EFFECTIVE ANNUAL INTEREST RATES EARNED BY THE OASI AND DI TRUST FUNDS

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INTRODUCTION

This Note presents new estimates of the effective annual interest rates earned by the assets of the Old-Age and Survivors Insurance (OASI) and Disability Insurance (DI) Trust Funds for the years 1940-83. The estimates are based on an improved formula for calculating the effective rate of interest earned by a portfolio of assets.

An accurate measure of the annual interest rates earned by the OASI and DI Trust Funds is important for several reasons. First, the investment performance of the trust funds receives considerable attention even though interest earnings represent only a small portion of total income. (In 1983, income from investment interest was approximately 1.3 percent of actual income.)[1] Effective annual interest rates serve as a convenient measure of the overall return on invested assets. Second, the effective annual rates are useful in estimating certain interest adjustments on various financial transfers among the Social Security trust funds (including the Hospital Insurance (HI) and Supplementary Medical Insurance (SMI) Trust Funds) or between a trust fund and the general fund of the Treasury. Similarly, the Railroad Retirement Board uses the rates in the determination of the amount of the annual financial interchange between the trust funds and the Railroad Retirement Account. Third, the effective annual OASDI rates are needed to evaluate various modifications to trust fund investment procedures that are proposed from time to time. Finally, it is informative to compare the annual effective interest rates earned by the OASI and DI Trust Funds with the rates earned by other organizations holding large reserves, such as life insurance companies.

The methodology used in calculating the effective yields presented in this Note is more refined than previous methods used by the Office of the Actuary. The model utilizes detailed monthly trust fund cash-flow data collected from Treasury statements. The approximate or, whenever possible, the actual dates that monies flow in and out of the trust funds are used in the calculation of the rates. The model itself will be discussed in more detail later in the Note.

TRUST FUND INVESTMENTS AND PROCEDURES

By law, the investment of the assets of the OASI and DI Trust Funds is the responsibility of the Secretary of the Treasury as the Managing Trustee of the Social Security trust funds. Any income to the trust funds, from payroll taxes or other sources, that is not immediately needed to meet benefit obligations and administrative expenses, is invested in interest-bearing obligations of the Federal Government. These obligations have generally been of two types: special-issue securities and regular government obligations.

The bulk of the combined OASI and DI portfolio has been invested in securities available only to the trust funds. These securities, called "special issues," are a type of bond bearing semiannual coupons and having maturity dates of June 30 from 1 to 15 years in the future. Special issues are redeemable by the Treasury any time prior to maturity at par value (their purchase price) plus accrued interest. Thus return of principal is guaranteed, since fluctuating market interest rates do not affect the redemption amount, either up or down. This feature is of particular significance, since the trust funds must be able to routinely (sometimes daily) "disinvest" special issues before maturity to meet benefit and expense obligations. Each special issue pays interest in the form of semiannual coupons at an interest rate determined by a specific formula. This formula has undergone several modifications through the years, but currently it defines the rate for new issues as the average market yield on all marketable government obligations that are not due or callable for at least 4 years from the date of determination. The rate is calculated at the beginning of each month based on the market yields at the end of the previous month. That rate then applies to all new special issues purchased by the trust funds during the current month.

The trust funds are also permitted to invest in regular government obligations bought, at time of issue or after issue, on the open market. These marketable securities have generally been long-term Treasury bonds, although certain quasi-government securities issued by federally sponsored organizations (such as the Federal National Mortgage Association and the Government National Mortgage Association) can also be purchased by the trust funds. Marketable securities held by the trust funds can be sold on the open market at any time for the current market price. (However, such securities have normally been purchased with the intention of being held to maturity and not being actively traded.) Thus, unlike the redemption of special issues, it is possible for the trust funds to realize a capital gain or loss upon the sale of marketable securities prior to maturity.

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[1] Calculated as the net interest on OASDI investments (excluding profit or loss on the sale of marketable securities) of $2.3 billion, divided by total OASDI income of $171.3 billion.

The *daily excess* of trust fund receipts over disbursements is invested immediately in short-term special issues, called certificates of indebtedness, with a maturity date of the following June 30. Each June 30, any such certificates that have not been redeemed prior to maturity are rolled over into the longer-term special-issue bonds, also with maturity dates of June 30 but in future years. The marketable securities generally do not have June 30 maturity dates; consequently, they are rolled over as they mature into certificates of indebtedness or other marketable securities, depending on the expected cash-flow needs of the trust funds. Marketable securities have not been purchased since 1980 and are not expected to be purchased in the foreseeable future. The maturity dates on the new special issues vary from 1 to 15 years with the durations generally being distributed so that approximately 1/15 of all special issues held by each trust fund will mature each year. Note that this investment goal is not attainable when disbursements exceed income for prolonged periods, since the trust funds are then forced to disinvest some of the special-issue bonds prior to maturity without being able to replace them on June 30.

Most of the interest income from investments is received semiannually on June 30 and December 31. This is because the special issues, which have historically comprised the majority of the combined OASI and DI portfolio, pay their interest-bearing coupons on these dates. Interest is also received at other times, primarily around the third of each month, when the trust funds must disinvest special issues in order to pay regular monthly benefits. At these times, the interest received is that amount accrued from the later of (1) the purchase date, and (2) the last coupon date, to the redemption date. Interest from marketable securities is also generally received on dates other than June 30 and December 31. However, these amounts have been relatively small, since the marketables have historically represented a small portion of the portfolio.

