percent for the pre-1885 cohort group to about 8.6 percent for the 1923–1927 cohort group, the Other Races share of accumulated OASDI benefits to date within these cohort groups has also increased monotonically and even more rapidly, from about 4.1 percent to 10.0 percent over the same cohort range.[58] The lower overall accumulated benefit/tax ratios to date for Other Races relative to Whites in the earliest two cohort groups are attributable to race differentials for females. In fact, accumulated benefit/tax ratios to date for Other Races males exceed those for White males in all of the cohort groups in Table 3 by proportions ranging from about 10 percent to 22 percent. In contrast, accumulated benefit/tax ratios to date for Other Races females are lower than those for White females in all but the 1895–1903 and

1923–1927 cohort groups. The female race differential is especially large for the pre-1885 and 1885–1894 cohort groups.[59]

Disaggregating to the level of individual birth cohorts, the accumulated benefit/tax ratio to date for Other Races exceeded that for Whites in 33 (or about 77 percent) of the 43 individual cohorts born in the 1885–1927 range when evaluated using the OASDI trust fund interest rate series. While there was only one individual cohort in that range for which the accumulated benefit/tax ratio to date for White males exceeded that for Other Races males, the ratio for White females exceeded the ratio for Other Races females in 24 (or about 56 percent) of those 43 individual cohorts.[60]

In sum, the race differentials implied by the accumulated benefit/tax ratios to date in Table 3 using the OASDI trust fund rate of return paint a somewhat different picture than the internal rate of return "to date" estimates in Table 2. The generally more favorable outcomes observed for Other Races compared to those for Whites under the internal rate of return measure do not appear as pronounced under the accumulated benefit/tax ratio measure. The overall White versus Other Races differentials in the accumulated benefit/tax ratios to date represent the net result of generally opposing differentials between the gender subgroups. Specifically, accumulated benefit/tax ratios to date for Other Races males exceed those for White males in all of the cohort groups and all but one of the 1885–1927 individual cohorts. The corresponding ratios for Other Races females, however, fall short of those for White females in most of the individual cohorts and cohort groups under the OASDI trust fund interest rate assumption.

In terms of race differentials in the accumulated benefit/tax ratios to date between the component OASDI programs, the modestly more favorable treatment to date on average of Other Races relative to Whites in most of these cohort groups under the OASI program (Appendix Tables B–4 through B–6) is reinforced and amplified by the generally substantial relative advantage of Other Races within each cohort group under the DI program (Appendix Tables C–4 through C–6); this result obtains under all three of the interest rate assumptions. For example, the ratio of the accumulated benefit/tax ratio to date for Other Races to the corresponding ratio for Whites under the DI program ranges from 1.44 to 2.16, depending on the cohort group and interest rate assumption. The corresponding ratio for Other Races relative to Whites under the OASI program ranges from 0.94 to 1.14, again depending on the cohort group and interest rate assumption.

In general, using the zero real interest rate series to accumulate historical OASDI taxes and benefits generates qualitative benefit/tax ratio results to date similar to those using the OASDI trust fund interest rate series, as shown in Appendix Table A–3.[61] Again, the accumulated benefit/tax ratio to date for females is substantially higher than that for males within all of the cohort groups in Appendix Table A–3, with the relative and absolute advantage of females declining monotonically over these cohort groups. The relative and absolute race differentials in Appendix Table A–3 are similar to those in Table 3 and much less pronounced and less uniform than the gender differentials. The race differentials in Appendix Table A–3 also share some of the characteristics of relative changes across cohort groups that were exhibited in Table 3. For example, with one

exception, the Other Races accumulated benefit/tax ratio to date increases relative to the White ratio across the cohort groups in Appendix Table A–3, with the Other Races ratio ranging from about 6 percent below the White ratio for the pre-1885 cohort group to about 12 percent above the White ratio for the 1923–1927 cohort group. Just as in Table 3, the lower overall accumulated benefit/tax ratios to date for Other Races relative to Whites in the earliest two cohort groups is attributable to race differentials for females. The accumulated benefit/tax ratios to date for Other Races males exceed those for White males in all of the Appendix Table A–3 cohort groups by proportions ranging from about 8 percent to 15 percent. In contrast, the Appendix Table A–3 accumulated benefit/tax ratios to date for Other Races females are lower than those for White females in all but the 1895–1903 cohort group. As in Table 3, the female race differential is especially large for the pre-1885 and 1885–1894 cohort groups. Disaggregating to the level of individual birth cohorts under the zero real interest rate assumption, the accumulated benefit/tax ratio to date for Other Races exceeded that for Whites in 31 of the 43 individual cohorts born in the 1885–1927 cohort range, two fewer individual cohorts than under the OASDI trust fund interest rate series. Under the zero real interest rate assumption, there was one individual cohort in that range for which the accumulated benefit/tax ratio to date for White males exceeded that for Other Races males (the same number as under the OASDI trust fund interest rate series) and 30 individual cohorts for which the accumulated benefit/tax ratio to date for White females exceeded that for Other Races females (compared to 24 individual cohorts under the OASDI trust fund interest rate series).

As shown in Appendix Table A–4, the substantial relative advantage of females in the accumulated benefit/tax ratio to date persists under the large company stocks interest rate series, although, again, the relative and absolute advantage of females declines monotonically over these cohort groups. The data in Appendix Table A–4 also reveal a substantial impact on the estimated race differentials for these early cohorts using the generally higher large company stocks interest rate series to accumulate historical OASDI taxes and benefits. Under this interest rate assumption, the accumulated benefit/tax ratios to date in all of the cohort groups except the pre-1885 cohort group suggest that relative outcomes for Other Races have been more favorable than those for Whites. The accumulated benefit/tax ratios to date for Other Races exceed those for Whites in those cohort groups by proportions ranging from 11 percent to 30 percent. The accumulated benefit/tax ratios to date for Other Races males exceed those for White males in all of the cohort groups in Appendix Table A–4 by proportions ranging from 11 percent to 30 percent. Even the accumulated benefit/tax ratios to date for Other Races females exceed those for White females in all but the first two cohort groups by proportions ranging from about 11 percent to 23 percent. Disaggregating to the level of individual birth cohorts under the large company stocks interest rate assumption, the accumulated benefit/tax ratio to date for Other Races exceeded that for Whites in 41 of the 43 individual cohorts born in the 1885–1927 range, a sharp increase over the number of such cases under either the zero real or OASDI trust fund interest rate series. Under the large company stock interest rate assumption, there were no individual cohorts in that range for which the accumulated benefit/tax ratio to date for White males exceeded that for Other

Races males and only six individual cohorts for which the accumulated benefit/tax ratio to date for White females exceeded that for Other Races females. Again, the latter result represents a sharp increase in the number of individual cohorts in which relative outcomes favored Other Races compared with estimates under either the zero real or OASDI trust fund interest rate series. For some of these early individual cohorts and cohort groups, then, the direction as well as extent of the race differential measured by the accumulated OASDI benefit/tax ratio is sensitive to the choice of the interest rate series.

VI. Concluding Thoughts

In a number of ways, the results presented in this series of analyses are both more comprehensive and more authoritative than those presented in comparable previous analyses. Although a number of studies have used administrative data to study historical redistribution across cohort, race, and gender groups under the OASI program, none has included all OASI and DI benefits as does the present analysis. At best, previous analyses typically have been limited to considering retired-worker and associated secondary benefits to aged dependent spouses and aged surviving spouses. In addition to these benefit types, the present study also includes all other OASI and DI benefit types. Under the OASI program, these include various types of child and disabled child benefits, spouse and surviving spouse with entitled child benefits, disabled widows and widowers benefits, various types of divorced spouse benefits, surviving dependent parent benefits, special age-72 benefits, and lump-sum benefits. Under the DI program, these include all of the various types of benefits to disabled workers and their spouse

