ABSTRACT
of
Conclusions From Michigan Studies of Social Security Financing
by
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By Social Security in this paper we shall mean the income benefits provided by Old-Age, Survivors and Disability Insurance (OASDI).

We had hoped to make this a definitive exposition of our studies here, but for a dynamic system one never reaches a definitive summary of ideas. Instead, one seeks to set up a process to adapt fairly and equitably to the emerging future.

OASDI is the largest insurance and annuity organization in the world. In 1994, outgo for benefits and administration (mainly the former) was $323.0 billion. Total income amounted to $381.1 billion. There was a very comfortable excess of $58.1 billion which added to the Trust Fund(s).

The actuarial profession and the public are awakening to the actuarial challenges of OASDI. As stated by Manuel Gelles some fifty years ago "in Social Security the actuarial techniques of private insurance actuaries are often depended upon, instead of such techniques being developed within the different set of financial and economic conditions inherent in social insurance." He argues for a pay-as-you-go system as being the proper technique.

He might have been willing to accept our concept of n-year roll-forward reserve financing, which is pay-as-you-go financing projected n-years. The reserve at the beginning of an n-year term is established to provide, with interest, the outgoes for those n years. The reserve is replenished each year by a required annual contribution equivalent to the annual outgo n years ahead. Our paper illustrates the estimated annual contribution rates to provide 1- and 2-year roll-forward reserve financing of OASDI. An immediate problem is observed, the substantial increase in such contribution rates to meet "baby-boom" retirements in the years 2010 to 2030.

Another difficulty emerges. The annual contribution rates applicable to taxable payrolls to provide the required annual contributions (for n-year roll-forward reserve financing) may change from year to year (mainly increase). To smooth these rates out, we define the m-year obligation, namely, the present value of the required annual contributions for the next m years, where m is a multiple of n. The obligation is then spread over the increasing taxable payrolls of the m years by a level percent contribution rate applied to those payrolls.

We now have two parameters for OASDI financing: $n(= 1 \text{ or } 2)$; and m = a multiple of n, and <20 under present conditions. A condition for the smoothing process is that it be over a fixed term of years, and not a moving term that advances one year at the end of each year. With m<20, at least interest in current year dollars is paid on the obligation for the m years. Better still, by the end of the m years, in theory, the m-year obligation is completely discharged, and there is an n-year reserve on hand to begin the next term of financing.

Illustrations of how n-year roll-forward reserve financing could be carried out in the 12-year terms (2014,2025) and (2026, 2037) are given in the paper. These terms cover the retirements of most of the "baby-boom" generation, the aforementioned coming problem of OASDI financing.

In the past, when conditions were more stable, it was widely accepted by actuaries that the 75-year summarized cost rate, as a level percent of taxable payrolls, was a valid measure of the long-range OASDI cost. In recent years, the computing process was carried out by calculating an OASDI obligation for a 75-year moving term, and funding the obligation by a level percent contribution rate applied to increasing taxable payrolls for those 75 years. Under present conditions, in each year less than interest, in current year dollars, is paid on the 75-year obligation. This has the potential of the obligation increasing each year (in current year dollars). At present, we prefer a fixed term process of m-year summarized cost rates with $m<20$. This is to insure that interest in current year dollars is paid on the m-year obligation, and that the obligation for those m years is completely discharged within the m years.

For a full understanding, one must also consider what happens in terms of constant dollars. For the terms (2014, 2025) and (2026, 2037) we have done so, by taking the illustrations in terms of current year dollars, and adjusting the dollar amounts by means of a projected Consumer Price Index. This is a simple operation but is controlled by the original current year dollar computation. Some individuals may wish to study constant dollar operations that are not controlled by an initial current year dollar calculation. Some insights may be gained in this direction but these may be difficult to communicate to the public.

We have also considered a dynamic theoretical model based on a constant force of interest; a constant growth rate of OASDI outgo; and a constant growth rate of taxable payroll. This can be a fruitful means for preliminary exploration of OASDI financing. Also it can be shown that the level percent contribution rate to be applied to the taxable payrolls in an m-year term is simply a weighted average of the year-by-year required contribution rates. Such annual percent rates have always been to the fore in the projections of the Office of the Actuary.

The Office of the Actuary, Social Security Administration, has performed great national service by annually projecting for 75 years, on Low Cost, Intermediate and High Cost bases, the year-by-year OASDI outgoes and the year-by-year taxable payrolls. Now their work should be extended to a realistic, adaptive system of financing OASDI to meet the unfolding conditions of our times.

Traditionally, the University of Michigan has provided much leadership in Social Security matters. In keeping with this tradition, Dean Ned Gramlich of the School of Public Policy Studies, chairs the current Advisory Council, and a Technical Panel is chaired by Howard Young, Adjunct Professor of Mathematics and Adjunct Associate Research Scientist, Institute of Labor and Industrial Relations. In addition, actuarial faculty members, and by now 15 actuarial undergraduates, have studied Social Security financing and related matters, under Research Experience for Undergraduates grants provided by the National Science Foundation and the Michigan Actuarial Program*.