A specific procedure is generally followed by the Managing Trustee for the disinvestment of securities prior to maturity. Certificates of indebtedness due to mature on the following June 30 are redeemed first. Issues with the lowest interest rates are redeemed before those with higher rates. If additional funds are needed, the longer-term special-issue bonds are redeemed. Those bonds with the shortest duration to maturity are redeemed first and bonds with the same duration to maturity are redeemed in order of ascending yield. Finally, if still more funds are required after the special issues have been exhausted, as was the case for the OASI Trust Fund in November and December of 1982, any marketable securities would be sold. Because the marketables are sold on the open market at their current market value, a capital gain or loss for the trust funds would usually result. This depends, generally, on (1) whether the coupon interest rate paid by the security is greater or less than the current average market yield and (2) the purchase price paid by the trust fund for the security (marketables are frequently purchased at discounts). In the fall of 1982, the OASI Trust Fund incurred a net capital loss of over $300 million on the sale of its marketables.[1]

INTEREST ON INVESTMENTS

The effective annual rates were calculated by relating interest on investments to invested assets, where interest on investments is composed of: (1) the coupons paid by the special issues and the marketable securities, (2) the accrued interest received at times other than coupon dates when securities are redeemed to meet disbursements, and (3) the amortization of the premiums or discounts of any marketable securities purchased on the open market after their initial issuance. Premium or discount arises when marketable securities are traded on the open market, subsequent to initial issue, at prices substantially above or below par. Amounts above par are known as premiums and result in offsets to investment income during the life of the security, while amounts below par are known as discounts and result in additional investment income. Recognition should be given to these gains and losses, since purchases made at premium or discount are planned in such a way that the total *yield* on the security (assuming it is held to maturity) will closely approximate prevailing interest rates on new securities. In effect, the amortization amounts are equivalent to interest earnings and should be considered part of the planned investment strategy of the Treasury Department with respect to the trust funds. Here the term amortization refers to the spreading of the gains or losses uniformly over the duration of the security assuming that it will be held full term to maturity. Historically, these amortized amounts have had a very small effect on the yearly investment earnings of the trust funds.

Certain amounts of interest received by the trust funds are not considered as earnings on invested assets. Among the excluded interest items are the interest-adjustment amounts that comprise part of the various transfers between the general fund of the Treasury and the trust funds or among the trust funds. Such transfers include those made from the general fund to the trust funds for deemed military-service wage credits, transitionally uninsured (Prouty) benefits (to the OASI Trust Fund only) and, more recently, unnegotiated benefit checks. Other transfers include reallocation of administrative expenses among trust funds, occasional retroactive reallocations of payroll taxes between the OASI and DI Trust Funds (usually resulting from changes in the law), and the financial interchange between the Railroad Retirement system and OASDI program. In all these cases, the interest adjustments that are included as part of the transfers are not considered interest on invested assets; rather, they are adjustments to restore the trust funds to the theoretical financial position in which they otherwise would have been.

In developing the formula for computing effective interest rates, it was decided to treat amounts lent to one trust fund by another (among the OASI, DI, and HI Trust Funds), under the temporary interfund-borrowing provisions of 1981[2], as assets from the view-

[1]*Statement of Account of Federal Old-Age and Survivors, Disability, and Hospital Insurance Trust Funds as of November 30, 1982*, dated February 1, 1983, Treasury Department, Bureau of Government Financial Operations, Division of Financial Management, Trust & Revolving Funds Branch.
[2]Public Law 97-123, enacted December 29, 1981.

point of the borrowing trust fund but not to include such loans as assets from the viewpoint of the lending trust fund. Although other alternatives have merit, this approach closely matches the underlying reasons for interfund borrowing and is believed to best reflect the rates of interest earned by the trust funds on normal invested assets. (If the OASI, DI, and HI Trust Funds are viewed collectively, interfund borrowing has practically no net effect on investment income.) To be consistent with this approach of treating borrowed amounts as assets and not liabilities, the monthly interest paid by the borrowing trust fund to service the outstanding loan balance is considered as ordinary outgo and is not subtracted from the investment interest earned during the month. Similarly, because an interfund loan is not considered as an invested asset of the lending trust fund, interest received on loan amounts is not included in investment interest. These assumptions are discussed in greater detail in the Technical Appendix at the end of the Note.

Another component of interest income that is excluded from the interest on investments is the interest received on advance tax transfers. Prior to May 1983, monthly Federal Insurance Contributions Act (FICA) and Self-Employment Contributions Act (SECA) taxes were credited to the trust funds as they were collected. The use of this procedure meant that these taxes were credited to the trust funds essentially uniformly throughout each month. However, beginning in May 1983, all such taxes are credited at the *beginning* of each month on an estimated basis. The additional interest earned by the trust funds as a result of these advance tax receipts is reimbursed to the general fund of the Treasury at the end of June and December (the same time that the trust funds are credited with the interest on special-issue holdings). It was decided to subtract this reimbursed interest from the total investment interest received during the 6-month period. The result is the net semiannual investment income received by the trust funds. Again, other approaches are possible; this one was selected because it is the one most consistent with the assumptions used in the interest rate formula regarding the timing of the receipt of the FICA and SECA taxes. (See the Technical Appendix.)

Finally, to be consistent with the objective of measuring the effective interest *rate* earned by the trust funds, it was decided that investment interest should not reflect realized capital gains and losses on the unplanned sale of marketables prior to maturity. In particular, the capital losses experienced by the OASI Trust Fund in 1982 are not reflected in the interest rate for 1982 because they resulted from forced sales that were not part of the planned investment strategy of the Treasury and, therefore, are considered as extraordinary items. Such losses would usually be considered as negative investment income in an evaluation of overall investment performance, rather than just interest earnings, but such a measurement is not the goal of this Note.

