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Special Studies in Federal Tax Statistics

2006

Selected Papers Given in 2006
at Annual Meetings
of the American Statistical Association
and Two Other Professional Conferences

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PREFACE

This is the sixth edition of the IRS Methodology Report series *Special Studies in Federal Tax Statistics, 2006.* The papers included in this volume were presented in 2006 at the Joint Statistical Meetings of the American Statistical Association (ASA) held in Seattle, Washington, the National Tax Association's Annual Conference on Taxation held in Boston, Massachusetts, and the United Nations Statistical Commission and Economic Commission for Europe Conference of European Statisticians held in Geneva, Switzerland.

◆ Content

This year's compilation has been divided into six areas of interest:

- ❒ The volume begins with four papers on the innovative uses of longitudinal panels, information documents, and time-series analysis;
- ❒ The second section presents three papers on IRS samples, surveys, and performance measurements;
- ❒ The third section contains a paper on tying Web site performance to mission achievement;
- ❒ The fourth section includes a paper on strategies to estimate a measure of heteroscedasticity;
- ❒ The fifth section contains three papers on special tax provisions for family-owned farms and closely held businesses, corporation life cycles, and the Free File Program;
- ❒ The final section presents a paper on improving customer utility on a centrally administered, shared Web site.

Nine of the articles in this volume were prepared by authors for publication in the *2007 Proceedings of the American Statistical Association* (ASA). Therefore, the format conforms basically to that required by the ASA, with the exception that we have not imposed a strict page limitation. Hence, in some cases, additional explanatory material may be included that is not available in the *Proceedings.*

The contents of the papers included here are the responsibility of the authors, who followed ASA's peer review guidelines for *Proceedings* papers and then sought additional comments from colleagues either within the SOI Division or elsewhere within IRS. Views expressed are also the responsibility of the authors and do not necessarily represent the views of the Treasury Department or the Internal Revenue Service.

◆ Acknowledgments

The editors of this collection, James Dalton and Martha Eller Gangi, would like to thank Paul Bastuscheck, Heather Lilley, and Lisa Smith for their invaluable contribution in laying out all the papers in this volume and Bobbie Vaira for her assistance in the publishing process.

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Special Studies in Federal Tax Statistics, 2006 is available online on the IRS Internet site at: http://www.irs.gov/taxstats/productsandpubs/article/0,,id=168008,00.html.

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Innovative Uses of Longitudinal Panels, Information Documents, and Time-Series Analysis To Study the Impact of the U.S. Tax System

Strudler ◆ Petska ◆ Hentz ◆ Petska

Sailer ◆ Pierce ◆ Lomize

Weber

Johnson ◆ Schreiber

Analysis of the Distributions of Income, Taxes, and Payroll Taxes via Cross-Section and Panel Data, 1979-2004

Michael Strudler, Tom Petska, and Lori Hentz, Internal Revenue Service, and Ryan Petska, Ernst and Young LLP

Different approaches have been used to measure the distribution of individual income over time. Survey data have been compiled with comprehensive enumeration, but under reporting of incomes, inadequate coverage at the highest income levels, and omission of some key sources of income jeopardize the validity of results. Administrative records, such as income tax returns, may be less susceptible to under reporting of income but exclude certain nontaxable income types and can be inconsistent in periods when the tax law has been changed. Record linkage studies have capitalized on the advantages of both approaches, but are costly and severely restricted by the laws governing interagency data sharing.

This paper is the seventh in a series examining trends in the distribution of individual incomes and tax burdens based on a consistent and comprehensive measure of income derived from individual income tax returns [1]. In the previous papers, we demonstrated that the shares of income accounted for by the highest income-size classes clearly have increased over time, and we also demonstrated the superiority of our comprehensive and consistent income measure, the 1979 Retrospective Income Concept, particularly in periods of tax reform. In this paper, we continue the analysis of individual income and tax distributions, adding for 8 years (1996-2003) Social Security and Medicare taxes to this analysis and using panel data (for 1996-2003). The paper has three sections. In the first section, we briefly summarize this measure of individual income derived as a "retrospective concept" from individual income tax returns. In the second section, we present the results of our analysis of time series data. We conclude with an examination of Gini coefficients computed from these data.

▶ Derivation of the Retrospective Income Concept

The tax laws of the 1980s, 1990s, and early 2000s made significant changes to both the tax rates and definitions of taxable income. The tax reforms of 1981 and 1986 significantly lowered individual income tax rates, and the latter also substantially broadened the income tax base. The tax law changes effective for 1991 and 1993 initiated rising individual income tax rates and further modifications to the definition of taxable income [2]. Law changes effective for 1997 substantially lowered the maximum tax rate on capital gains. The newest law changes, beginning for 2001, lowered marginal rates and the maximum tax rate on long-term capital gains, as well as decreased the maximum rates for most dividends. With all of these changes, the questions that arise are what has happened to the distribution of individual income, the shares of taxes paid, and average taxes by the various income-size classes?

In order to analyze changes in income and taxes over time, consistent definitions of income and taxes must be used. However, the Internal Revenue Code has been substantially changed in the last 26 years—both the concept of taxable income and the tax rate schedules have been significantly altered. The most commonly used income concept available from Federal income tax returns, Adjusted Gross Income (AGI), has changed over time making it difficult to use AGI for intertemporal comparisons of income. For this reason, an income definition that would be both comprehensive and consistent over time was developed [3]. The 1979 Retrospective Income Concept was designed to include the same income and deduction items from items available on Federal individual income tax returns. Tax Years 1979 through 1986 were used as base years to identify the income and deduction items, and the concept was subsequently applied to later years including the same components common to all years.

The calculation of the 1979 Retrospective Income Concept includes several items partially excluded from AGI for the base years, the largest of which was capital gains [4]. The full amounts of all capital gains, as well as all dividends and unemployment compensation, were included in the income calculation. Total pensions, annuities, IRA distributions, and rollovers were added,

including nontaxable portions that were excluded from AGI. Social Security benefits (SSB) were omitted because they were not reported on tax returns until 1984. Also, any depreciation in excess of straight-line depreciation, which was subtracted in computing AGI, was added back. For this study, retrospective income was computed for all individual income tax returns in the annual Statistics of Income (SOI) sample files for the period 1979 through 2004. Loss returns were excluded, and the tax returns were tabulated into income-size classes based on the size of retrospective income and ranked from highest to lowest. Percentile thresholds were estimated or interpolated for income-size classes ranging from the top 0.1 percent to the bottom 20 percent [5]. For each size class, the number of returns and the amounts of retrospective income and taxes paid were compiled. From these data, income and tax shares and average taxes were computed for each size class for all years.

▶ The Distribution of Income and Taxes

With this database, we sought to answer the following questions—have the distribution of individual incomes (i.e., income shares), the distribution of taxes (i.e., tax shares), and the average effective tax rates (i.e., tax burdens) changed over time? As a first look at the data, we examined the income thresholds of the bottom (or entry level) of each income-size class, and a clear pattern emerged. While all of the income thresholds have increased over time, the largest increases in absolute terms, and on a percentage basis, were with the highest income-size classes.

For example, $233,539 were needed to enter the top 0.1 percent for 1979, and $1,639,047 were needed for entry into this class for 2004. This represents more than a 600-percent increase. Also, $79,679 of retrospective income were needed to enter the top 1-percent size class for 1979, and $363,905 were needed for entry into this size class for 2004, an increase of 357 percent. For the top 20 percent, the threshold increased by 179 percent, and, for the bottom 20 percent, the increase was only 139 percent. Since much of these increases is attributable to inflation, we computed constant dollar thresholds, using the Consumer Price Index [6].

What is most striking about these data are the changes between 1979 and 2004 for the various income-size percentile thresholds (see Figure A). For example, the threshold for the top 0.1 percent grew (using a 1982-1984 base) from $321,679 for 1979 to $867,680 for 2004, an increase of 170 percent. Similarly, the threshold for taxpayers in the 1-percent group rose from $109,751 for 1979 to $192,644 for 2004, an increase of just over 75

Figure A—Constant Dollar Income Thresholds, 1979-2004 (1982-84=100)

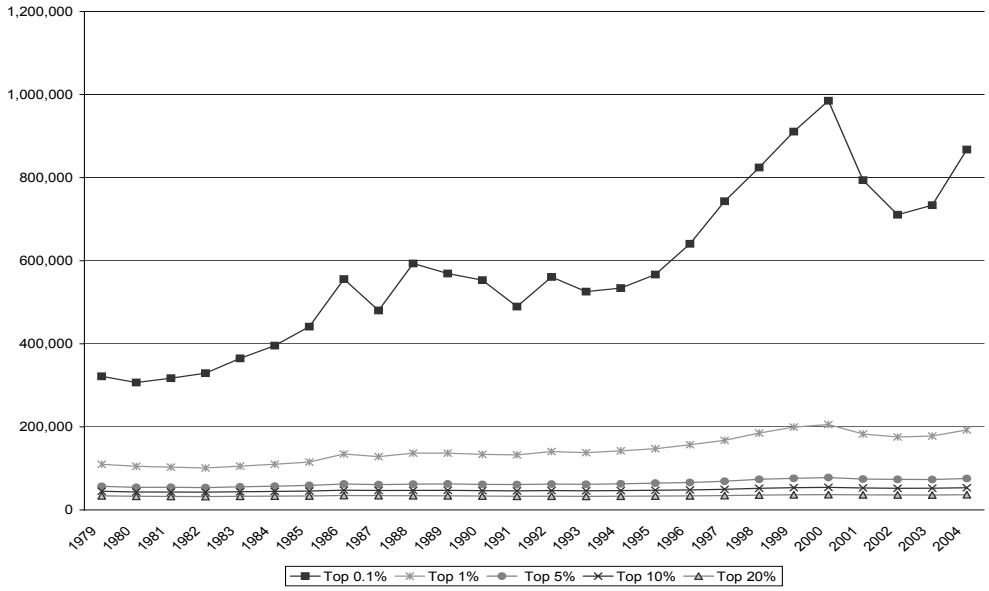
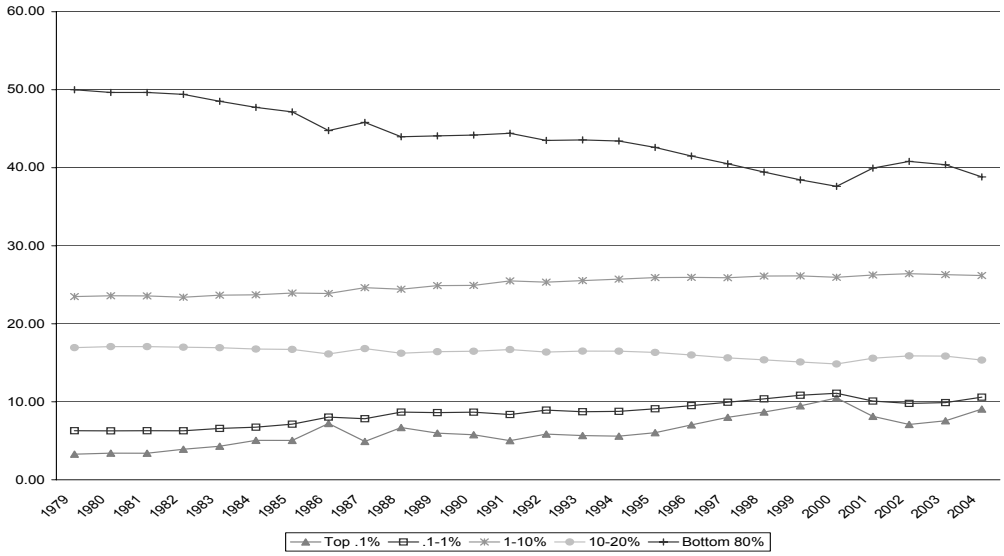


Figure B—Income Shares by Income Percentile Size Classes, 1979-2004



percent. However, the thresholds for each lower percentile class show smaller increases in the period; the top 20-percentile threshold increased only 7.2 percent, and the 40-percent and all lower thresholds declined.

Income Shares

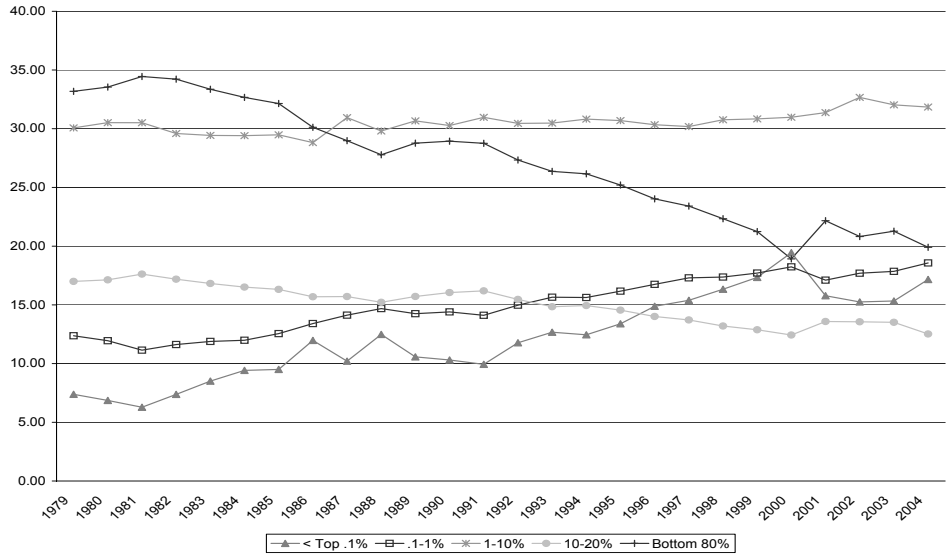
The share of income accounted for by the top 1 percent of the income distribution has climbed steadily from a low of 9.58 percent (3.28 for the top 0.1 percent) for 1979 to a high of 21.55 (10.49 for the top 0.1 percent) for 2000. With the recession and, then, the stagnating economy of 2001 and 2002, this share declined for 2 years but has increased from then to 19.65 percent (9.06 for the top 0.1 percent) for 2004. While this increase has been mostly steady, there were some significantly large jumps, particularly for 1986, due to a surge in capital gain realizations after the passage, but prior to implementation, of the Tax Reform Act of 1986 (TRA). The top 1-percent share also increased rapidly for 1996 through 2000, when sales of capital assets also grew considerably each year. Notable declines in the top 1-percent share occurred in the recession years of 1981, 1990-1991, and 2001.