* By Michigan Studies, we mean the papers presented to the 1991-1995 Actuarial Research Conferences by Cecil Nesbitt and actuarial students. These papers appear in Actuarial Research Clearing House (ARCH), 1991.1-1995.1 issues. ARCH is published by *The Society of Actuaries, 475 N. Martingale Road, Schaumburg, IL 60173-2226 U.S.A.*

Outline of
"Conclusions From Michigan Studies of Social Security Financing"

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By such studies we mean the papers prepared during the past five years by actuarial students and Cecil Nesbitt, and which have appeared in **Actuarial Research Clearing House (ARCH)**. These papers have been encouraged by the National Science Foundation and the Michigan Actuarial Program.

The paper is in three parts. A lengthy Abstract, followed by 17 pages of text, graphs, tables and references. The third part is a 10 page Appendix which gives the proofs of text statements.

The presentation consisted of four challenges.

First Challenge: To realize that Old-Age Survivors and Disability Insurance is the largest insurance and annuity organization in the world.

The Office of the actuary, Social Security Administration, makes year-by-year projections for 75 years of key OASDI figures on three sets of assumptions: Low Cost, Intermediate, and High Cost. In Table 1, projected OASDI outgo for benefits, and projected taxable payrolls are displayed on the Intermediate basis. The trillion dollar projected outgo for OASDI by year 2015 is one indication of the size of OASDI.

TABLE 1
Projected Outgo and Projected Taxable Payroll for OASDI
Based on Intermediate Basis
(In Billions)

Year	Projected Outgo	Projected Taxable Payroll	100*[(2)/(3)] %
1995	340	2960	11.486
2005	587	4926	11.916
2015	1139	8502	13.397
2025	2309	14089	16.389
2035	4131	23511	17.570
2045	6823	39050	17.472

Second Challenge: New thinking re financing benefit obligation. The idea consists of open group cashflow financing instead of the classical closed-group present value approach of pension funding. In essence, n-year roll-forward reserve financing is pay-as-you-go financing projected n years. The required annual contribution is the discounted value under interest of the projected outgo for the year n years ahead. This enables year-end reserves to be held at a level equivalent to the outgoes of the next n years.

Figure 4 shows how 2-year roll-forward reserve financing might provide adjustment of the present "roller-coaster" financing of OASDI. Under current law, a considerable reserve fund will buildup but is expected to be exhausted by year 2030. The lower graph indicates the 2-year financing could be begun about year 2002, and would not need adjustment until about year 2015.

Figure 4
(Figure 2.2 of [15])