INVESTED ASSETS

The assets of the trust funds change daily, as income is received and expenditures are made. However, a record of the daily transactions of the trust funds is not readily available; a monthly summary of trust fund activity is the most detailed record publicly available.[1] Daily levels of invested assets were approximated from the monthly figures by making assumptions about the average timing of the various cash-flow transactions within the month. (See the Technical Appendix.) Even if actual daily figures were available, their use would have affected the calculated rates only slightly because approximate daily figures were already calculated.

Invested assets include the special issues and marketable securities discussed previously, plus a small residual cash balance. The cash balance varies from day to day, and is even occasionally negative when transactions are not recorded promptly. Because the cash balance is relatively small and the funds are theoretically available for investment, the cash balance is included in this Note as part of invested assets.

As discussed in the previous section, amounts borrowed under the interfund-borrowing provisions are counted as assets of the borrowing trust fund only and are not considered to be assets of the lending trust fund.

GENERAL DESCRIPTION OF THE METHODOLOGY

The calculation of the effective annual interest rates for the trust funds is basically a two-step process. First, a dollar-weighted rate of return was calculated for each of the 6-month periods, January through June and July through December, for the OASI and DI Trust Funds, separately. This computation parallels the semiannual crediting of interest on special-issue holdings in June and December. The formula used to derive each semiannual rate is (1) the interest on investments, divided by (2) the average level of the assets (or exposure). As was discussed in a preceding section, the numerator is the sum of net interest on invested assets received during the 6 months plus any amortization of premiums or discounts for the same period. A detailed discussion of the assumptions and methods used in computing the exposure that forms the denominator in the interest rate formula is presented in the Technical Appendix at the end of the Note. In general terms, the exposure was calculated by utilizing detailed monthly cash-flow data over the 6-month period and by approximating the actual dates of each trust fund transaction. All transactions were treated on a strict cash-flow basis, with the trust funds being credited with income on the date it was received and charged with outgo on the date it was disbursed. A semiannual rate was then calculated as the quotient of the interest earnings over the exposure. For reasons discussed below, however, these semiannual rates were not directly used in the derivation of the final *annual* rates.

In the second step, annual rates of return were calculated on both a calendar-year and an "old-fiscal-year" basis (July to June). The latter set of rates corresponds to the investment year of the trust funds, and the interest actually credited in this period (on a cash basis) is almost identical to the accrued interest. The annual rates (i) were computed using the following formula:

$$i = \left\{ \left[1 + \frac{I_1 + I_2}{E_1 + E_2} \right]^2 - 1 \right\} \times 100$$

[1] This is the monthly Treasury publication cited in footnote 1 on page 2.

where

I_j = the net interest received on investments during the jth 6-month period of the year; and

E_j = the net exposure of the trust fund assets for the jth 6-month period of the year.

The term "year" refers to either a calendar or an old fiscal year.

It is important to note that the annual rates were not derived from the separate semiannual rates. Rather, the interest earnings for the two half-years were combined as were the two exposures to form an "aggregate" semiannual rate based on data for the entire year. The annual rate was then calculated by compounding the "aggregate" semiannual rate. This approach avoids a potential distortion that would result from compounding individual half-year rates having large differences in their exposures. For example, suppose assets were rapidly declining. Compounding of the separate 6-month rates would give equal weight to the interest rates earned during each 6-month period, despite the fact that most of the interest earned during the year was received during the first half of the year. By combining the interest and exposure amounts as shown in the formula, appropriate weights are automatically given to the various blocks of assets earning different interest rates. While numerous other formulas could have been used, the above formula was judged to yield the best measure of the effective annual interest rate for the purpose at hand.

Annual rates for OASI and DI combined were calculated by applying the same formula to the pooled data from both trust funds.

EFFECTIVE ANNUAL INTEREST RATES

Table 1 presents the effective annual rates of interest for the OASI, DI, and combined OASDI Trust Funds by single years on both a calendar-year and an old-fiscal-year basis. Figure 1 shows the combined OASDI rates graphically. For the years 1940-60, the curves remain relatively flat except for the sharp variations in 1948, 1949, and 1951 in the graph of the calendar-year rates. These spikes result from the fact that in calendar years 1948 through 1951, interest accrued does not match interest credited (apparently due to late payment of interest amounts by the Department of the Treasury). This results in an overstatement of the effective interest rates in calendar years 1948 and 1951 and an understatement in the calendar-year rate for 1949.

Table 1.—Effective annual interest rates by trust fund, 1940-83
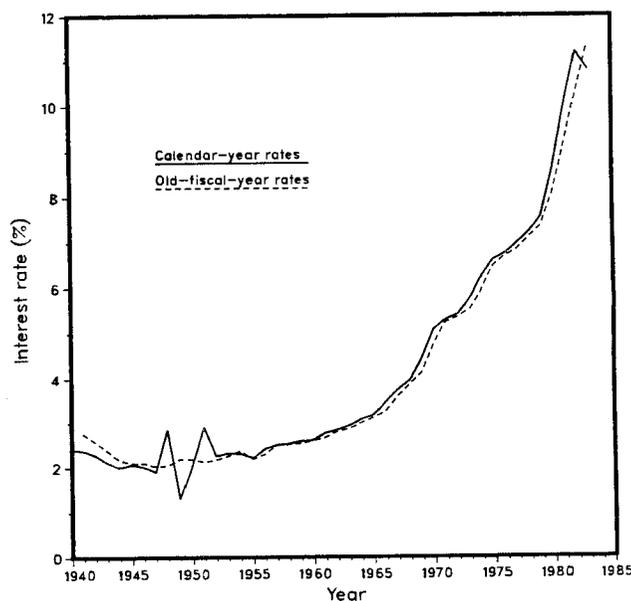[Percent]