This pattern of an increasing share of total income is mirrored in the 1-to-5-percent class but to a considerably lesser degree. For this group, the income share increased from 12.60 percent to 15.19 percent in this period. The 5-to-10-percent class's share of income held fairly steady over this period, going from 10.89 percent for 1979 to 10.99 percent for 2004. The shares of the lower percentile-size classes, from the 10-to-20-percent classes to the four lowest quintiles, show declines in shares of total income over the 26-year period (see Figure B).

Tax Shares—Income Tax

The share of income taxes accounted for by the top 1 percent also climbed steadily during this period, from 19.75 percent (7.38 for the top 0.1 percent) for 1979, then declined to a low of 17.42 percent (6.28 for the top 0.1 percent) for 1981, before rising to 36.30 percent (18.70 for the top 0.1 percent) for 2000 (see Figure C). The corresponding percentages for 2000 for the 1-percent and 0.1-percent groups are 37.68 percent and 19.44 percent, respectively, accounting for the 2000 tax rebate, which is discussed below. For the recession year of 2001 and the subsequent year (2002) with its large decline in net gains from the sale of capital assets, these shares declined to 32.53 percent for the top 1 percent and 15.06 percent (15.25 percent including the rebate of the child tax credit) for the top 0.1-percent group (32.95 percent and 15.25 percent, respectively, including a rebate of a portion of the child tax credit). These have since increased to 35.73 percent for the top 1-percent group and 17.16 percent for the top 0.1 percent. As with incomes, there were some years with unusually large increases, though a common

Figure C—Income Tax Shares by Income Percentile Size Classes, 1979-2004



feature for these years was double-digit growth in net capital gains [7]. The 1-to-5 percent size class exhibited relatively modest change in its share of taxes, increasing from 17.53 percent to 20.50 percent in the period. The 5-to-10 percent class, and all lower income-size classes, had declining shares of total tax.

Average Tax Rates—Income Tax

What is most striking about these data is that the levels of the average tax burdens increase with income size in most years (the only exceptions being 1980 through 1986 for just the highest group). The progressive nature of the individual income tax system is clearly demonstrated.

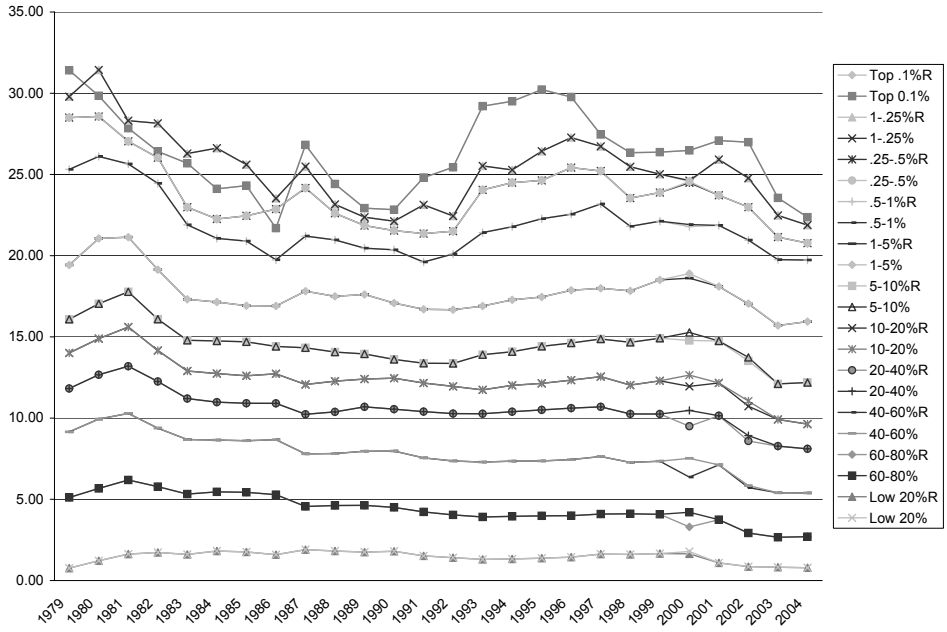
Despite the fact that the overall average tax rate remained virtually the same for 1979 and 2001, the average rate for all but the very lowest size class actually declined (see Figure D) [8]. While this at first appears to be inconsistent, it is clear how this did in fact occur—over time, an increasing proportion of income has shifted to the upper levels of the distribution where it is taxed at higher rates (see Figure B). For 2003, the average tax rate fell to 11.63 percent, the lowest rate over the 26 years of this study. For 2004, this increased slightly to 11.81 percent.

In examining the average tax data by income size, four distinct periods emerge. First, the average tax rates were generally climbing up to the implementation of the Economic Recovery Tax Act (ERTA) effective for 1982. This was an inflationary period, and prior to indexing of personal exemptions, the standard deduction, and tax brackets, which caused many taxpayers to face higher tax rates. (Indexing became a permanent part of the tax law for Tax Year 1985 [9].) Also, this period marked the recovery from the recession in the early 1980s.

Similarly, average taxes also climbed in the period after 1992, the period affected by the Omnibus Budget and Reconciliation Act (OBRA). This was not surprising for the highest income-size classes, ones affected by the OBRA-initiated 39.6-percent top marginal tax rate, but the average tax rate increases are also evident in the smaller income-size classes for most years in the 1993-to-1996 period as well.

For the majority of intervening years (i.e., 1982 through 1992), average tax rates generally declined by small amounts for most income-size classes, although the period surrounding the implementation of the 1986 Tax Reform Act (TRA) gave rise to small increases in some classes. Despite the substantial base broadening and rate lowering initiated by TRA, for most income-size classes, the changes to average rates were fairly small.

Figure D—Average Tax Rates by Size Classes, 1979-2004



However, it should be kept in mind that individuals can and do move between income-size classes. The rates for the top 0.1 percent clearly show the effects of the 1986 capital gain realizations, in anticipation of the end of the 60-percent long-term gain exclusion, which began in 1987. The average tax rate for this income-size class dropped for 1986, but it rose sharply for 1987, before dropping again for each of the next 3 years.

To assess what happened, it is important to look at the underlying data. The substantial increase in capital gain realizations for 1986 swelled the aggregate income and tax amounts for upper income classes and also raised the income thresholds of these top classes. However, since much of the increase in income for these size classes was from net long-term capital gains, which had a maximum effective tax rate of 20 percent, it is not surprising that the average tax rate for these top size classes declined.

Next, we consider if those years are affected by the Taxpayer Relief Act of 1997 (1997 through 2000), when the top rate on long-term capital gains was reduced significantly from 28 percent to 20 percent. For 1997, the first year under this law, when the lower rates were only partially in effect, the average tax rate fell for the top 0.1-percent group of taxpayers but increased for all other groups. However, for 1998, the first full year under lower capital gain rates, all groups above and including the 40-to-60-percent class had reduced average tax rates (while the lowest two quintiles had virtually the same average tax rates). For all groups (except for the 20-to-40 and the 60-to-80-percent groups in 1999), the average rates returned to increasing for both 1999 and 2000.

The Economic Growth and Tax Relief Reconciliation Act of 2001 (EGTRRA) further reduced marginal tax rates over several years. One of these reductions was the introduction of a 10-percent bracket on the first $6,000 ($12,000 if married filing a joint return) of taxable income. In an attempt to fuel a recovery from recession, this reduction was introduced retroactively in the form of a rebate based on Tax Year 2000 filings. Therefore, we simulated the rebate on the Tax Year 2000 Individual File to see its effects on average tax rates. When the rebate (estimated at $40.5 billion) is taken into account, the average rates for 2000 decreased for all groups, except for the top 0.1 percent and the 1-to-5 percent, reversing the prerebate increases. Tax Year 2001 was a mixture of increases and decreases in average tax rates by income group. Most groups paid higher average taxes; however, the 1-to-5-percent and 5-to-10-percent

groups paid lower average taxes along with the bottom 20-percent group.

For 2002, when the 10-percent rate applied to all returns and all rates above 15 percent were reduced by one-half of 1 percentage point, the average tax rate fell for every group. Further, as the economy stagnated, another rebate of $400 per child was sent to individuals who received a child tax credit for that year. This was in lieu of receiving the additional amount for 2003 as part of the increased child tax credit provided by the Jobs and Growth Tax Relief Reconciliation Act of 2003 (JGTRRA). Simulating this on Tax Year 2002, we estimated that $14.2 billion were sent to taxpayers further reducing average taxes for 2002. The individuals who gained the most from this rebate were in the 5-to-10-percent group through the 40-to-60-percent group. For 2003 and 2004, with further reductions in marginal rates, capital gain rates (to 15 percent), and the introduction of the same rates for qualified dividends, average tax rates decreased further to 11.63 percent and 11.81 percent, respectively. These were the lowest averages over the 26 years of this study. Further, aside from the 0.1-percent group in 1986 and the 0.5-to-1-percent group in 1991, all groups had their lowest average rates in these 2 years.

Tax Shares—Income Plus Social Security Tax

For individual taxpayers, Social Security taxes compose a fairly large portion (about 40 percent for 2003) of their Federal tax burden [10]. To broaden our analysis, we merged data from W-2s with individual income tax records for the years 1996-2003. Total Social Security taxes included self-employment taxes and taxes on tips reported on tax returns and two times the Social Security taxes (representing both the taxpayers' and the employers' shares) reported on W-2s. The employers' share of this tax was added into retrospective income, as well. Also, in order to have a better income concept over time, we altered retrospective income by including total Social Security benefits. As stated above, this was not included in income because it was not on older (pre-1984) tax returns, but, since this part of our study began with 1996, we were able to relax this constraint.

Including Social Security taxes (see Figure E), an interesting trend occurred. Through 2000, the tax share of all the higher income groups up to the 5-percent class increased each year, while the share of all the groups above the 20-percent class went down. However, after 2000, the top 0.1-percent group paid a decreasing share each year, while individuals in the 20-40-percent class paid an increasing share each year. The tax shares of other groups varied between the years. Overall, the top 20 percent paid a lower tax share (68.03 percent) in 2003 than they did in 2000 (70.27 percent), but this share was still higher than they paid in 1996 (66.21 percent). This occurred despite the fact that the share of the top 0.1-percent group declined from 9.30 percent for 1996 to 9.02 percent for 2003.

Figure E—Tax Shares (Including Social Security Taxes) by Percentile Size Classes, 1996-2003

Year	Total	< .1%	.1 - .25%	.25 - .5%	.5 - 1%	Top 1%	1-5%	5-10%	10-20%	Top 20%	20-40%	40-60%	60-80%	Low 20%
1996	100.00	9.30	3.59	3.55	4.44	20.88	16.40	12.29	16.64	66.21	19.82	10.23	3.19	0.55
1997	100.00	9.69	3.75	3.64	4.57	21.66	16.35	12.10	16.36	66.46	19.38	10.27	3.28	0.60
1998	100.00	10.39	3.82	3.65	4.61	22.46	16.63	12.11	16.13	67.34	18.78	9.96	3.32	0.61
1999	100.00	11.24	3.91	3.82	4.70	23.66	17.05	12.06	15.85	68.62	18.23	9.48	3.12	0.55
2000	100.00	12.32	3.96	3.92	4.70	24.90	16.99	11.87	15.58	69.34	17.69	9.26	3.16	0.55
2000 Rebate	100.00	12.65	4.06	4.01	4.80	25.52	17.26	11.95	15.54	70.27	17.34	8.89	2.95	0.55
2001	100.00	9.95	3.74	3.57	4.64	21.90	17.16	12.51	16.44	68.01	18.59	9.74	3.12	0.54
2002	100.00	9.08	3.58	3.56	4.60	20.82	17.47	12.87	16.96	68.12	18.87	9.60	2.90	0.51
2002 Rebate	100.00	9.17	3.62	3.60	4.65	21.03	17.64	12.89	16.91	68.47	18.71	9.46	2.85	0.52
2003	100.00	**9.02**	**3.54**	**3.57**	**4.63**	**20.77**	17.54	12.73	16.99	68.03	19.08	9.58	2.78	0.53
% change in share		**-3.01%**	**-1.39%**	**0.56%**	**4.28%**	**-0.53%**	**6.95%**	**3.58%**	**2.10%**	**2.75%**	**-3.73%**	**-6.35%**	**-12.85%**	**-3.64%**

Figure F—Combined Panel 'P': Average Tax Rates (Including Social Security Taxes) by Size Classes, 1996-2003

Year	Total	Top 5%	5-10%	10-20%	20-40%	40-60%	60-80%	Low 20%
1996	22.78	28.01	24.73	23.23	21.82	19.53	16.53	8.91
1997	22.76	27.44	24.34	23.73	21.87	19.86	16.89	9.23
1998	21.83	25.05	23.78	22.59	21.00	19.33	16.76	9.53
1999	22.37	26.91	24.19	22.96	21.34	19.25	16.86	9.88
2000	22.44	26.60	24.13	23.11	21.50	19.38	17.32	10.92
2001	22.13	26.27	24.06	23.00	21.42	19.38	17.17	10.31
2002	21.55	26.78	22.85	22.00	20.33	18.41	16.22	10.01
2003	20.14	24.15	21.55	20.90	19.30	17.72	15.78	10.61
All years	21.94	26.30	23.66	22.64	21.02	19.06	16.68	10.02
% change 96-03	-11.59%	-13.78%	-12.86%	-10.03%	-11.55%	-9.27%	-4.54%	19.08%

▶ Average Tax Rates Including Social Security Taxes Using Panel Data

For 1996 through 2003, we used a panel of individual tax returns that were selected at a 1-in-5,000 return random sample embedded in each year's Individual Statistics of Income (SOI) sample. These returns were based on the primary taxpayer having certain Social Security number endings and are part of Social Security's Continuous Work History Sample (CWHS). The reason for studying a panel of returns is to obtain a more well-rounded approach to analyzing tax returns over time. While "the rich" may appear to be getting greater concentrations of income over time, the composition of who "the rich" are may also be changing over time. By looking at the panel, we defined income groups from the combined data (indexed for inflation) over this time period. As with the 1996-2003 cross-sectional study, in order to have a better income concept over time, we altered retrospective income by including total Social Security benefits. Then, we analyzed how income and taxes changed in each of these years, classifying each year's returns in quintile classes.