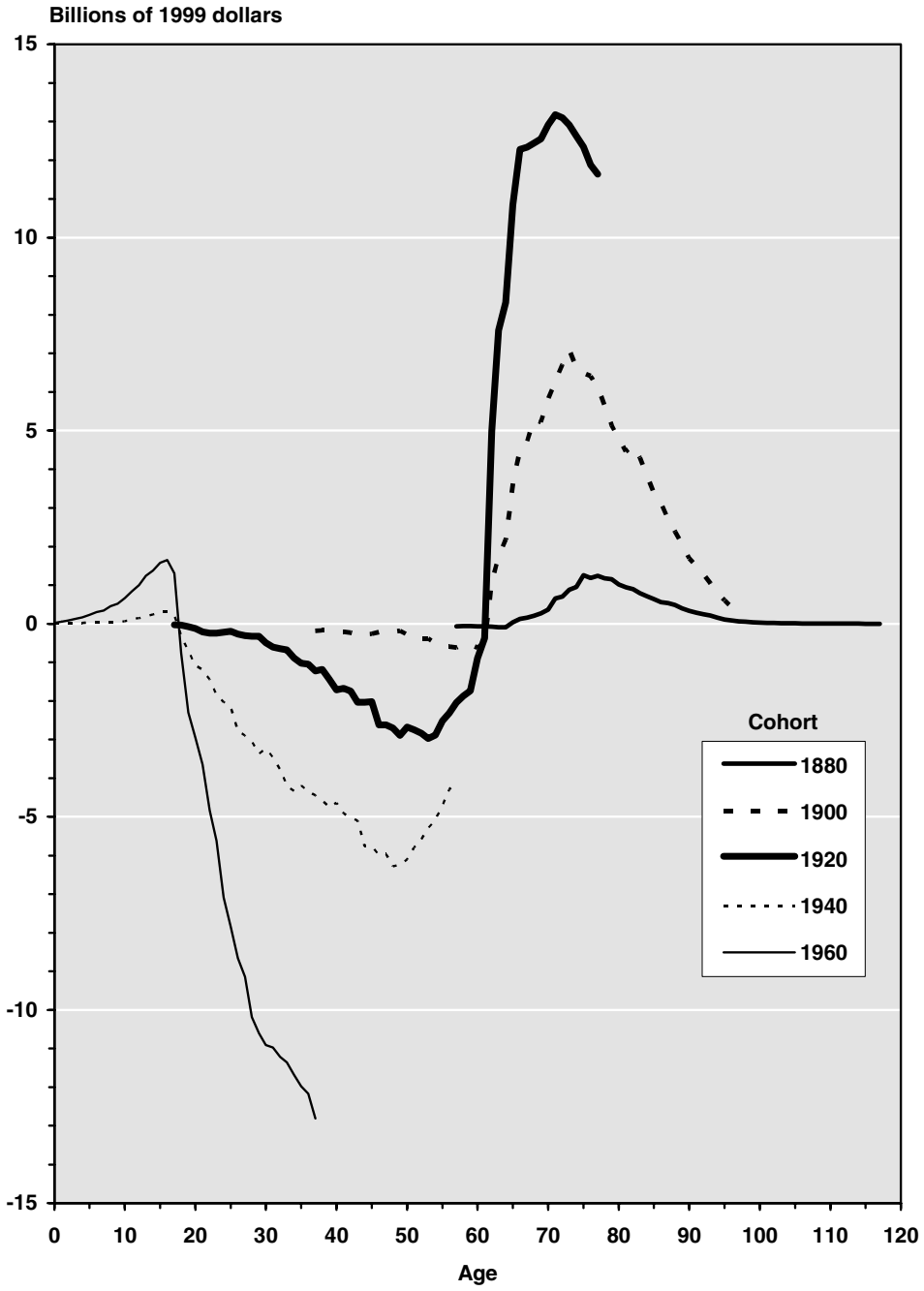
and child dependents. On the tax side, this study includes all OASDI payroll tax payments and benefit income tax payments that are ultimately returned to the OASI and DI trust funds. These historical tax payments are included for all cohort members, including those paid by cohort members who continue working past typical retirement ages and including those benefit income taxes paid by all OASDI beneficiaries and ultimately returned to the OASI and DI trust funds. By relying exclusively on a variety of historical administrative data sources for its main findings, this analysis also avoids the use of hypothetical worker methods or simplifying assumptions to fill in missing historical data from administrative data files, lending more authority to the estimated outcomes to date.

The results presented in this paper cannot be regarded as definitive, however, since the approach adopted requires other types of assumptions. One of these, for example, is the assumption that the relative distribution of each benefit type by age, race, and gender at year-end is representative of the corresponding distribution of total benefit payments of that type during the entire year. It should also be kept in mind that the administrative data sources used in this analysis required the use of the individual-specific allocation of secondary benefits—some of the results would likely differ under a worker-account allocation of such benefits.

As a final note, it bears repeating that this analysis estimates outcomes under the OASI, DI, and combined OASDI programs for only the earliest affected cohorts, ending with the cohort born in 1927. Redistributional outcomes for later cohorts may differ significantly from those for the early cohorts considered in this analysis, reflecting program changes, greater emphasis on benefit types associated

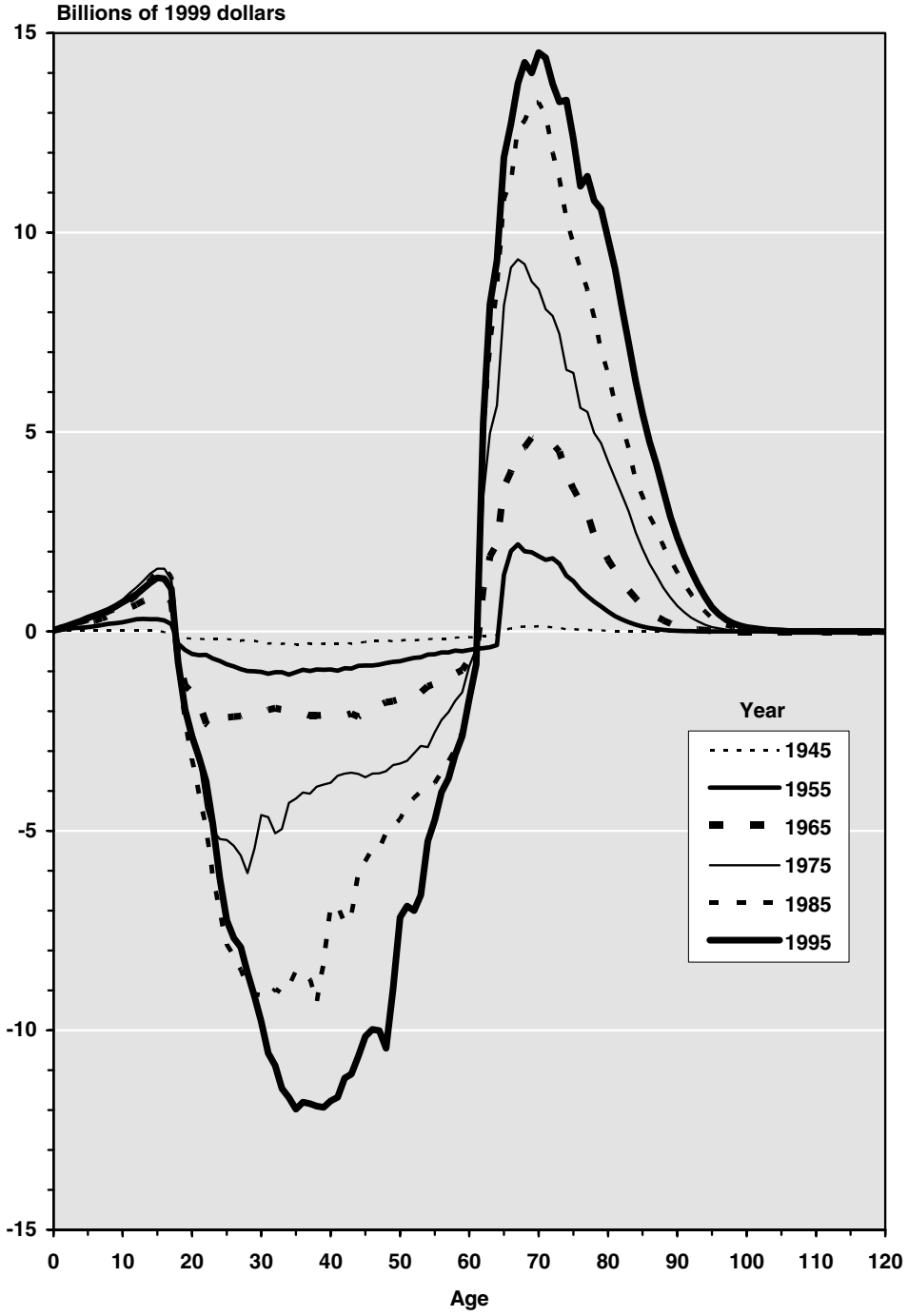
with early life cycle ages, and changes over time in such factors as the earnings, family status, net immigration, and mortality experience of the various race and gender groups.

Chart 1.
Aggregate annual OASDI real net transfers over the period of analysis (1937–1999) for selected birth cohorts, by age



SOURCE: Author's calculations.

Chart 2.
Aggregate annual OASDI real net transfers in selected years, by age



SOURCE: Author's calculations.