Year	Calendar year			Old fiscal year[1]		
	OASI	DI	OASDI	OASI	DI	OASDI
1940	2.385	—	2.385	—	—	—
1941	2.363	—	2.363	2.754	—	2.754
1942	2.261	—	2.261	2.574	—	2.574
1943	2.089	—	2.089	2.375	—	2.375
1944	1.983	—	1.983	2.154	—	2.154
1945	2.057	—	2.057	2.078	—	2.078
1946	2.002	—	2.002	2.091	—	2.091
1947	1.884	—	1.884	2.013	—	2.013
1948	2.832	—	2.832	2.044	—	2.044
1949	1.299	—	1.299	2.176	—	2.176
1950	2.018	—	2.018	2.164	—	2.164
1951	2.888	—	2.888	2.110	—	2.110
1952	2.240	—	2.240	2.165	—	2.165

Table 1.—Effective annual interest rates by trust fund, 1940-83 (Cont.)
[Percent]

Year	Calendar year			Old fiscal year[1]		
	OASI	DI	OASDI	OASI	DI	OASDI
1953	2.310	—	2.310	2.255	—	2.255
1954	2.296	—	2.296	2.359	—	2.359
1955	2.198	—	2.198	2.177	—	2.177
1956	2.401	—	2.401	2.289	—	2.289
1957	2.494	2.315	2.492	2.497	2.178	2.496
1958	2.520	2.435	2.516	2.513	2.378	2.509
1959	2.584	2.505	2.578	2.536	2.470	2.532
1960	2.595	2.623	2.598	2.596	2.563	2.593
1961	2.744	2.852	2.755	2.652	2.720	2.658
1962	2.813	2.922	2.825	2.789	2.895	2.800
1963	2.913	3.001	2.923	2.844	2.967	2.859
1964	3.075	3.159	3.084	2.997	3.060	3.004
1965	3.168	3.351	3.184	3.123	3.222	3.133
1966	3.462	3.727	3.483	3.260	3.594	3.288
1967	3.720	4.134	3.753	3.589	3.878	3.611
1968	3.907	4.381	3.950	3.853	4.128	3.875
1969	4.351	5.099	4.437	4.049	4.781	4.127
1970	4.956	5.833	5.074	4.653	5.491	4.756
1971	5.154	5.991	5.286	5.118	5.976	5.244
1972	5.287	5.989	5.406	5.224	5.996	5.351
1973	5.663	6.177	5.754	5.412	6.036	5.521
1974	6.156	6.499	6.218	5.868	6.310	5.947
1975	6.565	6.730	6.593	6.420	6.666	6.463
1976	6.727	6.757	6.731	6.674	6.747	6.686
1977	6.936	7.119	6.958	6.823	6.895	6.833
1978	7.166	7.468	7.199	7.082	7.295	7.104
1979	7.444	7.953	7.524	7.288	7.746	7.348
1980	8.510	8.797	8.568	7.987	8.465	8.076
1981	9.924	10.104	9.947	9.149	9.158	9.151
1982	10.851	11.944	11.178	10.178	10.905	10.292
1983	10.876	10.378	10.785	11.226	11.626	11.342

[1]Defined as the 12-month period ending on June 30 of the year shown.

Figure 1.—Effective annual interest rates for OASDI: comparison of calendar-year rates with old-fiscal-year rates

After about 1960, the annual OASDI effective rates climb steadily upward. After 1979, the rates increase by at least 1 percent per year, until the maximum rate of about 11 percent is reached in old fiscal year 1983 (calendar year 1982). Note that in 1955-79, the graphs of

both the calendar-year and old-fiscal-year rates practically coincide, but after 1979, the calendar-year rate is slightly higher, reflecting the later measuring period at a time when rates were accelerating rapidly.

Although both the OASI and DI Trust Funds purchase new special issues at about the same time and at exactly the same new-issue rates, the effective annual rates will differ for each trust fund. This result occurs because each trust fund has different cash-flow patterns, leading to purchases of different amounts of new securities and with different maturity dates. Thus, on a given day the investment mix of each portfolio by yield and duration will normally be quite different. Because the effective interest rate measures, essentially, an average rate of interest for all securities in a portfolio, the different composition of assets leads to different effective interest rates.

Table 2.—Comparison of effective annual interest rates for OASDI with average annual new-issue rates, old fiscal years 1941-83

[Percent]

| Old fiscal year[1]	OASDI effective annual rate	Average annual new-issue rate[2]	Difference
1941	2.754	2.500	.254
1942	2.574	2.375	.199
1943	2.375	2.042	.333
1944	2.154	1.875	.279
1945	2.078	1.875	.203
1946	2.091	1.875	.216
1947	2.013	1.990	.023
1948	2.044	2.094	-.050
1949	2.176	2.125	.051
1950	2.164	2.125	.039
1951	2.110	2.125	-.015
1952	2.165	2.250	-.085
1953	2.255	2.292	-.037
1954	2.359	2.365	-.006
1955	2.177	2.250	-.073
1956	2.289	2.385	-.096
1957	2.496	2.500	-.004
1958	2.509	2.500	.009
1959	2.532	2.625	-.093
1960	2.593	2.625	-.032
1961	2.658	3.458	-.800
1962	2.800	3.885	-1.085
1963	2.859	3.844	-.985
1964	3.004	4.062	-1.058
1965	3.133	4.125	-.992
1966	3.288	4.531	-1.243
1967	3.611	4.865	-1.254
1968	3.875	5.417	-1.542
1969	4.127	5.823	-1.696
1970	4.756	7.229	-2.473
1971	5.244	6.438	-1.194
1972	5.351	5.969	-.618
1973	5.521	6.250	-.729
1974	5.947	7.010	-1.063
1975	6.463	7.510	-1.047
1976	6.686	7.406	-.720
1977	6.833	7.021	-.188
1978	7.104	7.542	-.438
1979	7.348	8.688	-1.340
1980	8.076	10.125	-2.049
1981	9.151	11.865	-2.714
1982	10.292	13.760	-3.468
1983	11.342	11.312	.030