In analyzing this panel over time, we classified returns into quintile classes for each of the 8 years, 1996 through 2003. We started with 120 million returns filed for 1996 and followed these returns. In analyzing this panel over time, we only included returns that were filed for each of the 8 years. This left us with 76.8 million returns out of the 120 million returns filed for 1996. Using inflation-indexed income, we then combined the income and taxes over time to create a "combined income and tax" for each of the tax returns. We then reclassified each return into percentile classes, with the 5-percent income class being the highest class analyzed (due to the high sampling variability at levels above this). Looking at average taxes for the combined income groups (see Figure F), while all groups' average tax rated declined over the period between 1996 from 2003 by 11.6 percent, the largest decline was in the higher income groups. The average tax rate of the top 5-percent group went down by 13.8 percent (from 28.0 percent to 24.2 percent) and the 5-to-10-percent group by 12.9 percent. The rates fell for all groups below the 80-percent level. The bottom 20-percent group, however, paid 19.1 percent higher average tax rates in 2003 than in 1996 (from 8.9 percent to 10.6 percent).

▶ Analysis of Gini Coefficients

To further analyze the data, we estimated Lorenz curves and computed Gini coefficients for all years. The Lorenz curve is a cumulative aggregation of income from lowest to highest, expressed on a percentage basis. To construct the Lorenz curves, we reordered the percentile classes from lowest to highest and used the income thresholds as "plotting points" to fit a series of regression equations for each income-size interval in the 26 years, both before and after taxes.

Figure G—Gini Coefficients for Retrospective Income, Before and After Taxes, 1979-2004

Year	Gini Before Tax	Gini After Tax	Difference	Percent Difference
1979	0.469	0.439	0.030	6.3%
1980	0.471	0.441	0.031	6.5%
1981	0.471	0.442	0.029	6.2%
1982	0.474	0.447	0.027	5.7%
1983	0.482	0.458	0.025	5.1%
1984	0.490	0.466	0.024	4.9%
1985	0.496	0.471	0.024	4.9%
1986	0.520	0.496	0.024	4.6%
1987	0.511	0.485	0.026	5.1%
1988	0.530	0.505	0.026	4.8%
1989	0.528	0.504	0.024	4.6%
1990	0.527	0.503	0.024	4.5%
1991	0.523	0.499	0.024	4.6%
1992	0.532	0.507	0.025	4.7%
1993	0.531	0.503	0.028	5.2%
1994	0.532	0.503	0.028	5.3%
1995	0.540	0.510	0.029	5.4%
1996	0.551	0.521	0.030	5.5%
1997	0.560	0.530	0.030	5.4%
1998	0.570	0.541	0.029	5.1%
1999	0.580	0.550	0.030	5.2%
2000	0.588	0.558	0.031	5.2%
2000 Rebate	0.588	0.557	0.032	5.4%
2001	0.564	0.534	0.030	5.4%
2002	0.555	0.525	0.030	5.3%
2002 Rebate	0.555	0.525	0.030	5.3%
2003	0.559	0.533	0.026	4.7%
2004	0.575	0.549	0.026	4.6%

Once the Lorenz curves were estimated for all years, Gini coefficients were calculated for all 26 years. The Gini coefficient, which is a measure of the degree of inequality, generally increased throughout the 26-year period signifying rising levels of inequality for both the pre- and posttax distributions. This result was not unexpected since it parallels the rising shares of income accruing to the highest income-size classes. Over this period, Figure G shows that the beforetax Gini coefficient value increased from 0.469 for 1979 to 0.588 (25.4 percent) for 2000, while the aftertax Gini value increased from 0.439 to 0.558 for a slightly higher percentage increase (25.5 percent). The economic downturn in 2001 and 2002 actually decreased the levels of inequality to 0.555 (pretax) and 0.525 (aftertax). For 2004, these rose back to 0.575 (pretax) and 0.549 (aftertax).

So, what has been the effect of the Federal tax system on the size and change over time of the Gini coefficient values? One way to answer this question is to compare the before- and aftertax Gini values [11]. Looking at this comparison, two conclusions are clear. First, Federal income taxation decreases the Gini coefficients for all years. This is not surprising in that the tax rate structure is progressive, with average rates rising with higher incomes so that aftertax income is more evenly distributed than beforetax income. A second question is whether the relationship between the beforetax and aftertax Gini coefficient values has changed over time.

The aftertax series closely parallels the beforetax series, with reductions in the value of the Gini coefficient ranging from 0.024 to 0.032. The largest differences, which denote the largest redistributive effect of the Federal tax system, have generally been in the periods of relatively high marginal tax rates, particularly 1979-81 and for 1993 and later years. In fact, simulating the tax rebate for Tax Year 2000 results in the largest difference (0.032) over all the years. If this were the only change in marginal rates of the new tax law (EGTRRA), the results would have been to increase the redistributive effects of Federal taxes. However, for Tax Year 2001 and beyond, the marginal rates of higher income classes were reduced from 38.6 percent to 35 percent for 2004.

To investigate further, the percentage differences between before- and aftertax Gini values were computed. These percentage changes in the Gini coefficient values, a "redistributive effect," show a decline ranging from 4.5 percent (1990) to 6.5 percent (1980). As for the differences, the largest percentage changes are for the earliest years, a period when the marginal tax rates were high. The largest percentage reduction was for 1980, but the size of the reduction generally declined until 1986, fluctuated at relatively low levels between 1986 and 1992, and then increased from 1993 to 1996. However, coinciding with the capital gain tax reduction for 1997, the percentage change again declined for 1997 and 1998. Nevertheless, it increased for 1999, 2000, and 2001 (although the 2001 percentage increased slightly if the rebate is included with the 2000 data). For 2003 and 2004, this difference declined to 4.7 percent and 4.6 percent, respectively, approaching the 1990 level.

So, what does this all mean? First, the high marginal tax rates prior to 1982 appear to have had a significant redistributive effect. But, beginning with the tax rate reductions for 1982, this redistributive effect began to decline up to the period immediately prior to TRA 1986. Although TRA became effective for 1987, a surge in late 1986 capital gain realizations (to take advantage of the 60-percent long-term capital gain exclusion) effectively lowered the average tax rate for the highest income groups, thereby lessening the redistributive effect.

For the post-TRA period, the redistributive effect was relatively low, and it did not begin to increase until the initiation of the 39.6-percent tax bracket for 1993. But since 1997, with continuation of the 39.6-percent rate but with a lowering of the maximum tax rate on capital gains, the redistributive effect again declined. Data from 2003 and 2004 show that the new tax laws have continued this trend. Analysis of panel data shows that these trends are not quite as great as seen by looking at annual cross-section data, but the trends cited above are still apparent.

▶ Endnotes

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Mudry, Kyle and Parisi, Michael, Individual Income Tax Rates and Tax Shares, 2003, *Statistics of Income Bulletin,* Winter 2005-2006, Volume 25, Number 3.

[8] Taxes, taxes paid, tax liabilities, tax shares, and average or effective tax rates are based on income tax, defined as income tax after credits plus alternative minimum tax (AMT) less the nonrefundable portion of the earned income credit (for 2000 and 2001, AMT was included in income tax after credits). However, for Figure F, tax includes Social Security and Medicare taxes less all of the earned income credit and refundable child credit.

[9] Nelson, Susan, Family Economic Income and Other Income Concepts Used in Analyzing Tax Reform, *Compendium of Tax Research*, Office of Tax Analysis, U.S. Department of the Treasury, 1987.

[10] Internal Revenue Service, *Data Book 2003*–Publication 55B. For Fiscal Year 2003, total Individual Income Taxes collected from withholding and additional taxes paid with tax forms filed were $987.2 billion, while total Social Security taxes were $647.9 billion.

[11] A comparison of the before- and after-tax Gini coefficients does not exclusively measure the effects of the tax system in that the tax laws can also affect before-tax income. For example, capital gain realizations have been shown to be sensitive to the tax rates.

Social Security Taxes, Social Security Benefits, and Social Security Benefits Taxation, 2003

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For most of its 90-year existence, the Statistics of Income (SOI) Division of the Internal Revenue Service and its predecessor organizations have used data provided by taxpayers on Forms 1040 to fulfill the legal mandate to produce statistics on the operation of the individual income tax system. It was not until Tax Year 1989 that SOI started using the Information Returns Master File (IRMF), which contains electronic documents filed by the payers of income to individuals, to add further details to the tax return information. To date, the *SOI Bulletin* has featured articles on the distribution of salaries and wages from Forms W-2[1] and the accumulation of assets in Individual Retirement Accounts from Forms 5498[2], based on this rich source of administrative data. In this paper, the authors make a modest proposal for another set of statistics that could be produced from the IRMF which would shed light not only on the operation of the individual income tax and the Social Security tax systems, but also on the interaction of the two systems. The paper illustrates some of the analysis that could be produced with this file.

▶ Components of the Social Security Impact

Figure 1 starts from the total income of everybody touched by the Social Security system, either as a payer of Federal Insurance Contributions Act (FICA) or Self-Employment Contributions Act (SECA) taxes, or as a recipient of Social Security benefits. The first line shows total income, which, for filers of tax returns, is the sum of all sources of income as shown on line 22 of Form 1040, or the equivalent lines of Forms 1040-A and 1040-EZ. For the purpose of this chart, the taxable portion of Social Security benefits has been excluded.

One of the advantages of working with information documents is that they enable SOI to show information on individuals who have not filed (and may never file) income tax returns for a given year. For these individuals, total income can be computed by adding salaries and wages from Forms W-2, gambling winnings from Forms W-2G, and nonemployee compensation, unemployment compensation, rents, royalties, interest, dividends, and pension distributions from various Forms 1099. For 2003, total income (other than Social Security benefits) stood at $6.7 trillion. This is the amount for all participants in the Social Security system, whether as benefit recipients or payers of Social Security taxes. The Social Security system added $386 billion to this income—basically in the form of benefits payments—and took out $542 billion—mainly in Social Security taxes, but also in the taxation of the Social Security benefits it paid out.

Figure 1—Computation of Social Security Impact

	Amount ($1,000)
Total income before Social Security	6,743,571,198
Additions, total	385,787,734
Gross Social Security benefits	384,037,692
Income tax reduction due to SECA	236,808
Excess FICA credit	1,513,234
Subtractions, total	541,579,465
FICA tax (employer's portion)	246,016,712
FICA tax (employee's portion)	246,016,712
Self-employment tax	29,278,008
Social Security tax on tips	148,273
Repayments of SS benefits	1,728,716
Tax on taxable benefits	18,391,044
=Total income after Social Security	6,587,779,467

Figure 1 also shows the details of the additions and subtractions. The $386 billion in additions are almost entirely the Social Security pensions and survivor benefits paid out by SSA, plus two small technical adjustments—self-employed individuals who pay their own Social Security taxes (instead of having them withheld and matched by employers) are able to deduct one-half of their so-called "self-employment tax" from their total incomes on their tax returns. This, of course, reduces their regular income tax by, roughly, that amount times the marginal tax rate. So, taxpayers in the 33-percent tax bracket for 2003 got back on their income tax forms roughly one-sixth of the self-employment tax they paid

into Social Security (33 percent of one-half the tax). In this tabulation, only that part of the self-employment tax that relates to retirement and survivor benefits, also known as SECA, is shown. Medicare taxes and payments are not part of this analysis.

Another technical adjustment was needed for individual taxpayers who overpaid their FICA taxes because they worked for more than one employer in the course of a tax year. If the total amount of their salaries and wages from the two employers exceeded the maximum subject to the FICA tax ($87,000 for Tax Year 2003), the excess FICA tax over $5,349 could be shown as a tax payment on the tax return. This overpayment amounted to $1.5 billion for 2003.

The largest subtraction from total income caused by the Social Security system is, obviously, the FICA tax, half of which is deducted from each employee's salary or wage, and half of which, at least legally, is paid by the employer. If it is true, as economic theory holds, that employees eventually get paid what their marginal utility determines them to be worth, then the employer's portion of Social Security taxes truly is a reduction in employees' salaries; for that reason, it is shown as a subtraction from income in Figure 1. In any case, it does represent amounts going into the Social Security system.

FICA tax data come from Forms W-2 filed by each employer. The self-employment tax is computed on Schedule SE of Form 1040. This is the Social Security tax paid by self-employed individuals. For purposes of this chart, the Medicare portion of this tax, also computed on Schedule SE, was not included.

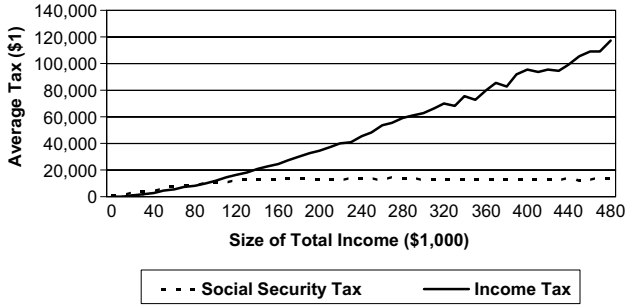
Social Security taxes on tip income that had not been collected by the employer, and that the waiter or other employee with tip income was supposed to report on his or her income tax return, represent a very small subtraction from total income.