Table 1.
Accumulated OASDI net transfers evaluated as of year-end 1999 using the interest rate earned by the OASDI trust fund, by birth cohort, race, and sex (in billions of dollars)

	Accumulated net transfers through 1999									"Mortality extension" lifetime net transfers across All Races, total
	White			Other Races			All Races			
Birth cohort	Males	Females	Total	Males	Females	Total	Males	Females	Total	
Pre–1885	288	229	517	14	8	22	302	237	539	539
1885–1894	740	859	1,599	43	39	82	783	898	1,681	1,681
1895–1903	916	1,406	2,322	75	89	163	991	1,494	2,485	2,488
1904–1910	896	1,421	2,317	83	105	188	979	1,526	2,505	2,542
1911–1916	767	1,165	1,931	72	100	172	839	1,265	2,104	2,260
1917–1922	242	759	1,001	35	72	107	277	831	1,108	1,469
1923–1927	-256	258	2	-9	31	22	-265	289	24	521

SOURCE: Author's calculations.

NOTE: The section with accumulated net transfers through 1999 presents "to date" results that are based on historical administrative data, while the "mortality extension" lifetime estimates are based on a relatively simple simulation (likely biased downward) that extends benefits and taxes over the full lifetimes of the cohorts represented in the table.

Table 2.
Real OASDI internal rate of return, by birth cohort, race, and sex (in percent)

Birth cohort	Internal rate of return considering benefits and total taxes through 1999									"Mortality extension" lifetime rate of return across All Races, total
	White			Other Races			All Races			
	Males	Females	Total	Males	Females	Total	Males	Females	Total	
Pre–1885	24.3	68.4	29.9	26.3	52.5	29.6	24.4	67.8	29.9	29.9
1885–1894	14.4	28.5	17.8	16.4	28.6	19.1	14.5	28.5	17.8	17.8
1895–1903	9.1	18.9	12.2	10.3	20.3	13.0	9.2	19.0	12.2	12.2
1904–1910	6.5	13.3	8.9	7.4	14.6	9.7	6.6	13.4	9.0	9.0
1911–1916	5.2	10.6	7.1	5.9	11.9	7.9	5.2	10.7	7.2	7.3
1917–1922	3.2	8.1	5.0	3.9	8.9	5.7	3.2	8.2	5.1	5.7
1923–1927	0.9	5.8	2.7	1.7	6.5	3.5	0.9	5.9	2.7	4.4

SOURCE: Author's calculations.

NOTE: The section considering benefits and total taxes through 1999 presents "to date" results that are based on historical administrative data, while the "mortality extension" lifetime estimates are based on a relatively simple simulation (likely biased downward) that extends benefits and taxes over the full lifetimes of the cohorts represented in the table.

Table 3.
Ratio of OASDI benefit/total OASDI tax accumulated values using the interest rate earned by the OASDI trust fund, by birth cohort, race, and sex

Birth cohort	Ratio of benefit/tax accumulated values through 1999									"Mortality extension" lifetime benefit/tax ratio across All Races, total
	White			Other Races			All Races			
	Males	Females	Total	Males	Females	Total	Males	Females	Total	
Pre–1885	10.754	57.747	16.413	11.795	38.559	15.315	10.800	56.829	16.365	16.364
1885–1894	8.158	38.288	13.654	9.130	31.243	13.454	8.206	37.916	13.644	13.641
1895–1903	4.741	19.063	8.195	5.284	19.356	8.329	4.777	19.080	8.204	8.207
1904–1910	3.166	10.247	5.084	3.498	10.088	5.196	3.191	10.236	5.093	5.145
1911–1916	2.284	6.281	3.362	2.523	6.279	3.595	2.302	6.281	3.380	3.541
1917–1922	1.274	3.317	1.825	1.488	3.188	2.025	1.290	3.305	1.841	2.102
1923–1927	0.729	1.771	1.001	0.887	1.792	1.179	0.741	1.773	1.017	1.365

SOURCE: Author's calculations.

NOTE: The section with the ratio of benefit/tax accumulated values through 1999 presents "to date" results that are based on historical administrative data, while the "mortality extension" lifetime estimates are based on a relatively simple simulation (likely biased downward) that extends benefits and taxes over the full lifetimes of the cohorts represented in the table.

Appendix A.

Table A–1.
Accumulated OASDI net transfers through 1999 evaluated as of year-end 1999 using a zero real interest rate, by birth cohort, race, and sex (in billions of dollars)

	White			Other Races			All Races		
Birth cohort	Males	Females	Total	Males	Females	Total	Males	Females	Total
Pre–1885	111	91	202	6	3	9	117	94	211
1885–1894	300	351	651	17	16	33	317	367	684
1895–1903	390	610	1,000	32	39	70	422	649	1,071
1904–1910	421	683	1,103	38	50	88	459	733	1,192
1911–1916	444	639	1,083	40	54	94	483	693	1,177
1917–1922	296	519	816	31	48	79	327	567	894
1923–1927	66	264	331	12	29	41	79	294	372

SOURCE: Author's calculations.

Table A–2.
Accumulated OASDI net transfers through 1999 evaluated as of year-end 1999 using the total rate of return to large company stocks, by birth cohort, race, and sex (in billions of dollars)

	White			Other Races			All Races		
Birth cohort	Males	Females	Total	Males	Females	Total	Males	Females	Total
Pre–1885	2,693	2,318	5,011	127	67	194	2,820	2,386	5,205
1885–1894	2,241	4,484	6,725	158	195	353	2,399	4,679	7,078
1895–1903	1,191	5,628	6,819	152	360	511	1,342	5,988	7,330
1904–1910	698	4,888	5,587	134	373	507	832	5,261	6,094
1911–1916	-295	3,211	2,916	47	297	345	-248	3,508	3,261
1917–1922	-2,501	1,060	-1,440	-142	132	-10	-2,643	1,192	-1,451
1923–1927	-3,415	-389	-3,805	-254	-4	-258	-3,669	-394	-4,063

SOURCE: Author's calculations.

Table A–3.
Ratio of OASDI benefit/total OASDI tax accumulated values through 1999 using a zero real interest rate, by birth cohort, race, and sex

	White			Other Races			All Races		
Birth cohort	Males	Females	Total	Males	Females	Total	Males	Females	Total
Pre–1885	9.802	54.064	15.065	10.930	34.221	14.155	9.850	53.059	15.025
1885–1894	8.090	38.321	13.596	9.017	30.577	13.306	8.135	37.900	13.581
1895–1903	4.909	19.855	8.568	5.509	20.065	8.738	4.949	19.867	8.579
1904–1910	3.464	11.444	5.674	3.812	11.167	5.756	3.490	11.425	5.680
1911–1916	2.789	7.750	4.160	3.022	7.660	4.377	2.806	7.743	4.176
1917–1922	1.800	4.671	2.593	2.031	4.399	2.794	1.817	4.646	2.609
1923–1927	1.163	2.777	1.595	1.341	2.681	1.784	1.177	2.767	1.611

SOURCE: Author's calculations.

Table A–4.
Ratio of OASDI benefit/total OASDI tax accumulated values through 1999 using the total rate of return to large company stocks, by birth cohort, race, and sex

	White			Other Races			All Races		
Birth cohort	Males	Females	Total	Males	Females	Total	Males	Females	Total
Pre–1885	3.353	20.520	4.967	3.706	17.770	4.813	3.367	20.430	4.961
1885–1894	1.826	10.804	3.122	2.297	10.462	3.483	1.847	10.790	3.137
1895–1903	1.297	6.729	2.368	1.578	7.769	2.621	1.315	6.783	2.383
1904–1910	1.149	4.489	1.918	1.385	4.961	2.147	1.165	4.519	1.933
1911–1916	0.943	2.945	1.428	1.121	3.363	1.668	0.955	2.974	1.445
1917–1922	0.575	1.491	0.821	0.701	1.691	0.984	0.584	1.507	0.833
1923–1927	0.339	0.795	0.461	0.440	0.978	0.602	0.347	0.812	0.473

SOURCE: Author's calculations.

Appendix B.

Table B–1.
Accumulated OASI net transfers through 1999 evaluated as of year-end 1999 using a zero real interest rate, by birth cohort, race, and sex (in billions of dollars)

	White			Other Races			All Races		
Birth cohort	Males	Females	Total	Males	Females	Total	Males	Females	Total
Pre–1885	112	91	202	6	3	9	117	94	211
1885–1894	301	352	652	18	16	34	318	368	686
1895–1903	385	609	994	31	38	69	416	647	1,063
1904–1910	408	678	1,086	36	49	85	444	727	1,171
1911–1916	419	629	1,048	35	52	87	455	681	1,136
1917–1922	263	505	768	23	45	68	287	550	837
1923–1927	43	254	296	5	26	31	48	280	328

SOURCE: Author's calculations.