[1]Defined as the 12-month period ending on June 30 of the year shown.

[2]Represents the average of the interest rates payable on new special-issue securities in each of the 12 months of the given year.

Table 2 compares the effective annual interest rates for OASDI with the annual average of the interest rates

on new issues, on an old-fiscal-year basis. As is evident from figure 2, the graphs of the annual average of the new-issue rates and the effective annual OASDI rates follow the same general rising trend. Initially, in 1941-46, both the new-issue rates and the effective annual rates declined with the effective rate being higher than the new-issue rate. In 1946-60, both curves remain relatively flat, and during this period, the two sets of rates are nearly identical. After 1960, however, both curves climb upward, and the new-issue rates consistently exceed the effective annual rates.

Figure 2.—Comparison of effective annual interest rates for OASDI with average annual new-issue rates, old fiscal years 1941-83
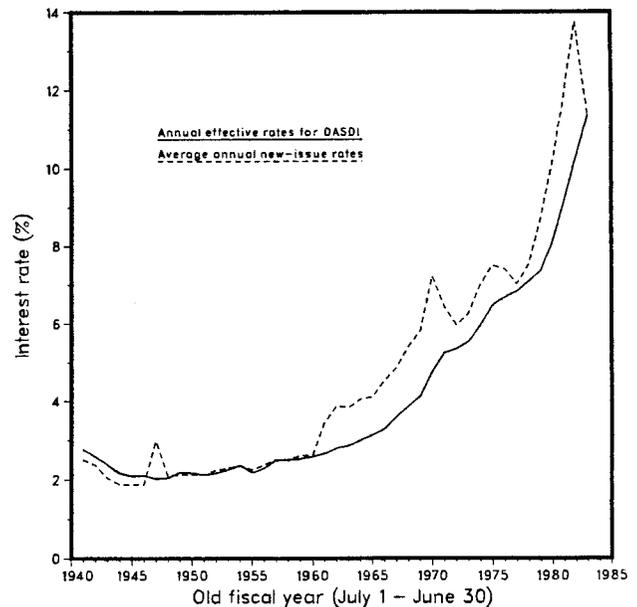
These patterns can be more easily evaluated by considering the average new-issue rates as the yield that would be realized on a portfolio invested entirely in new special-issue securities each July 1 with a maturity date of the following June 30. In contrast, the actual OASDI portfolio contains, in addition to special issues at the recent new issue rate, older securities which were purchased at new-issue rates prevailing in the past and which have not yet been redeemed. As these older securities are disinvested and are replaced by newer securities at current rates, the effective interest rate of the combined OASDI portfolio will tend to follow the trend of the new-issue rates. Thus, for example, in 1941-46 the effective portfolio rate tended to follow the downward path of the new-issue rate. In 1960-83, the opposite occurred. As the portfolio gradually lost older lower-interest securities, and acquired newer higher-interest issues, the portfolio rate followed the upward path of the new-issue rate. If the recent decline in new-issue rates continues, the effective annual rate would once again exceed the new-issue rate and would tend to follow its downward trend. The fact that the combined OASDI portfolio holds securities with varying durations of up to 15 years or more accounts for the more stable pattern of the annual effective rates and the

relatively smoother appearance of the effective rate curve.

The investment performance of the combined OASI and DI Trust Funds has been criticized occasionally as a result of comparisons with the investment yields of privately-managed money funds. Many of the comparisons are inappropriate because they contrast the effective rate earned by the combined OASI and DI portfolio with the current market yield on new public and private issues. As discussed above, in times of rising interest rates, the average yield on the "mature" portfolio would be lower than the rates for new securities. Under such circumstances, conclusions regarding the investment performance of the trust funds must be carefully drawn. A more meaningful comparison would involve the new-issue rate on trust fund securities versus the market yield on new public and private issues. Alternatively, the effective rate earned by trust fund assets could be compared to the effective interest rates on other portfolios with similar time horizons.

Table 3 compares the effective annual interest rates for the combined OASI and DI Trust Funds with the effective annual interest rates for life insurance company general accounts. Figure 3 shows the comparison graphically. In most years, the life insurance company rates exceed the OASDI rates, although by 1970, the differential is very small. This difference reflects the different types of investments held by the trust funds, as compared to those held by insurance companies. The latter are comprised largely of corporate bonds, some stocks, mortgage loans, and rental properties. These types of investments carry a greater yield in compensation for the greater risk involved. Beginning in 1980, however, the OASDI rates exceed the life insurance company rates; and by 1982, this difference has grown to about 2 percent. Once again, any conclusions must be drawn carefully. In this instance, the more favorable results for the trust funds reflect the rapid diminution in the level of assets held by the trust funds. As the funds were drawn down, they quickly became comprised of recent higher-interest issues only. The insurance company reserves, however, were not similarly depleted and so continued to hold a greater proportion of older, lower-interest securities.