Since the additions include all payments of Social Security benefits, the small amount that was paid out in error (usually because the taxpayer earned too much money in some quarter to qualify), and had to be repaid by the recipient, is shown here as a subtraction. Finally, an $18-billion subtraction is shown in Figure 1 because some Social Security benefits are subject to the individual income tax. The amount of taxes thus raised is moved from the general fund to the Social Security trust fund, and, thus, these taxes do, in fact, go into the Social Security system.

▶ Impact of Social Security Taxes and the Individual Income Tax

Figure 2 shows the impact of the Social Security tax (both FICA and SECA) on workers and self-employed individuals at various income levels. For comparison purposes, the average income tax for these same individuals is shown as well. While income taxes keep rising with income, Social Security taxes level off at just over $13,000 per taxpaying unit when total income reaches $160,000. At the very lowest income levels, Social Security taxes actually tend to be higher than income taxes.

Figure 2—All Individuals With Social Security Taxes, 2003: Average Tax by Size of Total Income and Type of Tax



When the same data are displayed showing total income tax and Social Security taxes as a percentage of total income, as is done in Figure 3, it becomes dramatically clear that the income tax is a progressive tax (although not as progressive as it used to be), while Social Security taxes are (and always have been) regressive.

For purposes of Figure 3, married couples filing jointly are shown as a single taxpaying entity. It was easier to combine the FICA and SECA taxes for the two taxpayers than it would have been to try to attribute some portion of the income tax to each of them.

Figure 3—All Individuals with Social Security Taxes, 2003: Taxes by Type as Percent of Total Income

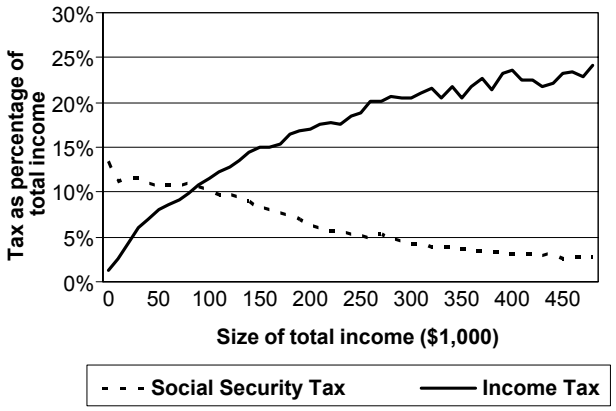


Figure 4—All Individuals with Social Security Benefits (SSB): SSB as % of Total Income, 2003

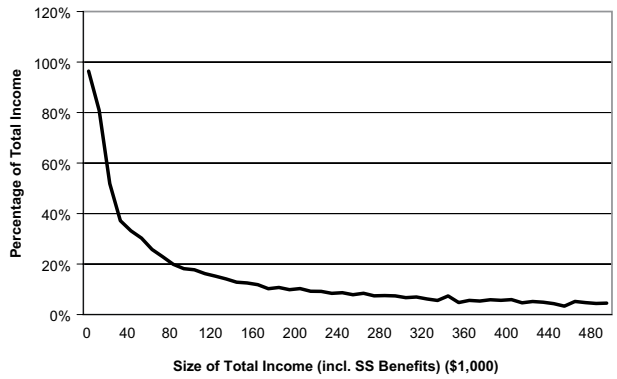
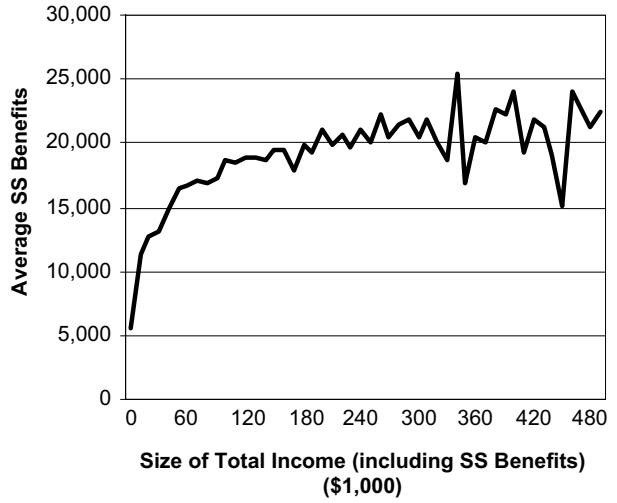


Figure 5—All Individuals with Social Security Benefits (SSB): Average SSB by Size of Total Income, 2003



On the other hand, each nonfiler is shown as a separate unit, whether married or not, since the information documents do not reveal any information on marital connections. In the case of nonfilers, the proxy for total Federal income tax is Federal income tax withheld; since they had not filed by the end of the following year, tax withheld was, in fact, the total amount they had paid to the Federal Government.

► Distribution of Social Security Benefits

It was noted previously that the impact of the FICA and SECA tax was highest on those in the lower-income classes—at least in proportion to income. Figure 4 shows that the distributions of Social Security benefits are also highest for lower-income individuals. Retirees with incomes greater than zero but under $10,000 derive 96 percent of their incomes from Social Security benefits. The percentage drops to 50 just under the $20,000 income level, and drops below 5 percent around the $400,000 income level.

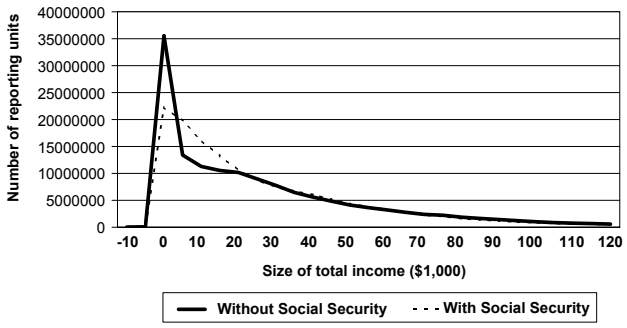
Figure 5 shows that, in terms of average Social Security benefits, the amounts rise steadily from the lowest income class until the benefits reach $20,000 for recipients with incomes around $150,000, and that the benefits then bounce around the $20,000 line for the rest of this distribution. In other words, the rich do not get any more in Social Security benefits than the middle class, but, as was shown earlier, they do not put any more into Social Security than the middle class, either.

► Overall Impact of the Social Security System

Figure 6 shows two income distributions: The first (the solid line) is based on total income without any Social Security benefits included or Social Security taxes taken out; the second income distribution (dotted line) subtracts from total income all the Social Security taxes (including income taxes paid on Social Security

benefits), and adds in all the Social Security benefits. It is evident that the Social Security system does keep many people out of the abject poverty of the "Under $5,000" class. The "with Social Security" distribution shows just over 20 million reporting units in this class, as opposed to over 35 million in the "without Social Security" distribution. On the other hand, the "with Social Security" distribution shows significantly more filing units in the $10,000 to $20,000 income area than does the "without Social Security" distribution. Between $20,000 and $70,000, the "with Social Security" line runs just very slightly above the "without Social Security" line, and, after $70,000, it runs very slightly below the "without Social Security" line.

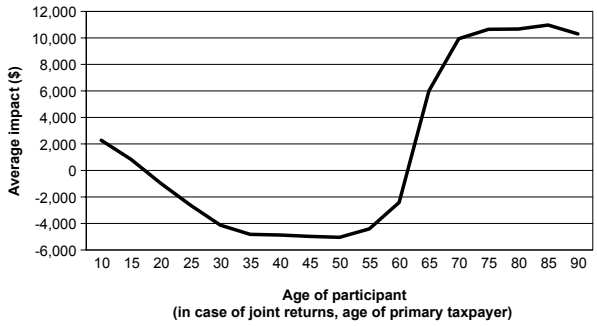
Figure 6—All Reporting Units in the Social Security Systems: Distribution of Total Income, Tax Year 2002



▶ Impact of the Social Security System by Age of Taxpayer

SOI's merged file of tax returns and information documents contains data on the age of the participants. For the purpose of Figure 7, Social Security benefits and Social Security taxes are combined into one variable, with benefits shown as positive amounts and taxes as negative amounts. The averages of these positive and negative amounts are shown for each age group (in 5-year increments). Figure 7 shows that the Social Security system has a positive impact on the very youngest children who come into contact with it, because they are getting survivor benefits. In the 15 under 20 age group, the effect turns negative, as people start working and paying Social Security taxes. During the peak earnings years of 35 to 55, participants tend, on average, to put between $4,500 and $5,000 into the system every year. Then, the average starts rising until it reaches positive territory for the 60 to 65 age group, and peaks just shy of the $11,000 mark for the 80 to 85-year-olds.

Figure 7—Average Impact of Social Security System by Age of Participant, 2003



▶ Social Security Taxes and Other Forms of Retirement Savings

SOI's merged file of tax returns and information documents contains data on other forms of retirement savings—Forms W-2 show payments into 401(k) plans and similar programs in the Government and nonprofit sectors; Forms 5498 show payments into Individual Retirement Accounts, including Traditional and Roth IRA plans. Unfortunately, IRS does not have information on how much is being placed into defined benefit plans by various employers. The only evidence for those contributions is a checkmark in a box on the W-2. Therefore, the following analysis is confined to those taxpayers who do not have employer-provided defined benefit plans.

Figure 8 shows that, for the lowest income taxpayers—those with earned incomes under $25,000—Social Security taxes represented the vast majority of their set-asides for retirement. For example, in the $20,000 under $25,000 earned income class, Social Security taxes (again, counting both the employer and employee portions of FICA) amounted to 12.2 percent of earned income. Contributions to other types of retirement plans amounted to only 1 percent of earned income. Nonetheless, this means that these individuals were having 13.2 percent of their earned incomes set aside for retirement purposes, which is actually a pretty respectable propor-

tion, considering that the highest percentage shown in this chart is 15.1 percent, which applies to the $80,000 under $85,000 earned income class.

► Future Steps

At SOI, we have started to collect these data for a panel of taxpayers beginning in 1999. In addition, we have been saving population data from the Information Returns Master File going back to 1995. So, if we combine 4 years of data selected retrospectively with prospective data from one of our 1999-base panels, we will have a data set with which we can follow participants in the Social Security system for 10 years; if we keep building on that, the panel will be available for analyzing equitable methods of adjusting the Social Security and income tax systems to keep Social Security solvent for future generations.

► Endnotes

[1] See Sailer, Yau, and Rehula (2001-2002) and Yau, Gurka, and Sailer (2003).

[2] See Sailer and Nutter (2004) and Bryant and Sailer (2006).

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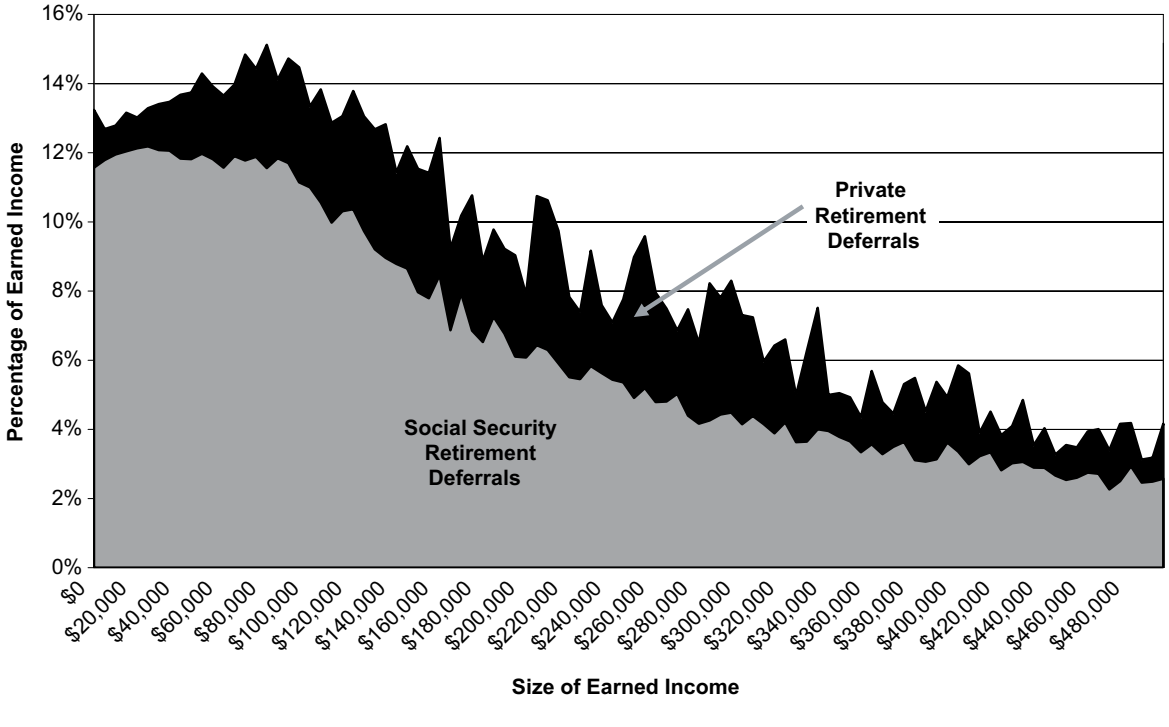
Figure 8—Retirement Deferrals as Percentage of Earned Income, by Size of Earned Income, 2003



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The Tax Year 1999-2003 Individual Income Tax Return Panel: A First Look at the Data

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This paper represents the Statistics of Income (SOI) Division's first release of data from its Tax Year 1999 Panel of Individual Income Tax Returns. A previous ASA paper explained the history and development of this panel so that only a brief review of the panel's history and design will be provided in this paper [1]. SOI's mission is to produce and publish data on the operation of the Federal tax system. Policy analysis and the development of recommendations on the operation of the tax system are not part of SOI's mission. SOI microdata files, tabulations, and articles are accepted as the nonbiased starting point for policy discussions by individuals of all ideological backgrounds. The fact that virtually all of SOI's published tabulations are based on cross-sectional samples where the sampling frames and sampling techniques are established and well-known certainly helps SOI fulfill this mission. The publication of tabulations based on panel samples, however, presents a more complicated situation as will be discussed later. The purpose of this paper is to work through some of those complications and to arrive at a series of panel tabulations that can be viewed in the same unbiased light as the more standard SOI tabulations. Already today, income tax return panels provide policy organizations such as the Treasury Department's Office of Tax Analysis (OTA) and Congress's Joint Committee on Taxation (JCT) with powerful policy analysis tools that are not available to researchers outside of those organizations. But it is not OTA or JCT's responsibility to provide voluminous amounts of tabular panel data to the public; it is SOI's responsibility, and this paper is hopefully a first step in meeting that responsibility.