Table B–2.
Accumulated OASI net transfers through 1999 evaluated as of year-end 1999 using the interest rate earned by the OASI trust fund, by birth cohort, race, and sex (in billions of dollars)

	White			Other Races			All Races		
Birth cohort	Males	Females	Total	Males	Females	Total	Males	Females	Total
Pre–1885	287	229	516	14	8	22	302	236	538
1885–1894	741	860	1,601	43	39	82	784	899	1,683
1895–1903	906	1,406	2,312	73	88	161	979	1,494	2,473
1904–1910	872	1,416	2,287	77	103	180	949	1,519	2,468
1911–1916	712	1,144	1,856	62	96	157	774	1,240	2,014
1917–1922	159	726	885	17	64	81	176	790	966
1923–1927	-304	236	-68	-24	24	0	-328	260	-67

SOURCE: Author's calculations.

Table B–3.
Accumulated OASI net transfers through 1999 evaluated as of year-end 1999 using the total rate of return to large company stocks, by birth cohort, race, and sex (in billions of dollars)

	White			Other Races			All Races		
Birth cohort	Males	Females	Total	Males	Females	Total	Males	Females	Total
Pre–1885	2,695	2,319	5,014	127	67	195	2,822	2,386	5,209
1885–1894	2,256	4,487	6,744	158	196	354	2,415	4,683	7,097
1895–1903	1,116	5,608	6,724	138	357	495	1,254	5,965	7,220
1904–1910	573	4,841	5,414	106	364	470	680	5,205	5,884
1911–1916	-576	3,091	2,515	-5	276	271	-581	3,366	2,786
1917–1922	-2,848	910	-1,938	-219	99	-121	-3,067	1,008	-2,059
1923–1927	-3,541	-462	-4,003	-307	-28	-335	-3,848	-490	-4,338

SOURCE: Author's calculations.

Table B–4.
Ratio of OASI benefit/total OASI tax accumulated values through 1999 using a zero real interest rate, by birth cohort, race, and sex

	White			Other Races			All Races		
Birth cohort	Males	Females	Total	Males	Females	Total	Males	Females	Total
Pre–1885	9.932	55.588	15.291	11.117	36.256	14.477	9.983	54.636	15.256
1885–1894	8.326	39.880	14.022	9.339	32.213	13.827	8.376	39.468	14.013
1895–1903	5.084	20.978	8.965	5.640	21.232	9.081	5.121	20.993	8.972
1904–1910	3.579	12.186	5.964	3.835	11.825	5.944	3.598	12.161	5.963
1911–1916	2.851	8.252	4.347	2.963	8.047	4.449	2.860	8.236	4.354
1917–1922	1.786	4.938	2.659	1.873	4.520	2.726	1.793	4.900	2.664
1923–1927	1.116	2.892	1.592	1.161	2.669	1.659	1.120	2.869	1.598

SOURCE: Author's calculations.

Table B–5.
Ratio of OASI benefit/total OASI tax accumulated values through 1999 using the interest rate earned by the OASI trust fund, by birth cohort, race, and sex

	White			Other Races			All Races		
Birth cohort	Males	Females	Total	Males	Females	Total	Males	Females	Total
Pre–1885	10.905	59.336	16.672	11.997	40.546	15.646	10.953	58.456	16.627
1885–1894	8.416	39.931	14.118	9.456	32.882	13.982	8.466	39.562	14.112
1895–1903	4.929	20.246	8.613	5.425	20.574	8.684	4.962	20.265	8.618
1904–1910	3.280	10.976	5.364	3.520	10.724	5.372	3.298	10.959	5.364
1911–1916	2.307	6.687	3.489	2.425	6.562	3.604	2.316	6.677	3.497
1917–1922	1.199	3.449	1.807	1.262	3.174	1.865	1.203	3.424	1.811
1923–1927	0.642	1.784	0.941	0.672	1.691	1.001	0.645	1.774	0.946

SOURCE: Author's calculations.

Table B–6.
Ratio of OASI benefit/total OASI tax accumulated values through 1999 using the total rate of return to large company stocks, by birth cohort, race, and sex

	White			Other Races			All Races		
Birth cohort	Males	Females	Total	Males	Females	Total	Males	Females	Total
Pre–1885	3.360	20.629	4.979	3.717	17.979	4.830	3.374	20.543	4.974
1885–1894	1.838	10.933	3.145	2.314	10.633	3.515	1.858	10.920	3.161
1895–1903	1.284	6.867	2.378	1.539	7.941	2.608	1.300	6.922	2.391
1904–1910	1.127	4.607	1.922	1.317	5.063	2.107	1.140	4.636	1.935
1911–1916	0.882	2.985	1.390	0.986	3.346	1.556	0.890	3.011	1.401
1917–1922	0.480	1.452	0.741	0.503	1.562	0.804	0.482	1.461	0.746
1923–1927	0.252	0.737	0.383	0.262	0.840	0.435	0.253	0.746	0.387

SOURCE: Author's calculations.

Table B–7.
Real OASI internal rate of return through 1999, by birth cohort, race, and sex (in percent)

	White			Other Races			All Races		
Birth cohort	Males	Females	Total	Males	Females	Total	Males	Females	Total
Pre–1885	24.3	68.4	29.9	26.3	52.5	29.6	24.4	67.8	29.9
1885–1894	14.4	28.5	17.8	16.4	28.7	19.1	14.5	28.5	17.8
1895–1903	9.0	18.9	12.1	10.0	20.2	12.8	9.0	18.9	12.1
1904–1910	6.3	13.2	8.8	6.9	14.3	9.2	6.3	13.3	8.8
1911–1916	4.9	10.5	7.0	5.2	11.5	7.4	5.0	10.6	7.0
1917–1922	2.9	8.0	4.8	3.0	8.4	5.0	2.9	8.0	4.8
1923–1927	0.6	5.7	2.4	0.8	5.9	2.7	0.6	5.7	2.5

SOURCE: Author's calculations.

Appendix C.

Table C–1.
Accumulated DI net transfers through 1999 evaluated as of year-end 1999 using a zero real interest rate, by birth cohort, race, and sex (in billions of dollars)

	White			Other Races			All Races		
Birth cohort	Males	Females	Total	Males	Females	Total	Males	Females	Total
Pre–1885	-0.2	0.0	-0.2	0.0	0.0	0.0	-0.2	0.0	-0.2
1885–1894	-1.0	-0.2	-1.2	-0.1	0.0	-0.1	-1.1	-0.2	-1.3
1895–1903	5.1	1.4	6.5	0.9	0.2	1.1	6.0	1.6	7.6
1904–1910	12.8	4.8	17.7	2.6	0.8	3.4	15.4	5.7	21.1
1911–1916	24.2	10.2	34.4	4.5	1.8	6.3	28.7	12.1	40.8
1917–1922	33.3	14.2	47.5	7.2	3.1	10.2	40.5	17.2	57.7
1923–1927	23.9	10.5	34.4	7.0	3.1	10.1	30.9	13.6	44.5

SOURCE: Author's calculations.

Table C–2.
Accumulated DI net transfers through 1999 evaluated as of year-end 1999 using the interest rate earned by the DI trust fund, by birth cohort, race, and sex (in billions of dollars)

	White			Other Races			All Races		
Birth cohort	Males	Females	Total	Males	Females	Total	Males	Females	Total
Pre–1885	-0.4	-0.1	-0.5	0.0	0.0	0.0	-0.4	-0.1	-0.5
1885–1894	-2.5	-0.6	-3.1	-0.1	0.0	-0.2	-2.6	-0.6	-3.2
1895–1903	13.0	3.6	16.6	2.3	0.5	2.8	15.3	4.2	19.4
1904–1910	30.3	11.4	41.7	6.2	2.0	8.2	36.5	13.4	49.9
1911–1916	58.6	24.8	83.4	10.8	4.4	15.3	69.4	29.3	98.7
1917–1922	82.1	34.7	116.7	17.4	7.4	24.8	99.5	42.1	141.5
1923–1927	45.4	21.2	66.7	14.4	6.5	20.9	59.9	27.7	87.6

SOURCE: Author's calculations.

Table C–3.
Accumulated DI net transfers through 1999 evaluated as of year-end 1999 using the total rate of return to large company stocks, by birth cohort, race, and sex (in billions of dollars)

	White			Other Races			All Races		
Birth cohort	Males	Females	Total	Males	Females	Total	Males	Females	Total
Pre–1885	-2.6	-0.5	-3.1	-0.1	0.0	-0.2	-2.7	-0.6	-3.3
1885–1894	-15.2	-3.5	-18.6	-0.7	-0.1	-0.9	-15.9	-3.6	-19.5
1895–1903	74.8	19.7	94.5	13.3	2.7	15.9	88.1	22.4	110.5
1904–1910	124.9	47.9	172.8	27.7	8.9	36.5	152.6	56.7	209.3
1911–1916	281.0	120.2	401.2	52.2	21.6	73.8	333.2	141.8	474.9
1917–1922	347.1	150.4	497.5	77.3	32.9	110.3	424.4	183.3	607.7
1923–1927	125.5	72.4	197.9	53.1	24.1	77.2	178.6	96.5	275.1

SOURCE: Author's calculations.