Table 3.—Comparison of the OASDI effective interest rate and the average annual interest rate for life insurance company general accounts, calendar years 1940-82

[Percent]

Calendar year	OASDI effective annual rate	Average annual rate for life insurance company general accounts[1]	Difference
1940	2.39	3.45	-1.06
1945	2.06	3.11	-1.05
1950	2.02	3.13	-1.11
1955	2.20	3.51	-1.31
1960	2.60	4.11	-1.51
1965	3.18	4.61	-1.43
1966	3.48	4.73	-1.25
1967	3.75	4.83	-1.08
1968	3.95	4.97	-1.02
1969	4.44	5.15	-.71
1970	5.07	5.34	-.27
1971	5.29	5.52	-.23
1972	5.41	5.69	-.28

Table 3.—Comparison of the OASDI effective interest rate and the average annual interest rate for life insurance company general accounts, calendar years 1940-82 (Cont.)

[Percent]

Calendar year	OASDI effective annual rate	Average annual rate for life insurance company general accounts[1]	Difference
1973	5.75	6.00	-.25
1974	6.22	6.31	-.09
1975	6.59	6.44	.15
1976	6.73	6.68	.05
1977	6.96	7.00	-.04
1978	7.20	7.39	-.19
1979	7.52	7.78	-.26
1980	8.57	8.06	.51
1981	9.95	8.53	1.42
1982	11.18	8.87	2.31

[1]American Council of Life Insurance, *1983 Life Insurance Fact Book*, Washington, D.C. Rates are calculated excluding capital gains or losses from investment income.

Figure 3.—Comparison of effective annual interest rates for the OASDI trust funds with the average annual rates for life insurance company general accounts, calendar years 1940-82
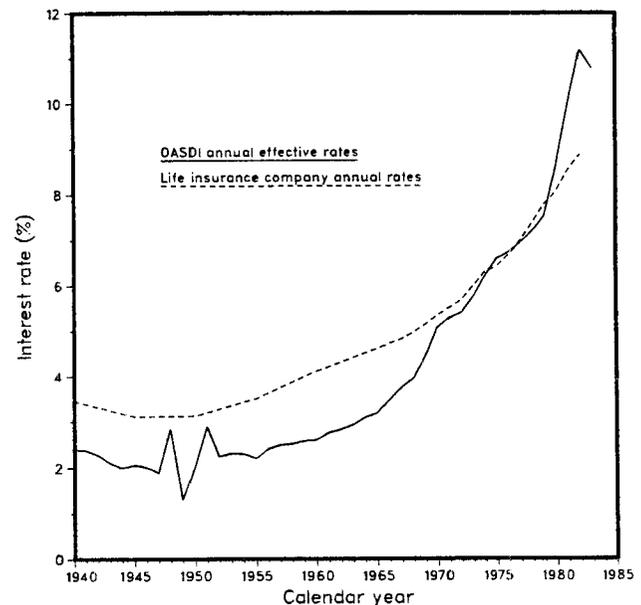
SUMMARY AND CONCLUSIONS

Despite the relatively minor role played by interest earnings in the financing of the OASDI program, it is important to have an accurate measure of the interest rate earned on the invested assets of the OASI and DI Trust Funds. The new formula introduced in this Note to calculate the historical effective annual rates utilizes detailed monthly cash-flow data to approximate the average daily level of trust fund assets. The resultant effective rates are consistent with the historical average annual new-issue rates and are believed to be more accurate than previous estimates. Comparisons of interest rates earned by different portfolios should properly reflect any differences in maturities, types of investments, and cash-flow circumstances.

TECHNICAL APPENDIX

This section discusses in detail the methodology and assumptions used in calculating the exposure for the effective annual interest rates. The "Statement of Account of Federal Old-Age and Survivors, Disability, and Hospital Insurance Trust Funds" was used as the source of most of the data on the monthly income and outgo of the OASI and DI Trust Fund for the years 1940 through 1983. This statement is issued monthly by the Department of the Treasury and is basically a balance sheet presenting detailed accounting information on each of the separate trust funds for a particular month. Additional data were obtained from the *Annual Statistical Supplement of the Social Security Bulletin,* published by the Social Security Administration, and unpublished tables produced by the Office of Systems of the Social Security Administration on a regular basis. Every cash-flow item that represents a financial transaction of the OASI or DI Trust Fund is reflected in the denominator of the effective rate formula with the exposure based on the approximate date of occurrence of each transaction. Before presenting the equation for the exposure, it is convenient to express in symbols the various individual items that compose the monthly cash flow of the trust funds:

Assets

A_j = invested assets held by the OASI and/or DI Trust Funds plus any undisbursed cash balances at the beginning of the jth month. Includes amounts borrowed from other trust funds but excludes amounts lent to other trust funds.

Income

C_j = OASI and/or DI payroll-tax contributions on wages and net earnings from self-employment collected in the jth month.

SD_j = OASI and/or DI payroll taxes collected by State and local governments and deposited with the trust funds in month j.

RF_j = excess tax contributions refunded by the trust funds in the jth month. This item appears as a *negative* quantity under income in the Treasury statement.

I_j^{inv} = investment interest received in the jth month (includes interest on advance tax transfers).

MS_j = reimbursements and transfers in the jth month from the general fund of the Treasury to the trust funds for deemed military-service wage credits.

P_j = reimbursements in the jth month from the general fund to the OASI Trust Fund for benefits paid to certain uninsured individuals who attained age 72 before 1968 (Prouty benefits).