▶ Background

Each year, the Statistics of Income Division produces a sample of individual income tax returns. The Tax Year 1999 sample included 176,966 returns sampled in 92 stratifications. The sampling rates ranged from 100 percent to .05 percent based on classifications of income and the type of forms and attachments included on each return [2]. The 1999 Edited Panel is an 83,434-return subsample of the 1999 cross-sectional sample. The 1999 Edited Panel contains only 21 stratifications with sampling ranging from 100 percent to .05 percent.

The base year of this panel represents a sample of tax returns. Subsequent years represent a sample of the returns filed by individuals listed as taxpayers on the 1999 base year return. This is a significant difference because it means that the base year sample unit can break apart into two returns through divorce or double the number of individuals in the unit through marriage. Even worse, a unit can divide into two returns through divorce and then, through a second marriage for each original taxpayer, end up representing four individuals. It is these changes that present problems in tabulating, presenting, and interpreting income tax return panel data.

▶ Potential Solutions

One solution to the changing marital status problem is to follow only the primary taxpayer listed on the tax return. The main problem with this approach is that approximately 95 percent of primary taxpayers listed on jointly filed returns are male, and, thus, a significant gender bias would be introduced into any analysis.

Another possible solution to the changing filing status problem would be to follow both the primary and secondary taxpayers separately. The main problem with this approach is the complexity involved in trying to divide up income between the primary and secondary taxpayers on jointly filed returns. Even if the income could be divided correctly, the act of doing so has implications. For example, do married individuals make independent or joint economic decisions? If their incomes are divided, how is the joint decisionmaking aspect retained in the data?

Finally, another possible solution is to simply examine only those panel units where the marital status has not changed. The main problem with this approach is that it excludes all taxpayers who, during the course of

the study, either get married, divorced, or had a spouse die. If changes in a taxpayer's marital status or the death of a spouse affect his or her economic well-being and decisionmaking process, then that information is lost under this approach.

Obviously, none of these solutions is really adequate, and perhaps the best solution is to utilize all three and compare the results. Unfortunately, such an exercise is beyond the scope of this paper. But given time and resource constraints, and the basic structure of the panel, the easiest and quickest solution to implement is the third solution: examine only those panel units where the filing status has not changed.

▶ An Analysis of Panel Units That Did Not Change Marital Status from 1999 to 2003

The first step is to subset the file to only those panel units where there are returns present for all 5 years of the study. This is not a required step in analyzing panel data. For example, one might want to examine only two points in time, 1999 and 2003, in which case the file would only need to be subset to returns where both of those years were present. But for this paper, the 5-year average Adjusted Gross Income (AGI) is computed and used in subsequent tables, and, in order to keep the basis for all tables consistent, only panel units with returns present for all 5 years will be used. (Another solution would be to impute missing returns, but that is beyond the scope of this paper.)

As Figure 1 shows, in 1999, the panel contained an estimated 127 million returns or panel units. But, as of 2003, only 106 million panel units had filed returns for all 5 years. Where did the 21 million panel units go? First, any single taxpayer who died during this time period obviously is part of the 21 million missing units, as are any 1999 filers who no longer met the filing threshold for any or all of the subsequent years. Another portion represents taxpayers who should have filed a return but did not. Often, these taxpayers file, but do so in a subsequent calendar year. Roughly 3 percent of the returns filed each year are for a previous tax year. In other words, the returns are eventually filed with the IRS, and generally within 2 years of the due date. Because of the way returns are selected for this panel, these returns will eventually be sampled and included in the panel file. But this presents SOI with an interesting publication issue. Should the tabulation of panel data be held up for 2 years while we await the addition of 3 percent of 1 year's data? For example, the file used for this paper is only complete for the period 1999 to 2001. This is a topic for further research.

Figure 1—Derivation of 1999-2003 Edited Panel Sample Used in Subsequent Tabulations

TaxYear	At least one return present in all years (1)	Column (1) and only one return present in each year (2)	Column (2) and the same marital status in all years (3)
1999	127,029,487	127,029,487	127,029,487
1999 through 2000	120,887,311	119,794,388	114,807,823
1999 through 2001	115,810,399	113,770,493	104,860,374
1999 through 2002	111,048,409	108,251,388	96,043,680
1999 through 2003	105,938,164	102,549,251	87,617,774

Notes: * 2002 and 2003 data are for returns received by IRS through Calendar Year 2004.
Additional returns for 2002 and 2003 were filed in Calendar Years 2005 and 2006.
* Married filing separately returns have been removed in columns 2 and 3 to simplify processing.
* Base-year prior-year returns (approximately 9,000 weighted returns) have been removed.
* Base-year single panel members who married another panel member in a subsequent year (approximately 4,000 weighted returns) have been removed.

The second step is to subset the file to those panel units where a return is filed in every year and only one return is filed each year. As is shown in Figure 1, by 2003, this step removes another 3.4 million returns from the panel. These 3.4 million returns generally represent joint filers who divorced and where each taxpayer now files independently of his or her former spouse and couples who on at least one occasion during this 5-year period filed using a marital status of married filing separately. Note that it is possible to add items from a married couple's two married filing separately returns to generate a combined return, but this process was not undertaken for this paper.

The final step is to subset the file to those panel units where a return is filed in every year and only one return is filed each year and where the marital status does not change. As Figure 1 shows, 14.9 million panel units were removed in this step. Only 87.6 million panel units remain. They generally consist of taxpayers who married during the 1999-2003 period or married couples where one of the spouses died during this period.

As Table 1 shows, in order to create the database that will be used for the subsequent tabulations in this paper, 31 percent of the panel units or base year returns, accounting for 19.4 percent of base year AGI, have been removed. Further research must be conducted to understand the impact of removing these panel units, including answering an important fundamental question: is it even legitimate to produce tabulations where 31 percent of the units have been removed. And if so, what data about the 31 percent should also be presented?

▶ 1999-2003 Edited Panel Tables

Table 2 is probably the most basic and straightforward panel tabulation that it is possible to produce. It is produced using the 87.6 million weighted panel units where each panel unit filed one and only one return for each year of the 5-year period under study and where each panel unit maintained the same marital status for the entire 5-year period. The panel units are classified by the AGI shown on the 1999 return and by the AGI shown on the 2003 return. The 2003 AGI amounts, as well as all other amounts shown in this paper, have been deflated to 1999 levels using the price deflator applied in other SOI Individual taxation data [3].

It should be noted that returns filed by dependents are included in Table 2. If an individual can be claimed as a dependent by another taxpayer, yet has income sufficient to require the filing of a return, the individual is required to file a tax return that is separate from the return on which he or she was claimed as a dependent. In the sample design of this panel, as in the standard SOI individual cross-sectional samples, no attempt was made to create a separate sample stratum for dependent returns. Thus, if sampled, a dependent return represents a unique panel unit as does the return, if sampled, on which that individual was listed as a dependent. Dependents, however, may exhibit significant income changes when they move from dependent status to independent tax filer. For example, a college student earning $4,000 a year at McDonald's may graduate and earn $40,000 in his or her first professional job. In Table 2, this situation cannot be separated from the case of an adult who is 35 years old and supporting a family who moves from an income of $4,000 in 1999 to $40,000 in 2003. Consequently, Table 3 excludes returns filed by base year dependents. This eliminates another 7.2 million panel units. But as can be seen from comparing both tables, the reduction in panel units is almost exclusively in the $1 under $10,000 AGI class.

A possible concern with Table 3 is that it only presents two points in time. A taxpayer may have earned $50,000 in 1999 and $50,000 in 2003 indicating no real change in income. But what if the taxpayer earned only $10,000 in 2000, 2001, and 2002? The 5-year average income is significantly different than the income at the beginning and the end points of the study period. Consequently, Table 4 is classified by the 1999 AGI and by the 5-year average AGI (in 1999 dollars). As mentioned earlier in the paper, Table 4 is the reason why, in constructing the database of panel units to be used in this study, only panel units where a return was filed for the entire 5-year period were used. As noted earlier, another alternative would be to ease this restriction and develop an imputation method for the missing data. Such an approach was beyond the scope of this paper but should be explored in future research. Imputations of this nature

may become essential as the panel ages and more panel units are found to be missing at least one return over the course of the study and thus reducing the number of panel units available for tabulations such as Table 4. Finally, another way to present the 5-year average AGI is in terms of the percentage change from the 1999 AGI. This has been done in Table 5.

▶ Endnotes

[1] Weber, Michael (2005), "The 1999 Individual Income Tax Return Edited Panel," 2005 Proceedings of the American Statistical Association, Social Statistics Section, Government Statistics Section, American Statistical Association, Alexandria, VA.

[2] For additional information on the sample design of the annual Complete Report sample, see Internal Revenue Service, Statistics of Income Individual Income Tax Returns, Publication 1304 (1999), "Section 2: Description of Sample."

[3] AGI is shown in constant dollars, calculated using the U.S. Bureau of Labor Statistics consumer price index for urban consumers. U.S. Department of Labor, Bureau of Labor Statistics, Monthly Labor Review.

Table 1—1999-2003 Full Edited Panel and Limited Edited Panel Differences

Size of AGI	Full 1999-2003 Edited Panel		Limited 1999-2003 Edited Panel	
	Number of Returns	Amount of AGI	Number of Returns	Amount of AGI
No adjusted gross income	1,016,365	-49,057,319	547,216	-35,182,329
$1 under $10,000	26,210,180	132,336,387	13,381,189	70,987,103
$10,000 under $20,000	23,966,960	357,434,358	14,953,415	224,834,852
$20,000 under $30,000	18,359,111	453,687,690	12,513,685	309,450,548
$30,000 under $40,000	13,368,846	464,230,987	9,700,429	337,085,999
$40,000 under $50,000	9,812,207	438,993,580	7,584,758	339,966,538
$50,000 under $75,000	16,897,458	1,031,747,639	13,882,868	849,235,065
$75,000 under $100,000	7,755,507	666,429,881	6,653,302	572,107,910
$100,000 under $200,000	7,188,685	944,083,593	6,271,959	825,602,106
$200,000 under $500,000	1,891,017	546,818,812	1,640,006	475,056,961
$500,000 under $1,000,000	355,710	241,057,746	309,944	210,134,851
$1,000,000 under $1,500,000	88,847	107,343,480	76,779	92,732,047
$1,500,000 under $2,000,000	38,160	65,801,348	33,102	57,095,640
$2,000,000 under $5,000,000	57,547	172,372,870	49,710	148,937,801
$5,000,000 under $10,000,000	14,176	97,281,129	12,123	83,216,258
$10,000,000 or more	8,711	215,765,177	7,289	181,949,562
Total	127,029,487	5,886,327,358	87,617,774	4,743,210,912

Size of AGI	Difference		Percentage Difference	
	Number of Returns	Amount of AGI	Number of Returns	Amount of AGI
No adjusted gross income	469,149	(13,874,990)	46.2%	28.3%
$1 under $10,000	12,828,991	61,349,284	48.9%	46.4%
$10,000 under $20,000	9,013,545	132,599,506	37.6%	37.1%
$20,000 under $30,000	5,845,426	144,237,142	31.8%	31.8%
$30,000 under $40,000	3,668,417	127,144,988	27.4%	27.4%
$40,000 under $50,000	2,227,449	99,027,042	22.7%	22.6%
$50,000 under $75,000	3,014,590	182,512,574	17.8%	17.7%
$75,000 under $100,000	1,102,205	94,321,971	14.2%	14.2%
$100,000 under $200,000	916,726	118,481,487	12.8%	12.5%
$200,000 under $500,000	251,011	71,761,851	13.3%	13.1%
$500,000 under $1,000,000	45,766	30,922,895	12.9%	12.8%
$1,000,000 under $1,500,000	12,068	14,611,433	13.6%	13.6%
$1,500,000 under $2,000,000	5,058	8,705,708	13.3%	13.2%
$2,000,000 under $5,000,000	7,837	23,435,069	13.6%	13.6%
$5,000,000 under $10,000,000	2,053	14,064,871	14.5%	14.5%
$10,000,000 or more	1,422	33,815,615	16.3%	15.7%
Total	39,411,713	1,143,116,446	31.0%	19.4%

Table 2—Tax Year 1999 filers present in 2000, 2001, 2002, and 2003 with no change in marital status by 1999 AGI class and 2003 AGI class in 1999 dollars