Table C–4.
Ratio of DI benefit/total DI tax accumulated values through 1999 using a zero real interest rate, by birth cohort, race, and sex

	White			Other Races			All Races		
Birth cohort	Males	Females	Total	Males	Females	Total	Males	Females	Total
Pre–1885	0.012	0.148	0.042	0.019	0.188	0.078	0.013	0.152	0.045
1885–1894	0.172	0.374	0.219	0.223	0.569	0.315	0.175	0.388	0.225
1895–1903	1.916	1.755	1.875	3.295	2.583	3.123	2.008	1.807	1.957
1904–1910	2.019	2.011	2.017	3.531	3.229	3.450	2.132	2.100	2.123
1911–1916	2.128	2.285	2.170	3.639	3.605	3.629	2.239	2.392	2.281
1917–1922	1.932	2.075	1.971	3.528	3.257	3.440	2.050	2.185	2.087
1923–1927	1.583	1.717	1.618	2.952	2.785	2.897	1.692	1.832	1.730

SOURCE: Author's calculations.

Table C–5.
Ratio of DI benefit/total DI tax accumulated values through 1999 using the interest rate earned by the DI trust fund, by birth cohort, race, and sex

	White			Other Races			All Races		
Birth cohort	Males	Females	Total	Males	Females	Total	Males	Females	Total
Pre–1885	0.012	0.164	0.044	0.020	0.240	0.088	0.013	0.170	0.047
1885–1894	0.183	0.389	0.230	0.256	0.633	0.354	0.187	0.405	0.237
1895–1903	1.950	1.786	1.908	3.364	2.654	3.195	2.045	1.839	1.993
1904–1910	1.991	1.989	1.990	3.495	3.227	3.423	2.103	2.078	2.096
1911–1916	2.137	2.302	2.181	3.643	3.639	3.642	2.248	2.410	2.292
1917–1922	1.968	2.118	2.008	3.589	3.332	3.506	2.087	2.231	2.126
1923–1927	1.484	1.645	1.526	2.769	2.648	2.729	1.587	1.753	1.631

SOURCE: Author's calculations.

Table C–6.
Ratio of DI benefit/total DI tax accumulated values through 1999 using the total rate of return to large company stocks, by birth cohort, race, and sex

	White			Other Races			All Races		
Birth cohort	Males	Females	Total	Males	Females	Total	Males	Females	Total
Pre–1885	0.009	0.159	0.038	0.016	0.277	0.083	0.010	0.167	0.041
1885–1894	0.228	0.377	0.261	0.332	0.623	0.404	0.233	0.392	0.269
1895–1903	1.944	1.746	1.894	3.340	2.575	3.163	2.037	1.796	1.977
1904–1910	1.787	1.808	1.793	3.157	2.952	3.103	1.889	1.889	1.889
1911–1916	2.085	2.273	2.135	3.535	3.606	3.556	2.192	2.381	2.243
1917–1922	1.849	2.024	1.895	3.382	3.196	3.323	1.962	2.133	2.008
1923–1927	1.291	1.491	1.342	2.413	2.367	2.398	1.380	1.585	1.434

SOURCE: Author's calculations.

Table C–7.
Real DI internal rate of return through 1999, by birth cohort, race, and sex (in percent)

	White			Other Races			All Races		
Birth cohort	Males	Females	Total	Males	Females	Total	Males	Females	Total
Pre–1885	a	a	a	a	a	a	a	a	a
1885–1894	a	a	a	a	a	a	a	a	a
1895–1903	166.9	109.3	152.0	401.6	143.5	327.1	179.4	111.6	161.7
1904–1910	35.5	35.1	35.4	70.7	56.5	67.0	38.4	36.9	38.0
1911–1916	16.6	19.8	17.4	29.6	30.3	29.8	17.8	20.9	18.5
1917–1922	11.3	14.5	12.0	21.5	21.7	21.5	12.2	15.4	13.0
1923–1927	6.7	10.3	7.5	15.0	16.0	15.3	7.6	11.1	8.4

SOURCE: Author's calculations.

a. Valid internal rates of return could not be identified under the DI program for the two cohort groups born prior to 1895. The latest individual birth cohort in these earliest cohort groups was already age 63 in 1957, the first year of the DI program.

Notes

[1] Because of the similarity of the studies and approaches, some of the material in this paper is drawn from the corresponding sections of the previous papers (Leimer 1998, 2003) on historical redistribution under the Disability Insurance and the Old-Age and Survivors Insurance programs, considered separately. In other instances, the reader is referred to the earlier studies for additional discussion. There are, however, some important differences between the analytical approach adopted in this paper and the approaches adopted in the previous papers in this series—these differences are discussed more fully below.

[2] In essence, the lifetime redistributional measures used in this paper compare the accumulated lifetime benefits and accumulated lifetime taxes experienced by groups of policy interest under the Social Security programs. Subject to some complicating qualifications discussed below, groups for whom lifetime benefits exceed their lifetime taxes can be said to receive a positive increment to their lifetime wealth. Groups whose lifetime benefits fall short of their lifetime taxes under the program can be said to suffer a negative increment to their lifetime wealth. These positive or negative increments are also referred to in this paper and in the associated literature as positive or negative lifetime net transfers. Again, subject to some complicating qualifications, the program can be said to redistribute lifetime wealth from groups that experience negative lifetime wealth increments to groups that experience positive lifetime wealth increments.

[3] The term "cohort," as applied in the present analysis, refers to the group of program participants born during a specific calendar year, while the term "cohort groups" refers to the group of program participants born within a specific calendar year range. As discussed below, these terms are sometimes defined somewhat differently in other studies of lifetime redistribution under the Social Security programs.

[4] The first study in this series, Leimer (1998), includes redistributional results to date under the DI program for individual cohorts born through 1975 but had access to annual tax and benefit data only through calendar year 1995. The second study in this series, Leimer (2003), includes redistributional results to date under the OASI program for cohorts born through 1922 based on annual tax and benefit data through calendar year 1997. The present analysis incorporates annual tax and benefit data through calendar year 1999 for cohorts born through 1927.

[5] See Leimer (1995) for a more thorough critique of the hypothetical worker approach, along with a discussion of the major assumptions, key analytical methods, measures, and uses of Social Security redistributional and "money's worth" analyses. Some redistributional and money's worth analyses employ a mix of historical data and hypothetical worker methods. Survey data matched with Social Security administrative earnings and benefit records, for example, can provide the basis for such analyses. As discussed further below, however, historical administrative data of this type are incomplete, as are other critical inputs such as family and mortality histories for all cohort members disaggregated

by characteristics of interest. Inevitably, then, simplifying assumptions or hypothetical worker methods must be introduced into the analyses to simulate the missing historical information and project any required prospective data. See Leimer (1995), Chen and Goss (1997), and Leimer (1999) for references to the broader Social Security redistributional and money's worth literature representing a wide variety of data and methods.

[6] Under the Social Security program, monthly benefits payable to dependents of a retired or disabled worker or to survivors of a deceased worker are referred to as "secondary" benefits, while benefits payable to the insured worker on whose account the benefits were earned are referred to as "primary" benefits.

[7] The administrative benefit data underlying this analysis assume, however, that the race of a secondary beneficiary is the same as that of the worker on whose account the benefits are paid.

[8] Because they are not linked, there is no way to associate the benefit data with the earnings or tax data of the worker on whose account the benefits are being paid. A third approach used in some redistributional and money's worth analyses shares both taxes and benefits between couples in what might be referred to as a "couple-specific" or "family-specific" approach. Again, the lack of linkage between the benefit and tax data sources in the present analysis prevents the use of such a couple- or family-specific approach. All of these approaches (worker-account, individual-specific, and family-specific) are valid perspectives from which to view the lifetime redistributional or money's worth characteristics of the program. Each represents a different unit of account component of the implicit index of equality being used to analyze the program, of course, but each of these perspectives can be of policy interest.

[9] Because of age differences between primary and secondary beneficiaries, the worker-account approach can lead to important differences in the allocation of secondary benefits across cohorts compared to the individual-specific allocation method. The two allocation methods are likely to lead to substantially different allocations of secondary benefits across gender groups, for obvious reasons. Differences in the cohort and gender group allocations may also vary substantially across race groups because of differences between the ages of primary and secondary beneficiaries characteristic of those groups.

[10] Some of these problems arise because the race information is collected from Social Security card or benefit applicants through voluntary self-reporting. If the number of applicants choosing not to supply race information increases over time, for example, or if attitudes affecting the selection of race change, the racial composition of each administrative race category can also change over time. In fact, the proportion of records with unknown race has been increasing over time for various reasons, gradually eroding the quality of the race variable; although this problem does not appear to be serious for the present analysis, it may become

so for future analyses. See Leimer (1998) and Scott (1999) for further discussion of problems posed by the administrative race variable.