IFB_j = transfers of principal to the trust funds during the jth month under the interfund-borrowing provisions. Amounts borrowed are considered as positive transfers while amounts lent are negative transfers.

I_j^{ifb} = interest received (+) or paid (-) in the jth month as service on outstanding interfund-loan balances.

I_j^{att} = interest reimbursed in the jth month by the trust funds to the general fund on advance tax transfers. This item is normally listed on the Treasury statement as *negative* income.

Outgo

BP_j = benefit payments paid in the jth month to beneficiaries in current-payment status.

RLS_j = retroactive benefit payments and lump-sum death benefits paid in the jth month.

UC_j = reimbursements in the jth month to the trust funds from the general fund for uncashed benefit checks. This item normally appears as a *negative* quantity under outgo.

AE_j = general administrative expenses paid by the trust funds in the jth month.

VR_j = vocational rehabilitation program payments in the jth month.

RR_j = transfer between the trust funds and the Railroad Retirement system during the jth month.

Other

EX_j = extraordinary transactions that occur irregularly and could be classified as either income or outgo.

M_j = miscellaneous small items that appear regularly as either income or outgo but are too insignificant to be considered individually.

In general, assets for the current and subsequent month can be reconciled by the following equation:

$$A_{j+1} = A_j + C_j + SD_j + RF_j + I_j^{inv} + MS_j + P_j + IFB_j + I_j^{ifb} + I_j^{att} - BP_j - RLS_j - UC_j - AE_j - VR_j - RR_j + EX_j + M_j.$$

The following is a general expression for the exposure for each of the 6-month periods, January through June and July through December, in terms of the above symbols:

$$E_i = A_{(6\times i)-5} + \sum_{j=(6\times i)-5}^{6\times i} [a_{1j}C_j + a_{2j}SD_j + a_{3j}RF_j$$
$$+ a_{4j}I_j^{inv} + a_{5j}MS_j + a_{6j}P_j + a_{7j}IFB_j + a_{8j}I_j^{ifb} +$$
$$a_{9j}I_j^{att} - a_{10j}BP_j - a_{11j}RLS_j - a_{12j}UC_j - a_{13j}AE_j -$$
$$a_{14j}VR_j - a_{15j}RR_j + a_{16j}EX_j + a_{17j}M_j]$$

where

E_i = the exposure for the 6-month period January through June ($i=1$) or July through December ($i=2$).

j = the month of transaction ($j = 1,...,12$).

a_{kj} = the weight or amount of exposure assigned to a particular cash-flow item in month j. Subscript k refers to the particular cash-flow item ($k = 1,...,17$) and subscript j refers to the month of occurrence ($j = 1,...,12$).

The coefficients, a_{kj}, can assume a range of values from 0 to 1 depending on the particular cash-flow item and the month of transaction. For both income and outgo items, the assigned weight or exposure was calculated as the ratio of (1) the length of time between the date of transaction and the end of the 6-month period to (2) the total length of time in the 6-month period, assuming that all months are 30 days in length. The exposure for positive income items (and negative outgo items such as uncashed checks) increases the total exposure for the 6-month period, while the exposure for all other outgo (and negative income items such as employee tax refunds and reimbursements for interest on advance tax transfers) decreases the total.

The following are some general remarks and simplifying assumptions about each of the terms in the exposure equation:

1. The assets (A_j) that appear in the formula are those assets held at the beginning of the 6-month period (i.e., either January 1 or July 1). They are assigned the full weight of 1 unit of exposure, equivalent to the full 6 months.

2. In the earlier discussion of interest on advance tax transfers, it was mentioned that the FICA and SECA taxes (C_j) received prior to May 1983 were essentially distributed evenly throughout each month. Thus for taxes credited during that period, it is reasonable to assume that all such income was received at mid-month. This same assumption is also used for subsequent months, despite the crediting of tax income at the beginning of the month. This assumption is valid because the earned investment interest that appears in the numerator of the effective rate formula is net of the reimbursed interest on advance tax transfers. Consequently, the semiannual interest reflects the interest earned on taxes as if the taxes were received and invested under the procedure in effect prior to May 1983. Thus for taxes credited in May 1983 and later, it was assumed that these amounts are also received and invested at mid-month. (Almost exactly the same results would be obtained by assuming taxes are received on the first of the month in the exposure and including interest on advance tax transfers in the interest on investments.) The weights (a_{1j}) assigned to each of the monthly tax contributions reflect exposure for half of the month of receipt (month j) plus the exposure for each subsequent full month remaining in the 6-month period.

3. The timing of the deposits of Social Security taxes collected by State and local governments (SD_j) has changed twice in the past 3 years. Prior to June 1980, taxes collected by State and local governments had to be deposited within 45 days after the close of the quarter in which the taxes were collected. For the period from July 1980 through December 1983, such taxes were required to be deposited within 30 days after the month of collection. It was assumed that deposits received in months prior to July 1980 were received at mid-month while deposits received in the months from July 1980 through December 1983 were received on the 25th day of the month. (The 25th day was selected rather than the 30th since this better reflected actual experience.) The weights assigned to State and local deposits (a_{2j}) reflect the differences in timing for these two periods. Beginning in 1984, the allowable lag period between collections and deposits was further shortened to 15 days; thus deposits for 1984 and later will be received on a more frequent basis.