1999 AGI Class	2003 AGI Class Number of Returns Total	No AGI	$1 under $10,000	$10,000 under $20,000	$20,000 under $30,000	$30,000 under $40,000	$40,000 under $50,000	$50,000 under $75,000	$75,000 under $100,000
No adjusted gross income	547,216	214,867	102,604	61,466	40,622	35,825	22,864	30,292	10,536
$1 under $10,000	13,381,189	323,254	6,080,426	4,256,066	1,739,812	560,508	191,054	177,047	30,662
$10,000 under $20,000	14,951,380	162,757	2,767,133	6,933,350	3,317,825	1,053,740	401,280	230,442	45,944
$20,000 under $30,000	12,513,684	92,699	963,453	2,558,577	4,851,252	2,620,841	769,204	495,761	97,250
$30,000 under $40,000	9,700,429	53,742	428,201	965,912	1,927,920	3,214,677	1,843,690	1,043,636	150,678
$40,000 under $50,000	7,584,758	43,461	220,012	457,085	705,715	1,416,150	2,228,147	2,162,117	262,504
$50,000 under $75,000	13,882,868	52,788	224,307	444,776	678,126	1,067,007	1,861,221	6,739,803	2,222,558
$75,000 under $100,000	6,653,302	31,444	82,435	123,614	184,404	205,300	346,463	1,700,573	2,591,549
$100,000 under $200,000	6,271,958	38,883	66,738	76,925	109,986	132,428	182,893	692,323	1,146,460
$200,000 under $500,000	1,640,006	31,180	12,752	20,562	25,463	20,003	20,508	91,604	104,496
$500,000 under $1,000,000	309,944	8,161	2,629	3,949	1,908	2,698	3,565	12,991	9,220
$1,000,000 under $1,500,000	76,779	2,259	750	733	450	1,412	959	2,428	1,855
$1,500,000 under $2,000,000	33,102	1,405	225	676	468	450	225	1,195	953
$2,000,000 under $5,000,000	49,710	2,340	468	540	631	475	833	1,256	1,465
$5,000,000 under $10,000,000	12,123	872	70	143	127	207	84	375	312
$10,000,000 or more	7,289	635	17	53	37	47	54	127	131
Total	87,615,738	1,060,748	10,952,219	15,904,426	13,584,747	10,331,771	7,873,045	13,381,971	6,676,572

1999 AGI Class	2003 AGI Class Number of Returns $100,000 under $200,000	$200,000 under $500,000	$500,000 under $1,000,000	$1,000,000 under $1,500,000	$1,500,000 under $2,000,000	$2,000,000 under $5,000,000	$5,000,000 under $10,000,000	$10,000,000 or more
No adjusted gross income	15,653	7,457	3,382	253	875	342	153	27
$1 under $10,000	14,322	7,982	56	-	-	-	-	-
$10,000 under $20,000	33,182	4,994	728	-	-	5	-	-
$20,000 under $30,000	47,811	14,661	2,170	5	-	-	-	-
$30,000 under $40,000	63,304	8,651	17	-	-	-	-	-
$40,000 under $50,000	78,236	9,153	-	2,177	-	-	-	-
$50,000 under $75,000	549,973	35,273	6,861	170	-	5	-	-
$75,000 under $100,000	1,311,996	68,024	5,471	2,030	-	-	-	-
$100,000 under $200,000	3,354,523	438,767	23,075	6,785	2,173	-	-	-
$200,000 under $500,000	501,362	678,530	109,881	11,920	5,039	6,644	49	12
$500,000 under $1,000,000	43,631	97,450	89,525	19,717	6,552	5,668	1,247	1,031
$1,000,000 under $1,500,000	8,873	17,849	19,466	9,878	4,195	5,007	588	78
$1,500,000 under $2,000,000	4,008	5,833	4,990	4,937	3,084	3,532	748	372
$2,000,000 under $5,000,000	4,605	7,173	7,306	4,783	4,720	10,053	2,175	887
$5,000,000 under $10,000,000	904	1,691	1,081	850	638	2,280	1,802	686
$10,000,000 or more	436	849	622	380	299	988	960	1,653
Total	6,032,817	1,404,338	274,631	63,886	27,575	34,525	7,721	4,746

Table 3—Nondependent Tax Year 1999 filers present in 2000, 2001, 2002, and 2003 with no change in marital status by 1999 AGI class and 2003 AGI class in 1999 dollars

1999 AGI Class	2003 AGI Class Number of Returns Total	No AGI	$1 under $10,000	$10,000 under $20,000	$20,000 under $30,000	$30,000 under $40,000	$40,000 under $50,000	$50,000 under $75,000	$75,000 under $100,000
No adjusted gross income	496,602	195,761	87,897	57,329	36,345	34,034	18,587	28,153	10,536
$1 under $10,000	7,291,321	151,389	3,227,229	2,438,563	932,795	264,682	114,827	122,804	22,649
$10,000 under $20,000	14,138,652	144,810	2,564,971	6,730,330	3,128,836	937,373	345,113	214,340	39,967
$20,000 under $30,000	12,401,452	82,708	937,417	2,544,513	4,829,287	2,606,777	761,172	485,712	95,232
$30,000 under $40,000	9,658,255	47,747	408,131	959,854	1,925,940	3,208,625	1,843,690	1,041,619	150,678
$40,000 under $50,000	7,572,662	41,454	220,012	455,078	703,708	1,416,150	2,226,113	2,160,083	262,504
$50,000 under $75,000	13,866,782	50,781	220,367	444,776	676,097	1,067,007	1,861,221	6,733,728	2,220,524
$75,000 under $100,000	6,647,392	29,474	82,435	123,614	182,434	203,330	346,463	1,700,573	2,591,549
$100,000 under $200,000	6,263,968	36,913	66,738	74,955	109,986	132,428	182,893	690,242	1,146,460
$200,000 under $500,000	1,638,337	31,180	12,752	20,562	24,907	20,003	20,508	91,048	104,496
$500,000 under $1,000,000	308,924	8,161	2,459	3,779	1,908	2,698	3,565	12,652	9,051
$1,000,000 under $1,500,000	76,553	2,259	750	733	450	1,412	959	2,371	1,855
$1,500,000 under $2,000,000	32,989	1,405	225	676	468	450	225	1,139	953
$2,000,000 under $5,000,000	49,572	2,340	468	540	614	475	833	1,256	1,465
$5,000,000 under $10,000,000	12,113	872	70	143	127	207	84	375	312
$10,000,000 or more	7,286	635	17	53	37	47	54	127	131
Total	80,462,859	827,890	7,831,937	13,855,497	12,553,939	9,895,700	7,726,307	13,286,222	6,658,361

1999 AGI Class	2003 AGI Class Number of Returns $100,000 under $200,000	$200,000 under $500,000	$500,000 under $1,000,000	$1,000,000 under $1,500,000	$1,500,000 under $2,000,000	$2,000,000 under $5,000,000	$5,000,000 under $10,000,000	$10,000,000 or more
No adjusted gross income	15,653	7,274	3,382	253	875	342	153	27
$1 under $10,000	10,325	6,002	56	-	-	-	-	-
$10,000 under $20,000	29,184	2,996	728	-	-	5	-	-
$20,000 under $30,000	43,795	14,661	172	5	-	-	-	-
$30,000 under $40,000	63,304	8,651	17	-	.	-	-	-
$40,000 under $50,000	76,229	9,153	-	2,177	-	-	-	-
$50,000 under $75,000	549,973	35,273	6,861	170	-	5	-	-
$75,000 under $100,000	1,311,996	68,024	5,471	2,030	-	-	-	-
$100,000 under $200,000	3,352,553	438,767	23,075	6,785	2,173	-	-	-
$200,000 under $500,000	501,362	677,973	109,881	11,920	5,039	6,644	49	12
$500,000 under $1,000,000	43,461	97,450	89,525	19,717	6,552	5,668	1,247	1,031
$1,000,000 under $1,500,000	8,873	17,849	19,466	9,878	4,195	4,837	588	78
$1,500,000 under $2,000,000	4,008	5,777	4,990	4,937	3,084	3,532	748	372
$2,000,000 under $5,000,000	4,587	7,173	7,306	4,783	4,720	9,984	2,140	887
$5,000,000 under $10,000,000	899	1,691	1,081	850	638	2,280	1,797	686
$10,000,000 or more	436	849	622	380	299	986	959	1,653
Total	6,016,638	1,399,564	272,633	63,886	27,575	34,284	7,680	4,747

Table 4—Nondependent Tax Year 1999 filers present in 2000, 2001, 2002, and 2003 with no change in marital status by 1999 AGI class and average 1999-2003 AGI class in 1999 dollars

1999 AGI Class	1999-2003 Average AGI Class Number of Returns Total	No AGI	$1 under $10,000	$10,000 under $20,000	$20,000 under $30,000	$30,000 under $40,000	$40,000 under $50,000	$50,000 under $75,000	$75,000 under $100,000
No adjusted gross income	496,602	244,713	103,300	53,236	38,361	16,612	14,740	11,493	3,829
$1 under $10,000	7,291,321	77,293	3,733,190	2,783,108	502,121	122,257	40,331	22,531	4,288
$10,000 under $20,000	14,138,652	32,600	1,103,155	9,341,917	2,968,718	472,937	125,178	65,591	18,796
$20,000 under $30,000	12,401,452	6,453	92,175	2,054,290	7,156,297	2,465,181	425,060	158,102	26,034
$30,000 under $40,000	9,658,256	6,394	16,461	318,777	1,905,998	4,903,657	1,930,748	516,779	46,365
$40,000 under $50,000	7,572,662	4,796	6,173	77,148	448,226	1,434,585	3,551,698	1,926,940	98,253
$50,000 under $75,000	13,866,782	11,631	2,140	37,306	219,033	597,781	1,822,815	9,240,646	1,716,485
$75,000 under $100,000	6,647,392	177	556	8,136	25,391	96,145	147,910	1,577,060	3,755,049
$100,000 under $200,000	6,263,968	2,802	2,081	556	2,140	31,397	48,824	342,598	1,077,802
$200,000 under $500,000	1,638,337	4,541	766	619	1,113	2,098	3,194	15,341	35,019
$500,000 under $1,000,000	308,924	821	-	-	56	170	-	783	56
$1,000,000 under $1,500,000	76,553	12	56	-	-	-	-	-	-
$1,500,000 under $2,000,000	32,989	100	-	5	-	-	-	-	-
$2,000,000 under $5,000,000	49,572	215	56	5	-	-	-	17	-
$5,000,000 under $10,000,000	12,113	61	-	-	-	-	-	-	10
$10,000,000 or more	7,286	12	-	-	-	-	-	-	-
Total	80,462,860	392,619	5,060,111	14,675,103	13,267,454	10,142,820	8,110,499	13,877,882	6,781,986

1999 AGI Class	1999-2003 Average AGI Class Number of Returns $500,000 under $1,000,000	$1,000,000 under $1,500,000	$1,500,000 under $2,000,000	$2,000,000 under $5,000,000	$5,000,000 under $10,000,000	$10,000,000 or more	$100,000 under $200,000	$200,000 under $500,000
No adjusted gross income	260	262	39	107	116	12	4,628	4,894
$1 under $10,000	-	-	-	-	-	-	6,200	-
$10,000 under $20,000	170	-	-	5	-	-	7,486	2,098
$20,000 under $30,000	5	-	-	-	-	-	17,683	170
$30,000 under $40,000	17	-	-	-	-	-	12,503	556
$40,000 under $50,000	-	556	170	-	-	-	20,056	4,062
$50,000 under $75,000	-	-	5	-	-	-	201,309	17,629
$75,000 under $100,000	2,072	-	-	-	-	-	1,013,742	21,156
$100,000 under $200,000	11,365	81	2,030	-	-	-	4,405,489	336,803
$200,000 under $500,000	77,690	6,204	1,533	3,476	24	-	455,894	1,030,824
$500,000 under $1,000,000	139,607	22,584	4,134	4,335	1,216	25	11,977	123,159
$1,000,000 under $1,500,000	30,609	20,003	6,481	4,389	308	.	356	14,340
$1,500,000 under $2,000,000	9,257	8,023	5,487	5,117	505	242	79	4,174
$2,000,000 under $5,000,000	10,437	9,177	7,508	18,720	2,337	544	17	537
$5,000,000 under $10,000,000	46	1,109	1,835	4,949	3,306	765	-	31
$10,000,000 or more	-	11	15	2,116	2,054	3,069	-	5
Total	281,535	68,010	29,238	43,214	9,867	4,658	6,157,419	1,560,438

Table 5—Tax Year 1999 nondependent filers present in 2000, 2001, 2002, and 2003 with no change in marital status by 1999 AGI class and average 1999-2003 AGI class in 1999 dollars

1999 AGI Class	1999-2003 Average Indexed AGI Percentage Change from 1999 AGI (Negative)					Total
	-100%	75%-100%	50%-75%	25%-50%	0 .1-25 %	
$1 under $10,000	77,293	14,570	88,039	318,916	1,034,061	7,291,321
$10,000 under $20,000	32,600	12,008	171,947	1,116,009	4,184,732	14,138,652
$20,000 under $30,000	6,453	13,994	172,635	1,051,765	3,960,772	12,401,452
$30,000 under $40,000	6,394	8,433	163,984	827,310	3,446,821	9,658,256
$40,000 under $50,000	4,796	10,187	117,338	659,362	2,753,416	7,572,662
$50,000 under $75,000	11,631	6,914	263,230	1,052,621	5,507,597	13,866,782
$75,000 under $100,000	177	8,692	152,127	571,149	2,782,426	6,647,392
$100,000 under $200,000	2,802	10,159	231,935	822,798	2,457,690	6,263,969
$200,000 under $500,000	4,541	13,940	125,620	363,488	554,625	1,638,337
$500,000 under $1,000,000	821	5,717	47,946	72,676	87,984	308,924
$1,000,000 under $1,500,000	12	2,841	18,023	18,383	16,747	76,553
$1,500,000 under $2,000,000	100	2,312	8,540	7,411	6,094	32,989
$2,000,000 under $5,000,000	215	4,484	14,488	10,533	9,042	49,572
$5,000,000 under $10,000,000	61	2,058	3,835	2,263	1,572	12,113
$10,000,000 or more	12	1,832	2,199	1,234	853	7,286
Total	147,906	118,139	1,581,886	6,895,918	26,804,431	79,966,259

1999 AGI Class	1999-2003 Average Indexed AGI Percentage Change from 1999 AGI (Positive)				
	0 .1-25 %	25%-50%	50%-75%	75%-100%	100%
$1 under $10,000	1,178,392	952,202	637,414	542,640	2,447,793
$10,000 under $20,000	4,650,586	1,884,650	929,415	486,283	670,422
$20,000 under $30,000	4,973,418	1,385,268	438,329	175,801	223,016
$30,000 under $40,000	3,894,720	880,707	255,018	81,405	93,464
$40,000 under $50,000	3,289,105	523,171	116,643	57,437	41,206
$50,000 under $75,000	5,958,052	781,723	152,324	62,679	70,011
$75,000 under $100,000	2,684,583	303,025	74,243	24,924	46,047
$100,000 under $200,000	2,169,316	343,000	88,947	50,879	86,443
$200,000 under $500,000	361,686	110,951	52,451	18,622	32,412
$500,000 under $1,000,000	49,727	17,816	7,575	6,455	12,208
$1,000,000 under $1,500,000	9,823	3,943	2,999	1,008	2,775
$1,500,000 under $2,000,000	3,828	1,848	829	509	1,519
$2,000,000 under $5,000,000	4,661	2,541	1,235	615	1,758
$5,000,000 under $10,000,000	1,150	558	199	116	300
$10,000,000 or more	564	256	113	57	166
Total	29,229,611	7,191,660	2,757,735	1,509,432	3,729,540

Note: This table exclude filers with "No adjusted gross income" for Tax Year 1999.