[11] The benefit tables used in this analysis from 1968 on would support a three-race categorization (corresponding to white, black, and other races). The benefit tables for most years prior to 1968, however, include only a two-race categorization corresponding to white and other races.

[12] While the inclusion of Unknowns with Whites was imposed by the administrative benefit data used in this analysis, there is some evidence that the vast majority of Unknowns would be categorized as white in survey data. An examination of the 1973 Exact Match File, which links the 1973 Current Population Survey (CPS) with Social Security administrative data, indicates that 95 percent of those with any Social Security-covered earnings and whose Social Security Summary Earnings Record race was unknown were coded as whites in the CPS portion of the file.

[13] Two CPS files that were examined indicate that the vast majority of persons of Hispanic origin in these files were coded as white. In the 1994 CPS, 91 percent of persons of Hispanic origin were coded as white; the corresponding proportion in the 1973 CPS is 97 percent. Similarly, an examination of the 1973 Exact Match File, which links the 1973 CPS with Social Security administrative data, indicates that 85 percent of persons identified as being of Hispanic origin in the CPS part of that file were coded as white in the Social Security administrative data part of that file, indicating that they had selected the white race category on the old SSA form. Because of this, it is not clear how best to group in the tax data those classified as Hispanic under the new SSA race code. Consequently, estimates were also developed under an alternative grouping that included those classified as Hispanic under the new SSA race code with Whites (rather than with Other Races) in the tax data. Fortunately, none of the main conclusions of the analysis were sensitive to this alternative grouping. The problems posed by the race allocations underlying the benefit data used in this analysis are discussed more fully in appendices to Leimer (1998, 2003).

[14] The White share of aggregate annual OASDI benefits, as estimated in this analysis, increased from 0.894 in 1991 to 0.903 in 1992. To put this in context, the White share of annual aggregate OASDI benefits exhibits a general decline over the 1937–1999 analysis period from a high of .966 in 1937 to a low of .886 in 1999, but also exhibits multiple inflection points over that interval. Consequently, it is difficult to assess the importance of the 1992 race reclassification relative to other factors, but it appears to have been responsible for at least some of the increase in the White share between 1991 and 1992, suggesting that the Other Races share of benefits is also likely overstated to some extent for at least some of the years prior to 1992.

[15] Of course, any general assumption other than full backward shifting would greatly complicate the identification of the specific individuals bearing the tax,

but the assumption that the employer share of the tax is shifted directly or indirectly to workers is supported by a number of analyses. See Dye (1984) for a summary of a number of empirical analyses of payroll tax incidence.

[16] See Smith (1989) for a description of the CWHS.

[17] The 1 percent file includes annual OASDI (or, prior to 1957, OASI) taxable earnings data only back to 1951. The 0.1 percent file includes annual OASI taxable earnings data back to 1937.

[18] For example, only the employer's portion of the tax was included for taxable wages above the annual maximum taxable earnings, a situation that can arise with multiple employers. In such cases, the employee portion of the tax on taxable wages above the annual maximum taxable earnings is refundable via the employee's Federal income tax return.

[19] The aggregate OASI and DI payroll tax liabilities for each year were derived by applying historical OASI and DI payroll tax rates to taxable wage and salary earnings and self-employment earnings (Tables 2.A3 and 4.B2 in the 2001 *Annual Statistical Supplement*). Sample payroll taxes were adjusted to aggregate controls for consistency with the benefit estimates described below and because of evidence that individual wage records tend to underestimate actual taxable earnings each year based on employer reports. The specific adjustment adopted effectively assumes that the proportional underestimate in a given year is the same for each race, gender, and age group.

[20] These estimates of tax liability do not adjust for some income tax offsets associated with the program. For example, the assumption that payroll taxes are backward shifted (in the form of lower wages) implies that workers' true earnings are higher than actually observed, and this unobserved portion of true earnings avoids the personal income taxation applied to observed earnings.

[21] Although the format and specific detail in these tables have varied over time, all of the summary tables except for the years 1940–1942 report monthly benefits in current payment status as of year-end. The summary tables for 1940, the first year that monthly benefits were paid, report benefits awarded during the year. The tables for 1941 and 1942 report benefits in force at year-end, where benefits in force represent benefits awarded after adjustment for subsequent changes due to terminations and other factors. Additional detail is provided in various issues of the *Social Security Yearbook* and the *Annual Statistical Supplement*. As examples of the tables used, see Tables 25–29 in the 1940 *Social Security Yearbook* and Table 5.A1 in the 2001 *Annual Statistical Supplement*.

[22] As indicated above, this problem does not arise for annual taxable earnings records, which are complete from 1951 to date in the 1 percent CWHS file (with a reporting lag) and from 1937 through 1977 in the last available 0.1 percent CWHS file. The benefit information in individual sample data files derived from

administrative records covers only about one-half of the historical period during which the Social Security program has been in existence.

[23] In addition to lump-sum death payments based on cumulative wage credits for decedents of any age, the 1935 Act also provided for lump-sum refunds based on cumulative wage credits for persons who had not attained insured status at age 65. The lump-sum refund provision was eliminated, beginning in 1940, under the 1939 Act.

[24] As a proportion of total annual OASI benefits, this combined category has grown from 54 percent in 1940 to 95 percent in 1999.

[25] The *Annual Statistical Supplement* provides additional information on all of these beneficiary categories. As examples, dependent parents benefits are paid to eligible parents of deceased workers; widowed fathers and mothers benefits are paid to surviving spouses or surviving divorced spouses caring for an eligible child; special age-72 benefits are paid to members of some of the earliest birth cohorts if those members attained age 72 without qualifying for retired-worker benefits. Special age-72 benefits differ from the other beneficiary categories in that the OASI trust fund receives transfers from the general fund of the Treasury to offset special age-72 benefit payments and associated administrative expenses. As such, special age-72 benefits might be excluded from the analysis on the grounds that these benefits are not financed by the OASI payroll tax. The rationale for inclusion is that these are OASI benefits targeted to many of the early cohorts included in this analysis and represent a very small proportion of total OASI benefits and taxes over the analysis period. In particular, had special age-72 benefits been financed through an increase in the payroll tax, the required OASI pay-as-you-go tax rate increase would have never reached as much as 0.1 percent of taxable payroll in any year; over the entire 1966–1999 historical period during which special age-72 benefits have been paid, all of these benefit payments could have been financed by an increase of less than 0.02 percentage points in the combined employer-employee payroll tax rate over that period. Consequently, the inclusion of special age-72 benefits in the analysis does not seriously violate the "financial balance" principle (that is, the principle of comparing benefits and taxes in the context of an essentially self-financed system).

[26] A summary table of benefits by beneficiary type, race, and age for 1981 was not published in the *Annual Statistical Supplement*, so the distribution of benefits by race, gender, and age within each beneficiary category in that year was derived by interpolating between the corresponding summary benefit table estimates for 1980 and 1982. Total annual benefits paid from the OASI and DI trust funds by beneficiary category were taken from Tables 91 and 92 in the 1963 *Annual Statistical Supplement* for the years 1937–1963 and from Tables 4.A5 and 4.A6 in the 2001 *Annual Statistical Supplement* for later years.

[27] The combined grouping of retired workers, spouses of retired workers, widows and widowers, and dependent parents into one large beneficiary category was

necessitated by the different treatment in some years of dual beneficiaries between the summary benefit tables and the annual aggregate benefit tables. (Dual beneficiaries are entitled to a primary benefit on their own account and to a larger secondary benefit on another account.) In the summary benefit tables for some years, the total benefit received by dual beneficiaries is usually reported as a retired-worker benefit, even though part of the benefit is attributable to the secondary eligibility. In the annual aggregate benefit tables for those years, however, the total benefit received by dual beneficiaries in the spouses of retired workers, widows and widowers, and dependent parents categories is split into parts, with the primary benefit included in the retired-worker category and the remainder of the total benefit included in the appropriate secondary benefit category (or categories). Recall that the summary benefit tables are used to identify the proportional distribution of benefits by race, gender, and age within each beneficiary category, while the annual aggregate benefit tables are used to identify aggregate OASI benefit payments for each beneficiary category.

[28] The eight OASDI beneficiary categories encompass a variety of beneficiary type conversions that can occur within and across the OASI and DI trust funds. For example, a disabled-worker benefit paid out of the DI trust fund is converted to a retired-worker benefit paid out of the OASI trust fund when the disabled worker attains age 65; analogous conversions are effected for any associated secondary benefits. An essential feature (and advantage) of the approach adopted in this series of analyses, then, is that all of the benefits paid out of the OASI and DI trust funds, respectively, can be compared for each cohort, race, and gender group to the corresponding OASI and DI taxes levied to fund those benefits. Similarly, the present analysis contrasts all benefits paid out of the combined OASI and DI trust funds for each cohort, race, and gender group to the combined OASI and DI taxes required to fund those benefits.