4. Refunds to workers of excess employee Social Security taxes (RF_j) are made from the general fund of the Treasury as part of the income tax processing, with reimbursement from the trust funds once a year at the end of May or June. The weights (a_{3j}) were determined assuming that such refunds occur on the last day of the month of transfer. As mentioned earlier, these refunds are actually funds flowing out of the trust funds so they are treated similarly to disbursements and their exposure is, in effect, subtracted from the total for the 6-month period.

5. The interest earned on investments (I_j^{inv}) is received on different days in different months. The bulk of the interest is received on the last day of June and December when the coupons on special-issue holdings are paid. Smaller amounts of interest are received at other times during every month. Most of the interest in the other months is accrued interest paid on the redemption of securities at the time benefit payments are made. Normally, benefit checks are mailed on the third day of each month. (When the third falls on a weekend or Federal holiday the checks are mailed on the first working day prior.) The majority of securities, however, are not normally disinvested on the same day checks are mailed; rather, the trust funds have been allowed a 2-day float (recently extended to 4.4 days) before redemption is required. (Securities needed to support benefit checks deposited directly with

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financial institutions must be disinvested on the day of deposit, i.e., the third day of the month or earlier. Currently, direct deposit benefit payments represent roughly 40 percent of total benefit payments.) To simplify these procedures in the model, it was assumed that all investment interest received in June and December was credited on the final day of the month, and all investment interest received in any of the remaining months was credited on the third day of the month. These assumptions generally result in a slight understatement of the exposure in June and December and a slight overstatement in the remaining months, with the net overall effect being insignificant.

6. Prior to 1983, the reimbursement from the general fund to the trust funds for benefits paid based on deemed military-service wage credits for veterans (MS_j) normally occurred on December 31 (with some exceptions for the earlier years). In 1983, there was a special one-time transfer on May 20. Beginning in 1984, the trust funds will receive transfers on an annual basis on July 1 for deemed wage credits for military service after 1983. In the model, the exposure for the military-service transfers is calculated based on the actual date of transaction.

7. Annual reimbursements are made from the general fund to the OASI Trust Fund for benefits paid under the so-called Prouty Amendment of 1966 to people aged 72 or older before 1968 who are not insured for regular Social Security benefits. The reimbursements (P_j) have been made each year at the end of December. The exposure is calculated based on the actual date of transaction.

8. In 1982, the OASI Trust Fund borrowed from both the DI and HI Trust Funds in order to meet benefit obligations on time. The borrowed amounts (IFB_j) are treated as investable income to the OASI Trust Fund with the exposure measured from the actual date the funds were received to the end of the 6-month period. With respect to the DI Trust Fund, the amounts lent are treated as ordinary outgo, with negative exposure measured from the date of the loan to the end of the 6-month period.

9. Because the amounts borrowed by the OASI Trust Fund are considered as investable assets and not liabilities, the interest paid to service the outstanding loan balances (I_j^{ifb}) is treated as ordinary outgo and is not subtracted from the earned investment interest appearing in the numerator. Similarly, the amounts lent by the DI Trust Fund are not considered as invested assets, and interest received on amounts lent is not included in investment income. Such interest is received or paid at the end of every month and is treated as ordinary income or outgo with exposure based on the end-of-the-month crediting date.

10. Interest on advance tax transfers (I_j^{att}) reimbursed to the general fund of the Treasury has already been mentioned as being subtracted out of the investment income. Such interest is usually reimbursed at the ends of June and December of each year.

11. In most months, benefits in current-payment status (BP_j) are mailed on the third of the month with the actual disinvestment of securities occurring up to 2 days afterward. (See the discussion on investment interest.) In the exposure model, these benefits are assumed to be paid on the third of the month, as discussed above. Because benefit payments are outgo items, their exposure is subtracted from the total exposure for the period.

12. Retroactive benefits and lump-sum death benefits (RLS_j) are paid throughout the month; therefore, it is reasonable to assume a mid-month average payment date for these benefits.

13. When the trust funds disinvest special issues to meet benefit payments or other expenses, the cash is transferred to the general fund of the Treasury to support the payments. Prior to 1983, funds for benefit checks that were never cashed were not returned to the appropriate trust fund. The estimated total of all uncashed benefit checks (UC_j) issued prior to 1983 (including interest on these amounts) was reimbursed in one lump sum to the appropriate trust funds on August 19, 1983. Beginning in 1985, benefit checks that have been uncashed for 6 months will be credited, with interest, to the trust funds regularly.[1] In the exposure model, reimbursements for uncashed checks are treated as negative outgo with their exposure based on actual date of reimbursement.

14. Trust fund administrative expenses (AE_j) and the costs of vocational rehabilitation services for Social Security disability beneficiaries (VR_j) are assumed to be distributed uniformly throughout each month, and therefore a mid-month payment date was used to calculate exposures.

15. Transfers between the Railroad Retirement system and the OASI and DI Trust Funds (RR_j) occur annually, usually in May or June. These transfers may be either to or from the trust funds. (In most years the direction has been from the trust funds to the Railroad Retirement system.) The exposure is calculated based on the actual date of the transfer and is either added to or subtracted from the total exposure for the period, depending on whether the transfer is to or from the trust funds.

16. Extraordinary transactions (EX_j) that occur irregularly but involve significant amounts, such as retroactive interest adjustments and retroactive reallocations of taxes or administrative expenses, are treated as individual items and assigned exposures based on the actual dates of the transactions. These items may represent either positive or negative cash flows.

17. Small miscellaneous amounts (M_j) such as gifts to the trust funds are grouped together in this category. Such amounts are assumed to be dis-

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[1] In July 1984, an interim reimbursement was made for additional uncashed checks accruing since the time of the initial adjustment.

tributed uniformly throughout the month of occurrence.

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