Creativity and Compromise: Constructing a Panel of Income and Estate Tax Data for Wealthy Individuals*

Barry W. Johnson and Lisa M. Schreiber, Internal Revenue Service

The Statistics of Income Division (SOI) of the IRS collects statistical data from all major Federal tax and information returns that are used by both the Congressional and Executive branches of the Government to evaluate and develop tax and economic policy. Among these are annual studies of Form 1040, *U.S. Individual Income Tax Return,* and Form 706, *United States Estate (and Generation–Skipping Transfer) Tax Return*.

Form 1040 is filed annually by individuals or married couples to report income, including wages, interest, dividends, capital gains, and some types of business income. In 1987, SOI undertook a major revision of the sample of Forms 1040 included in its annual studies in order to include a panel component, along with the usual cross-sectional sample. Cross-sectional samples provide reliable coverage of population totals and support annual budget projections as well as a wide range of other research; panels are more useful for estimating behavioral responses to hypothetical tax law changes. The new sample design was created to include all members of a tax family (primary and secondary filers and their dependents) in the panel, and represented the cohort of tax families filing returns in 1988 for Tax Year 1987. It included 39 strata based on income, filing status, and total receipts from businesses and farms (see Czajka and Schirm, 1991; Schirm and Czajka, 1991). For the base year, the initial SOI Form 1040 sample included 114,700 returns, 88,000 of which were panel members, not counting returns filed by dependents, which were added at a later time.

In 1994, the sample for SOI's annual estate tax studies was changed so that data from any Form 706 filed for a deceased 1987 Family Panel member would be collected. A Federal estate tax return, Form 706, must be filed for every U.S. decedent whose gross estate, valued on the date of death, combined with certain lifetime gifts made by the decedent, equals or exceeds the filing threshold applicable for the decedent's year of death. The return must be filed within 9 months of a decedent's death, although a 6-month extension is often requested and granted. All of a decedent's assets, as well as the decedent's share of jointly owned and community property assets, are included in the gross estate for tax purposes and reported on Form 706. Also reported are most life insurance proceeds, property over which the decedent possessed a general power of appointment, and certain transfers made during life. Assets are valued on the day of the decedent's death, although an estate is also allowed to value assets on a date up to 6 months after a decedent's death if market values decline. Special valuation rules and a tax deferral plan are available to an estate that is primarily composed of a small business or farm. Expenses and losses incurred in the administration of the estate, funeral costs, the decedent's debts, bequests to a surviving spouse, and bequests to qualified charities are all allowed as deductions against the estate for the purpose of calculating the tax liability.

▶ The Tax Family Concept

The initial unit of observation for the SOI 1987 family panel was defined as a tax family, which included a taxpayer, spouse, and all dependents (not limited to children) claimed by either. Thus, a tax family could represent single filers (widowed, divorced or separated, or those who were never married), as well as married filers and their dependents. Dependents did not need to live in the same household as the parent to be included in the tax family; however, information on dependents whose incomes fell below the filing threshold was generally not available unless reported on the parent's return. Coresident family members who were not claimed as dependents were not included in the tax family. An interesting complication of the tax family concept is the treatment of married couples who, for various reasons,

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elected to file separately. For the purposes of the SOI panel, only the partner whose separately filed return was selected into the sample in 1988 was included in the panel; the only way for both spouses of a married couple filing separately in 1988 to have been permanently included in the family panel was for returns filed by each spouse to have been independently selected. Thus, the tax family differs significantly from the more common "household" measure used by many national surveys (Czajka and Schirm, 1993) [1].

▶ The Data

Between 1987 and 2004, there were 6,614 Federal estate tax returns filed for 1987 Family Panel members or visitors [2]. Of these, 5,659 estate tax returns were identified as having been filed for permanent 1987 Individual Family Panel members who died between 1994 and 2004 [3]. These 5,659 decedents form the core of the SOI Family Panel Decedent Data Set (FPDD) [4].

Individual income tax data were collected by SOI for the 1987 Family Panel from Tax Year 1987 through Tax Year 1996. SOI data consist of both the set of data items that are collected for administrative processing of Form 1040 and all attachments, as well as many more detailed data items required for complex statistical and economic analysis of taxpayer behavior. In addition, data collected by SOI are extensively tested and adjusted to minimize nonsampling error related to taxpayer mistakes and errors introduced during the data transcription process. For tax years after 1996, SOI continued to collect administrative data related to the Family Panel members, but due to problems of panel drift decided to discontinue SOI processing of panel member returns, electing instead to develop new panels based on lessons learned from this initial exercise. The most convenient source of the administrative data for 1997 to 2004 is the Compliance Data Warehouse (CDW) maintained by the IRS Office of Research. The CDW houses, among other things, a complete archive of administrative data for Form 1040 and selected attachments in a normalized relational database. Its primary purpose is generalized statistical research on taxpayer behavior, so that very little information which can be used to identify individual taxpayers is available. In fact, only a four-digit name control and a masked Social Security number (SSN) for the primary filer of a return are available to most users of this dataset. Special permission was required to gain access to tables that link the actual SSN with the masked version. Combining data from SOI and the CDW, a total of 72,373 income tax returns filed for Tax Years 1987-2003 were available for the FPDD.

Ideally, an income tax return would be available for every tax period between 1987 and a decedent's year of death. For 98.2 percent of decedents, this was the case. For 1.3 percent of all decedents, only 1 return was missing from the time series 1987 through the last full year prior to death, leaving only a handful of decedents for whom more than 1 return was missing from the panel [5].

A panel sample of income tax filers, the elements of which have at their core two common factors, that of being sampled based on 1987 reported income and that of having an estate tax return filed sometime after that, poses interesting analytical challenges. Two of these relate to selecting appropriate reference periods and determining how to treat changes in tax family composition over time. In addition, the selection criteria for inclusion in the FPDD changed during the sample period due to changes in the estate tax filing threshold, which ranged from $600,000 in gross assets in 1994 to $1.5 million in 2004. Another important consideration is that only a decedent's share of a married couple's assets is reported on an estate tax return, while income tax returns for married couples who file jointly report income attributable to both partners. Because income tax data were obtained from two different sources, there are also variations in the available data items from different tax years, subtle differences in data definitions, and differences in data quality. Finally, with a few exceptions, only income subject to taxation is reported on a tax return, and that reported income may be subject to both accidental and intentional misreporting by the taxpayer.

The FPDD includes individual income tax data for Tax Period 1987 for all sampled tax families by definition. It also includes an estate tax return for at least one member of each tax family. This suggests two relevant reference periods for research purposes, either 1987 or the year of death reported on the estate tax return. Selecting 1987 as the reference period is advantageous for

some research because the probability of being selected into the file is known, making it theoretically possible to produce population estimates from the file. However, since wealth valuation data in the file are for deaths between 1994 and 2004, the time series of income data vary from about 7 years to 17 years, which might be limiting for certain types of analysis.

Because one of the prime features of the FPDD is the connection of income to wealth, the date of death—that is, the date for which wealth data are available—is also an attractive reference period. The income stream that would be most relevant in this case would be income reported in the years immediately prior to death. Focusing on income in this way would be appropriate for studying changes in income sources and savings habits as individuals approach the end of their lives, and analyzing the relationship between wealth and realized income. Given that years of death in the FPDD range from 1994-2004, a disadvantage of this approach is the difficulty of controlling for intertemporal differences in economic conditions that affect rates of return and therefore influence portfolio allocation decisions. This dynamic nature of portfolio allocation decisions, often indicated by the realization of capital gains, also makes it difficult to align income earned in one period with assets observed in another, even when the two periods are relatively close.

Longitudinality introduces problems with the tax family concept because, over time, a filing unit may change composition, which is usually accompanied by changes in filing status (Czajka and Radbill, 1995). For example, married persons divorce, single persons marry, couples who customarily file jointly may elect to file separately and vice versa, dependent filers may file independently, or one spouse of a married couple may die. Tax families for married persons can be particularly complex. As a result, an individual might appear in the panel as: a primary filer on a joint return married to an original panel member or visitor (spouse who entered the panel after 1988); a married primary filer on a separate return whose spouse may or may not be in the panel; a secondary filer on a joint return (married to an original panel member or to a visitor); and as a single filer. The longer the time series is carried forward, the greater the possibility for combinations of these events to occur. There are a number of strategies for handling these changes in tax family composition. The most straightforward is to limit analysis to only those filing units that do not change over time. However, this approach tends to introduce a bias since the more stable filing units will tend to have more stable incomes. A second approach is to focus analysis on person level data, imputing income for each individual in the tax family.

Figures 1 and 2 show panel members grouped into two broad categories, single filers and joint filers, in order to examine changes in filing status over time [6]. Looking first at each panel member's filing status in 1987, Figure 1 shows that, overall, filing status changed for 24.6 percent of all filers between 1987 and the year prior to death [7]. There was slightly more stability for single filers, only 15.2 percent of whom filed a joint return at some point during the period; 26.4 percent of joint filers became single filers sometime between 1987 and death. Figure 2 shows each panel member's filing status in the year prior to death and compares it to income tax returns filed for earlier tax periods. Only filers for whom a Form 1040 was available for at least 7 years prior to death were included in the figure [8]. Using this criterion, filing status was constant for 85.1 percent of all panel members over the 7 years preceding death. Individuals who were single filers at death were much more likely to have changed filing status in the

Figure 1—Filing Status Stability, Using 1987 as Reference Year

Filing status	Return present 1987	Filing status unchanged 1987 to 1 year prior to death	
		Number	Percentage
Single	881	747	84.8
Joint	4,778	3,518	73.6
Total	5,659	4,265	75.4

Figure 2—Filing Status Stability Using Year of Death as Reference Year

Filing status	Return filed year prior to death	Number of years prior to death filing status unchanged			Percentage unchanged for 7 years
		3	5	7	
Single	1,865	1,586	1,370	1,186	63.6
Joint	3,744	3,681	3,630	3,588	95.8
Total	5,609	5,267	5,000	4,774	85.1

years preceding death than those who were joint filers. Only 63.6 percent of all individuals who were single filers in the year prior to death had been single over the 7 years examined, reflecting both couples for whom one spouse died and those who divorced or separated during the period. Almost 95.8 percent of individuals who were joint filers at death had been married for at least the previous 7 years.

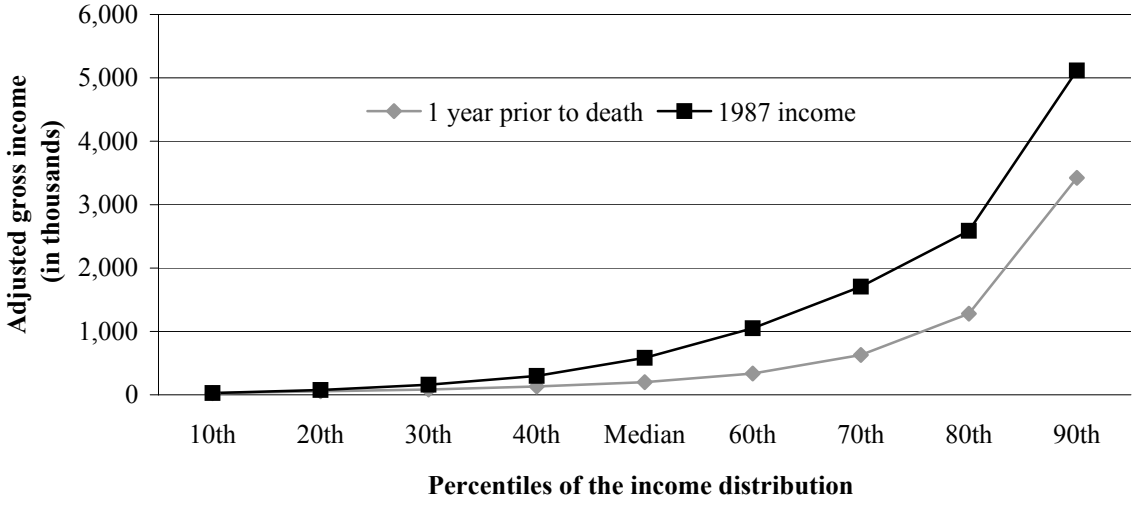
▶ Descriptive Statistics

Despite the limitations and challenges discussed in the previous section, the FPDD gives a unique opportunity to learn more about the way that incomes change as people age and contemplate the end of their lives and also provides a snapshot of the wealth that was the source of a portion of that income. This section briefly describes individuals in the FPDD. For this analysis, filing units are again examined in two broad groups, single filers and joint filers, all estimates are unweighted, and all money amounts have been converted to constant 2001 dollars [9].

There are 5,659 decedents in the FPDD. In 1987, the base year of the panel, 881 were single filers, 48.2 percent of whom were female. The majority, 64.3 percent, of the 4,778 panel decedents who were joint filers in 1987 were male. The mean and median ages of females in the FPDD were 65 and 66, respectively, in 1987 and 76 and 78 at death. The mean and median age for males in 1987 were 63 and 64, respectively, and 75 and 76 at death. These statistics indicate that many of the decedents in the FPDD were at or nearing retirement in 1987, the inception of the panel.