[29] Prior to 1994, all of the proceeds from the income taxation of OASI and DI benefits were transferred back to the respective OASI or DI trust fund. Beginning in 1994, provisions exposing a greater proportion of OASI and DI benefits to income taxation went into effect, with the associated additional revenues transferred back to the Hospital Insurance (HI) trust fund. Consequently, the additional income tax revenues that are transferred to the HI trust fund do not contribute to the long-run financial balance of the OASI and DI trust funds.

[30] An alternative rationale for including the income tax liabilities deriving from OASI and DI benefits would be to provide redistributional estimates net of income taxation in general, as in Leimer (1998, 2003). This alternative rationale requires that all OASI and DI benefit income taxation liabilities, as appropriate, including the portion transferred to the HI trust fund and not available for funding OASI or DI benefits, be subtracted from OASI and DI benefits or added to the payroll taxes of the respective programs.

[31] In terms of identifying net transfers or calculating the internal rate of return for each cohort, race, and gender group, it does not matter whether benefit income tax

liabilities are added to payroll taxes or subtracted from gross benefits. For the accumulated benefit/tax ratio measure, however, the two alternatives lead to different interpretations of the measure. If benefit income tax liabilities are subtracted from gross benefits in the numerator of the ratio and compared to payroll taxes in the denominator, the benefit/tax ratio measure could be interpreted as reflecting the relative distribution of the net benefits funded solely by payroll taxes under the program. In contrast, if gross benefits in the numerator are compared to the sum of payroll taxes plus benefit income tax liabilities in the denominator, as in the present analysis, the benefit/tax ratio measure implicitly reflects the relative distribution of the gross program benefits that are funded by all tax sources associated with the program.

[32] For example, U.S. Department of the Treasury (2001) reports estimates for calendar years 1994–1996 based on an analysis of tax returns in those years. Final, unpublished, Treasury estimates were used for calendar year 1997. Unpublished Treasury estimates, described as "based on preliminary tax data" were used for 1998, while the unpublished Treasury estimates for 1999 are described as "based on actual OTA transfers" (which reflect preliminary estimates of the associated tax liabilities). The estimated average effective income taxation rate on OASI benefits (excluding the portion transferred to the HI trust fund) generally rose from about 1.5 percent in 1984 to about 2.9 percent in 1999. For DI benefits, the estimated average effective income taxation rate (again excluding the portion transferred to the HI trust fund) increased from about 0.5 percent in 1984 to about 1.2 percent in 1999.

[33] Assuming the same effective benefit income taxation rate across all groups may bias the accumulated net transfers, accumulated benefit/tax ratios, and internal rates of return estimated in this analysis upward for Whites relative to Other Races and for males relative to females. This effect is probably not large for most of the cohorts considered in this analysis, for whom the income taxation of benefits has a relatively small effect (especially since the portion of benefit income taxes transferred to the HI trust fund is excluded). To test the potential importance of the bias for these cohorts, simulations were also run under the assumption that all revenues from the income taxation of OASI and DI benefits were paid by White beneficiaries (with the annual effective proportional tax rates on their OASI and DI benefits adjusted to levels that would generate the same aggregate OASI and DI benefit income tax liabilities actually observed in each year across all beneficiaries, again, excluding the portion transferred to the HI trust fund). In these simulations, no benefit income taxes were paid by beneficiaries of Other Races. Even this extreme assumption caused no change in any of the redistributional measures' relative rankings of White vs. Other Races overall outcomes within any of the cohort groups considered and had relatively little effect on the White vs. Other Races race rankings within single year birth cohorts. The only qualitative differences by race for these early cohort groups occurred in the accumulated benefit/tax ratios to date estimated for White vs. Other Races females in some of the later cohort groups under some of the interest rate assumptions considered. Across all program participants, excluding benefit

income taxation from the analysis entirely raises the estimated OASDI accumulated benefit/tax ratios to date, as expected, but all of the increases are relatively small. The largest absolute increase in these ratios under any of the interest rate series considered is from 5.680 to 5.942 under a zero real interest rate assumption for the 1904–1910 cohort group, a relatively modest overall effect. Similarly, the simulated effect on estimated real internal rates of return of excluding benefit income taxation ranges from essentially no effect for the pre-1885 cohort group to an increase from 2.727 percent to 2.826 percent for the 1923–1927 cohort group. Despite the relatively small effect of benefit income taxation on these early cohorts, the relatively crude approach adopted in this analysis for incorporating the income taxation of benefits should be improved upon in future analyses to the extent that the data allow, since the income taxation of benefits represents a growing source of trust fund revenue that will have increasingly important distributional consequences for later cohorts. Unfortunately, identifying the incidence of benefit income taxation requires information that is frequently of poor quality or not available in micro data sources, so that incorporating benefit income taxation into redistributional analyses represents a considerable complication.

[34] The inflation rate series and the large company stock index series correspond respectively to the Consumer Price Index for all urban consumers (not seasonally adjusted) and the S&P 500 Composite index with dividends reinvested; these series can be found in Ibbotson (2001). The estimated effective annual interest rates earned by the OASI, DI, and combined OASDI trust funds are taken from Kunkel (1997) for the years 1940–1996; unpublished estimates for 1997–1999 were also provided by Jeffrey L. Kunkel of the Office of the Chief Actuary of the Social Security Administration. The OASI trust fund rate for the years 1937–1939 was assumed to be the same as the rate for 1940.

[35] Both the OASI and DI updated tables presented in appendices to this paper differ from the corresponding data presented in Leimer (1998, 2003) in a number of other respects. First, as indicated above, both previous papers in this series defined the accumulated net transfer, accumulated benefit/tax ratio, and internal rate of return redistributional measures as net of income taxation in general, so that all liabilities deriving from benefit income taxation were deducted from net program transfers, including the portion of benefit income taxes transferred to the HI trust fund. Following the approach adopted for the OASDI program in this paper, the OASI and DI appendices to this paper include only that portion of benefit income tax liabilities that are ultimately returned to the OASI and DI trust funds, respectively, and exclude the portion transferred to the HI trust fund. Second, the definition of the accumulated benefit/tax ratio to date in both previous papers in this series contrasted gross benefits less benefit income taxes in the numerator of the ratio to program payroll taxes in the denominator. Again, following the approach adopted for the OASDI program, the definition of the accumulated benefit/tax ratio to date in the OASI and DI appendices to this paper contrast gross program benefits in the numerator to the sum of program payroll taxes and benefit income taxes specific to that program in the denominator.

Finally, in cases where the number of beneficiaries and average benefits had to be allocated to individual ages within an age group in processing the information included in the summary benefit tables, the smoothing algorithms used within and across age groups in all of the tables in the present analysis are identical to those used in Leimer (2003) and described in Appendix A to that paper. The smoothing algorithms used for the DI summary benefit tables in Leimer (1998) applied a somewhat different approach, as discussed in the appendix to that paper. Other details of the historical DI and OASI benefit estimation procedure in this paper are the same as those described in the appendices to Leimer (1998, 2003).

[36] See Leimer (1994, especially 18–19, 27–28; 1995, 7–8) for a discussion of the interest rate choice in redistributional analyses.

[37] This description assumes that the size of the net transfers has no market effect on the interest rate earned on trust fund assets, an assumption that is potentially unrealistic for large net transfers. Also, the use of the effective rate of return to the entire portfolio of trust fund assets might be deemed to be inappropriate for analyzing the effects of small changes in taxes or benefits, because it neglects details of trust fund financing practice related to investment in new issues and disinvestment of existing assets. These details lose relevance, however, in the context of analyzing the effects of large net transfers over time across different age, race, and gender groups.

[38] Over nearly all of the historical period, the rates of return on the special Treasury obligations held by the trust funds were based on the rates for marketable Treasury obligations sold to private investors. The mean and sample variance of the real annual rate of return to OASDI trust fund assets over the 1940–1999 period, for example, both lie between the corresponding statistics for the Ibbotson (2001) intermediate-term government bond series and U.S. Treasury bill series. See Kunkel (1997, 1999) for further information on the determination and history of the rates earned on trust fund assets.

[39] Various characteristics of the Social Security program, such as the automatic inflation adjustment of benefits, can reduce overall portfolio risk for program participants. See Leimer and Richardson (1992) for a discussion of the associated theoretical issues as well as empirical estimates; their estimates suggest that consumers may use a zero or even negative real discount rate when discounting expected Social Security taxes and benefits.