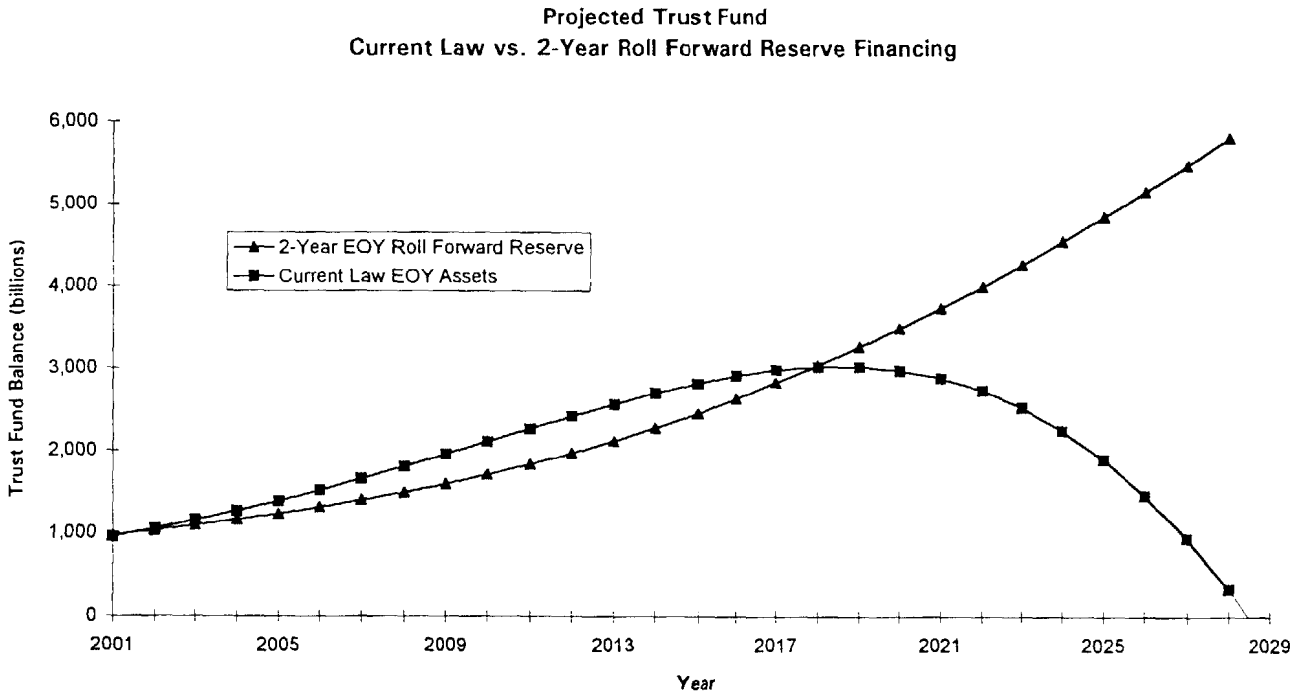
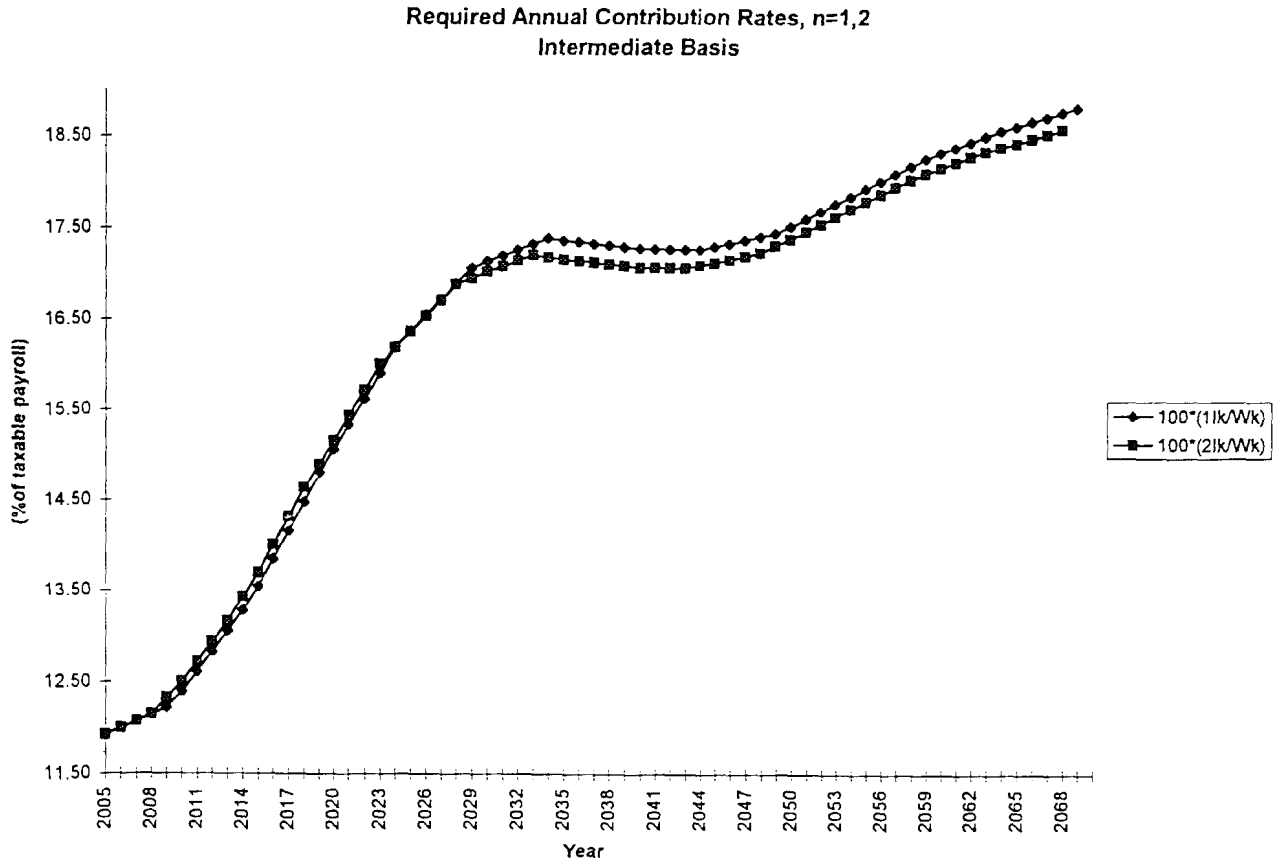


Figure 5 shows the required annual contribution rates for n=1 and n=2 financing from year 2005 forward. From 2010 to 2030, the "baby-boomers" are retiring and have marked impact. From 2030 to 2050 some stability is projected.