[40] Some analysts argue, for example, that the political risks associated with the future level of taxes and benefits justify the use of a higher market rate of return in Social Security money's worth analyses. Again, these issues are discussed in greater detail in Leimer (1994, 1995).

[41] A deficiency of most money's worth analyses is that they ignore the administrative costs of the alternative to which the Social Security program implicitly is being compared, biasing the comparison against Social Security. To the extent that they can be identified, of course, the administrative costs of

specific alternatives to the Social Security program could be incorporated into money's worth analyses.

[42] Administrative costs, operating expenses, and loading charges in private markets in part reflect marketing costs, adverse selection, and the inability to exploit the economies of scale enjoyed by a compulsory, nearly universal, public program. See Leimer (1991) for additional discussion.

[43] Because administrative expenses represent a necessary cost associated with the provision of the retirement saving, annuity, survivors, and disability insurance features of the program, net redistribution from a program perspective might be defined as the accumulated value of a group's benefits plus the accumulated value of their allocated share of administrative expenses less the accumulated value of their taxes.

[44] There are, of course, a variety of other reasons why money's worth measures may not accurately reflect the value of the program to participants, including the failure of money's worth measures to adjust for market imperfections, general equilibrium effects, and individual preferences regarding risk and other program characteristics. See Leimer (1995) for a more complete discussion.

[45] To illustrate typical patterns of net transfers by age under the OASDI program, the charts in this paper include net transfers for cohorts born after 1927, even though these younger cohorts are not included in the redistributional estimates presented later in the analysis.

[46] This figure does not itself appear in Table 1, but is the sum of the "All Races" "Total" accumulated net transfers through 1999 for the "Pre-1885" through the "1923–1927" cohort groups in that table.

[47] Over the 1937–1999 analysis period, the geometric means of the zero real interest rate series (with a nominal rate equal to the rate of inflation), the OASDI trust fund interest rate series, and the large company stocks total rate of return series were 4.0 percent, 5.3 percent, and 12.9 percent, respectively. The geometric mean of each rate of return series is defined here as

$$g = \left[\prod_{t=1938}^{1999} (1 + r_t) \right]^{\left(\frac{1}{1999 - 1937}\right)} - 1,$$

where r_t represents the corresponding nominal interest rate in year t.

[48] An upper age limit of 120 was chosen to provide reasonable assurance that the age limit would accommodate all surviving cohort members in the benefit and tax projections. The life tables and mortality rate projections used in the annual Trustees Report extend through age 119, implicitly assuming an upper age limit of 120, while the published 1990 decennial Census mortality rates extend through the "110+" age group.

[49] Studies of socioeconomic mortality differentials have found a strong negative association between mortality and income. As examples, see Duleep (1986) and Menchik (1993).

[50] The only race, gender, and cohort groups with negative lifetime net transfers under the "mortality extension" simulation using the OASDI trust fund interest rate are the White male and all male groups in the 1923–1927 cohort group. All race, gender, and cohort groups are estimated to receive positive lifetime OASDI net transfers under the "mortality extension" simulation using the zero real interest rate assumption. Using the generally higher total rate of return to large company stocks interest rate series under the "mortality extension" simulation, the Other Races females and all Other Races groups each have one less cohort group experiencing negative lifetime net transfers compared to the "to date" estimates in Appendix Table A–2.

[51] The internal rate of return is defined in this application as the constant interest rate that equates accumulated benefits and accumulated taxes. In this application, then, the internal rate of return produces an accumulated aggregate real OASDI net transfer of zero for the cohort group in question. Multiple internal rates of return are possible given the nature of the lifetime net transfer flows experienced under the OASDI program. The internal rate of return algorithm adopted in this analysis searches first for the positive root closest to zero and then searches the negative domain if no positive root is found. A positive root was found, however, that equated accumulated OASDI benefits with accumulated OASDI taxes for all of the cohorts considered in this analysis. In the case of multiple roots, of course, one root is not more correct than any other root, regardless of the search algorithm adopted.

[52] Separate tables are not included in this paper to display results at the individual (single year) birth cohort level, because (1) the number of individual cohorts represented in this analysis is relatively large and (2) specific estimates for any individual cohort, taken by itself, are less reliable (because of sample size) than estimates for grouped cohorts and less reliable than the pattern of results across a broader range of cohorts (both of which are reported in this paper).

[53] Although the internal rate of return is widely used as a Social Security money's worth measure, the lifetime accumulated net transfer and benefit/tax ratio measures have a sounder theoretical basis, particularly in the context of historical data where interest rates have varied widely over time. In a money's worth context, for example, the essential question underlying these measures is the extent to which the program has affected the lifetime resources of program participants, either in an absolute or relative sense. In weighting the net transfers that have occurred at different points in time for various groups, the weights implicit in the accumulated net transfer or benefit/tax ratio measures reflect the rates at which participants were assumed to be able to transform resources over time. In contrast, the internal rate of return implicitly weights net transfers as if these funds could have been transformed over time at a constant nominal or real

rate, depending on the calculation method. For this and other reasons, the internal rate of return is not a reliable indicator of the extent to which (or even the direction in which) the program has affected the lifetime resources of program participants. The accumulated net transfer and benefit/tax ratio measures, however, suffer from a lack of consensus over the appropriate interest rate series to use for particular questions and the likelihood that, for some questions, the appropriate interest rates vary across groups of policy interest. See Leimer (1994, 1995) for additional discussion.

[54] Some readers may be surprised that the lifetime accumulated benefit/tax values under the "mortality extension" simulation in Table 3 fall slightly below the corresponding "to date" (through 1999) accumulated benefit/tax values for some of the earliest cohort groups. Given the "mortality extension" simulation assumptions, such results will occur when the current aggregate benefit/tax ratio (even if greater than one) for a particular cohort group in the last historical data year falls below the corresponding "to date" accumulated benefit/tax ratio for that cohort group in that year. In fact, this situation obtained using the OASDI trust fund interest rate for all but one of the individual (single year) cohorts, taken as a whole, that were born in 1900 and earlier years. Such occurrences for the earliest cohort groups are not surprising, then, given the relatively large accumulated benefit/tax ratios experienced to date by those cohorts and the relatively few members of those cohorts remaining in the last historical data year.

[55] This occurs for the all Whites and all persons groups in the 1923–1927 cohort group under the trust fund interest rate series assumption and for the Other Races male group in the 1911–1916 cohort group under the large company stocks interest rate assumption.

[56] This monotonic decline in the relative and absolute advantage of females is also evident in the "mortality extension" simulation results, where the ratio of the female to male accumulated benefit/tax ratio using the OASDI trust fund interest rate declined from about 5.3 for the pre-1885 cohort group to about 2.6 for the 1923–1927 cohort group; the absolute difference between the female and male accumulated benefit/tax ratios declined from about 46.0 to about 1.5 over the same cohort group range.

[57] All of the accumulated values referred to in this paragraph were calculated using the OASDI trust fund interest rate series, consistent with the accumulated benefit/tax ratios presented in Table 3.

[58] These accumulated benefit and tax shares were also calculated using the OASDI trust fund interest rate series, consistent with the accumulated benefit/tax ratios presented in Table 3.

[59] With relatively minor differences in some of the numerical values, this paragraph also generally describes results under the "mortality extension" simulation using the OASDI trust fund interest rate. The increase across cohort groups in the Other Races accumulated benefit/tax ratio relative to that for Whites

is not as pronounced, however; under the "mortality extension" simulation, the Other Races accumulated benefit/tax ratio increases from about 7 percent below that for Whites in the pre-1885 cohort group to about 11 percent above that for Whites in the 1923–1927 cohort group. Also, accumulated benefit/tax ratios for Other Races males exceed those for White males in all of the cohort groups by proportions ranging from about 10 percent to 15 percent in the "mortality extension" simulation, and the only cohort group for which the accumulated benefit/tax ratios to date for Other Races females exceed those for White females is the 1895–1903 cohort group.

[60] Under the "mortality extension" simulation using the OASDI trust fund interest rate, the Other Races accumulated benefit/tax ratio also exceeded that for Whites in 33 of the individual cohorts in the 1885–1927 range. There was also only 1 individual cohort in that range for which the accumulated benefit/tax ratio for White males exceeded that for Other Races males, but 30 individual cohorts for which the ratio for White females exceeded that for Other Races females (or about 70 percent of those cohorts).

[61] As indicated above, the geometric means of the nominal "zero real interest rate" and OASDI trust fund interest rate series over the 1937–1999 analysis period are relatively close at 4.0 percent and 5.3 percent, respectively, although the year-to-year patterns of these two interest rate series are quite different. In contrast, the geometric mean of the nominal total rate of return to large company stocks interest rate series is much higher (12.9 percent) over the analysis period than the geometric means of the other two interest rate series.

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