Figure 5


Required Annual Contribution Rates, n=1,2
Intermediate Basis
(%of taxable payroll)
18.50
17.50
16.50
15.50
14.50
13.50
12.50
11.50
2005
2008
2011
2014
2017
2020
2023
2026
2029
2032
2035
2038
2041
2044
2047
2050
2053
2056
2059
2062
2065
2068
Year
100*(1Ik/Wk)
100*(2Ik/Wk)

Third Challenge: How to smooth the annual contribution rates. We use

a. m-year Obligation, here denoted by ${}_nI_m$, is the present value of the required annual contributions for those m years for n-year roll-forward reserve financing.

b. W_m is the present value of the taxable payrolls (normally increasing) for those m years.

c. ${}_nr_m = {}_nI_m/W_m$ = level percent contribution rate applicable to taxable payrolls in the m years.

Questions:

1. How large should m be? We prefer to take $m<20$ and thereby in the first year pay at least interest on the initial m-year obligation.

2. Should m be in regard to a fixed term or a moving term? A fixed term provides that the initial obligation is completely discharged by the end of m years. With a moving term, there is uncertainty about whether the obligation is ever discharged.

3. Should we work in current year (of experience) dollars, or in terms of constant dollars?

Table 4 is based on 1995 Report data, Intermediate basis, $n=2$, $m=12$, ${}_2r(2014,2025)$ = 14.951%, δ = .0619602 (as force of interest), current year dollars.

Table A.9.3 is Table 4 with all current year dollar amounts adjusted by the projected CPI of the 1995 Report (starting with 100% for 1995). Thus, dollar amounts are in constant 1995 dollars, and by 2025 are about one-third of the current year amounts.

Table 4

Illustration of Operation of Level Percent Contribution Rate for Years (2014,2025)

1995 Data, Intermediate Basis, n=2, m=12, r(2014,2025)=14.951%, δ=.0619602

(In Billions)*@

[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
Calendar Year	Taxable Payroll	Required Contribution in Year k			Supplementary Fund	Required Reserve	Total Reserve
k	W_k	r(2014,2025)*W_k	${}_2I_k$	$[(3)-(4)]*e^{\delta 2}$	$F_k = F_{k-1}*e^{\delta} + (5)$	${}_2A_{12:31:k}$	(6) + (7)
2014	8062	1206	1082	128	128	2221	2348
2015	8502	1272	1165	111	247	2389	2636
2016	8945	1338	1253	88	351	2570	2921
2017	9412	1408	1348	62	435	2765	3200
2018	9903	1482	1450	33	496	2974	3470
2019	10420	1559	1552	7	535	3192	3727
2020	10963	1640	1662	-22	546	3418	3964
2021	11527	1725	1779	-57	525	3659	4184
2022	12120	1813	1905	-95	463	3918	4381
2023	12744	1907	2040	-137	356	4195	4550
2024	13400	2005	2169	-169	209	4475	4685
2025	14089	2108	2306	-204	19	4758	4777

*More figures were used in the calculations. Rounding to billions produces small discrepancies.

@All dollar figures are in terms of current year dollars

Table A.9.3

Illustration of Operation of Level Percent Contribution Rate in Constant 1995 Dollars for years (2014, 2025)

1995 Data, Intermediate Basis, n=2, m=12, r(2014,2025)=14.951%

(In billions)[e]

[1]	[2][e]	[3][e]	[4][e]	[5]	[6][e]	[7][e]	[8][e]
Calendar Year	Taxable Payroll		Required Contribution in Year k	*not needed*	Supplementary Fund	Required Reserve	Total Reserve
k	W_k	r(2014,2025)*W_k	${}_2I_k$			${}_2A_{2025,k}$	(6) + (7)
2014	3942	590	529	62	62	1086	1148
2015	3998	598	548	52	116	1123	1239
2016	4044	605	566	40	159	1162	1321
2017	4092	612	586	27	189	1202	1391
2018	4140	619	606	14	207	1243	1451
2019	4188	627	624	3	215	1283	1498
2020	4237	634	642	-9	211	1321	1532
2021	4284	641	661	-21	195	1359	1554
2022	4331	648	681	-34	166	1400	1566
2023	4379	655	700	-46	122	1441	1563
2024	4427	662	716	-56	69	1479	1548
2025	4476	670	732	-65	6	1511	1517

[e]Constant dollar values obtained from Table 4 by dividing values there by (CPI/100), as projected in [3], Table III.B1., p.177, Intermediate basis

Fourth Challenge: Should we question the Office of the Actuary's approach to long-term financing of OASDI?

The present financing for the long-term of OASDI may be characterized by $n = 1$, $m = 75$, *moving-term smoothing.*

We prefer $n = 2$, $m < 20$, fixed-term smoothing. Thereby, we undertake a more modest obligation, and completely discharge it, instead of pushing it to the future.

The problem of OASDI financing is neither simple nor easy.