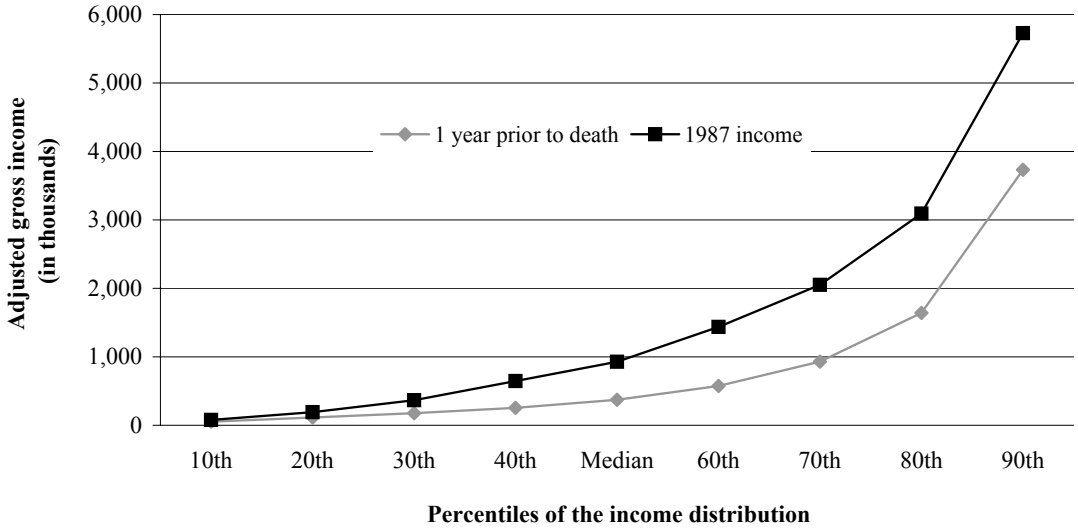
For all filing units whose filing status did not change between 1987 and the year prior to death, reported adjusted gross income (AGI) declined over this period, which is not surprising given that most individuals in the panel were transitioning from work into retirement over the period covered by the panel. For single filers, mean AGI declined from almost $2.0 million in 1987 to $980,000 at death. Figure 3 shows that this decline was an overall flattening and downward shift of the AGI distribution for these filers, with relatively little change for those in the lower percentiles and with the largest differences in the middle of the distribution. Median AGI, for example, declined from about $580,000 in 1987 to almost $200,000 in the year prior to death, a decrease of 65.6 percent. A similar pattern is shown in Figure 4 for joint filers, for whom mean AGI declined from $2.2 million to $1.7 million between 1987 and the death of

Figure 3—Income Distribution in 1987 and Year Prior to Death, Single Filers*



* Dollar amounts are unweighted and in constant dollars.

Figure 4—Income Distribution in 1987 and Year Prior to Death, Joint Filers*



* Dollar amounts are unweighted and in constant dollars.

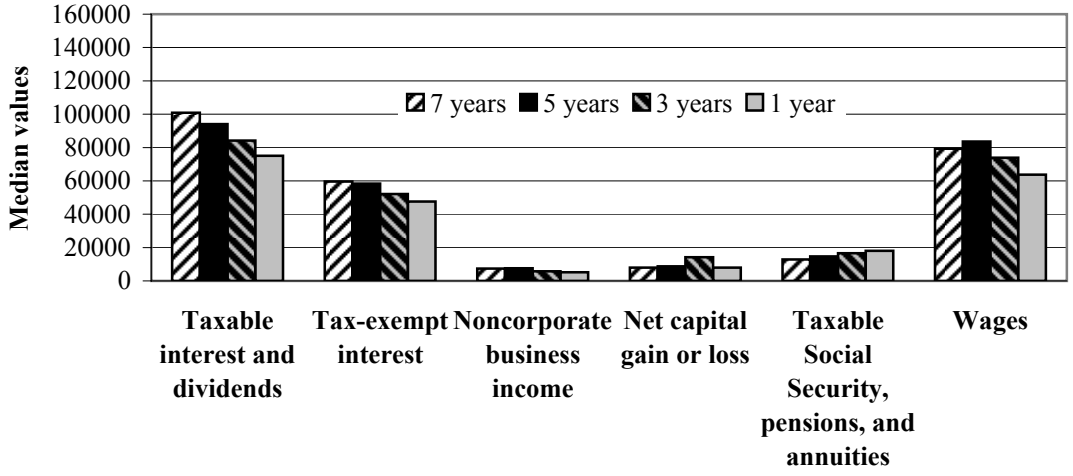
one partner. Median AGI for joint filers declined nearly 60.0 percent, from almost $930,000 to about $370,000, while AGI for those in the 90th percentile declined less over the period, about 35.0 percent.

Figures 5 and 6 decompose AGI into major components for selected years over the 7-year period preceding a panel decedent's year of death [10]. For single filers, overall, median values for wages, taxable interest and dividends, and income from noncorporate businesses decreased as individuals aged. Median values for tax-exempt interest, derived from investments in bonds issued by State or local governments, also declined, overall, for the 7-year period shown in Figure 5. However, for wealthier decedents, those with $5 million or more in gross assets at death, income from tax-exempt bonds increased over this period. For all single decedents, taxable Social Security, combined with pension and annuity income, increased over time, while gains from sales of capital assets were relatively stable.

Figure 6 shows that, while the income distributions for single and joint filers exhibit similar downward shifts over time, the sources of these declines differ between the two groups. For joint filers, income from wages, as well as interest and dividends from taxable investment assets, declined over the 7 years preceding the death of one spouse, but income from most other sources was either stable or increased over this period. Most notable was the relative stability in tax-exempt income for joint filers, overall. For the wealthiest joint filers, however, those where one spouse owned $10 million or more in gross assets at death, tax-exempt income increased by 40 percent over the period examined. For these wealthy filers, income from noncorporate businesses increased by almost 27.0 percent over time.

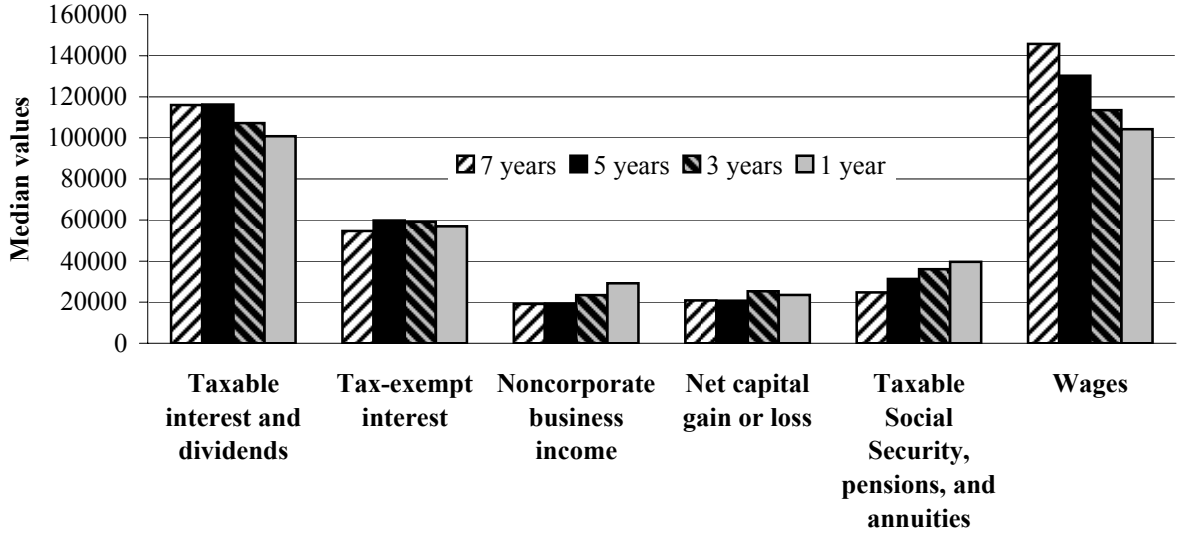
Figures 5-6 showed that, as panel members aged, the share that wage income contributed to AGI decreased, while the patterns of change in income from other sources varied somewhat, depending on filing status and wealth class. It has been noted that the realization of income derived from assets is a more or less voluntary event. Wealthy individuals, those for whom return on investments makes up a relatively large source of income, have the ability to allocate their portfolios in order to take maximum advantage of preferences built into the tax code, to reduce risk, and to vary income significantly according to their own consumption needs. According to Steuerle (1985), the voluntary nature of capital income recognition implies that "taxes paid and benefits received will vary tremendously among persons in fairly identical circumstances." He goes on to state that, because of the voluntary nature of income recognition, using income

Figure 5—Changes in Income Composition, Selected Years Prior to Death, Single Filers*



* Dollar amounts are unweighted and in constant dollars.

Figure 6—Changes in Income Composition, Selected Years Prior to Death, Joint Filers*



* Dollar amounts are unweighted and in constant dollars.

as a classifier in statistical analyses will be inaccurate or misleading for many purposes.

For many decedents, income reported on a tax return in the year prior to death will be closely correlated with the assets reported on an estate tax return filed at death [11]. It is, therefore, possible to estimate rates of return on various asset classes. Rates of return are estimated as income attributable to each class of assets as reported on Form 1040 and its attachments in the last year prior to death, divided by the value of those assets reported on Form 706. Figure 7 shows median values for estimated rates of return for all capital assets, for investment assets that produce taxable income, and for tax-exempt bonds. For single filers with gross assets under $1 million, the rate of return on capital was 4.27 percent. This rate declined for individuals in higher wealth classes, and was just 2.13 percent for single filers with $10 million in gross assets at death. Likewise, rates of return on investments that produced taxable interest or dividends declined with gross asset size. It is interesting to note, however, that the rate of return on tax-exempt investments was fairly stable for single filers, regardless of their wealth. These trends, when combined with those seen previously in Figures 5 and 6, suggest a systematic reordering of the portfolio, over time, favoring tax-exempt income sources over those that produce taxable income. For joint filers, rates of return show a similar pattern across wealth classes, although there was more variation across wealth categories for rates of return on tax-exempt bonds than was seen for single filers [12].

Figure 7—Selected Rates of Return One Year Prior to Death, by Size of Gross Assets

Asset	Size of gross assets	Single	Joint
Return on capital assets	All	2.74	2.84
	Under $1 million	4.27	4.31
	$1 million, under $5 million	3.27	3.52
	$5 million, under 10 million	2.40	2.48
	$10 million or more	2.13	1.85
Return on taxable bonds and stocks	All	2.92	2.15
	Under $1 million	3.83	3.01
	$1 million, under $5 million	3.08	2.37
	$5 million, under 10 million	2.58	2.20
	$10 million or more	2.65	1.77
Return on tax-exempt bonds	All	5.72	5.12
	Under $1 million	5.77	5.72
	$1 million, under $5 million	5.84	5.49
	$5 million, under 10 million	5.72	5.17
	$10 million or more	5.65	4.40

▶ Conclusion

Panel data consisting of income reported by wealthy taxpayers provide important opportunities to study the ways in which income changes over time. When paired with wealth data from Federal estate tax returns, the resulting data set provides a rare opportunity to learn more about the relationship of wealth to realized income, which is an important consideration in many public policy debates, and about changes in income that occur as people near the ends of their lives. These data, however, present many challenges to researchers, a number of which have been explored in this paper. Techniques for dealing with problems that arise due to the longitudinality of the data set, differences in reporting units on income and estate tax returns for joint filers, the dynamic nature of investment portfolios, and many other challenges must be explored before the full potential of the FPDD can be realized. However, the preliminary statistics presented in this paper suggest that there is much that can be learned by addressing these issues using even the most basic assumptions.

▶ Endnotes

[1] Dependents are not included in the analysis presented in this paper.

[2] Estate tax returns filed prior to 1994 were identified by matching panel member SSNs to the IRS Master File. Due to the limited amount of estate tax data available from the Master File for these pre-1994 decedents, they are not included in the FPDD.

[3] Estate tax returns were filed for an additional 57 panel members, but they were missing key documentation or schedules at the time of SOI processing and had to be rejected.

[4] Visitors to the panel were not included in the final dataset since income data were only available for

the period of time that they were associated with an original panel member.

[5] Missing returns can occur either because a taxpayer was not required to file in a given year, or because of an error in reporting a taxpayer's SSN. The latter occurred mainly in the case of secondary SSNs in the 1987 panel. After the period covered by this study, the IRS implemented processing improvements that have reduced these types of errors.

[6] The category "single" includes filers who were unmarried, widowed, and married individuals who elected to file separately since the data on these returns should reflect income attributable to one individual.

[7] The year prior to death is used because a return filed for the year of death would usually reflect income earned during only that portion of the year during which a decedent was alive.

[8] "Seven years" is used since that is the maximum number of full-year income tax returns that would be available for 1987 panel members who died in 1994.

[9] Values were converted to constant dollars using the GDP chain-type price index. Source: Bureau of Economic Analysis.

[10] Only those panel members whose filing statuses did not change over the 7 years preceding their years of death are included in Figures 5 and 6.

[11] In some cases, assets that generated income reported in the year prior to death may have been sold and the proceeds either consumed or invested differently prior to reporting on Form 706; however, no attempt to adjust the data was made for this analysis.

[12] For joint filers, asset values reported for the decedent spouse were doubled in an attempt to approximate the full value of a married couple's asset holdings. This approach will likely overstate the combined asset holdings, in aggregate, causing rates of return to be understated somewhat.

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2

Measuring, Monitoring, and Evaluating Internal Revenue Service Data

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Monitoring Statistics of Income (SOI) Samples

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For most of its 90-year history, the main function of the Statistics of Income (SOI) Division has been the collection of information for the Department of Treasury and Congress [1]. One of the beneficial practices of a Federal statistical agency, according to the Committee on National Statistics, is its continual development of more useful and timely data, including operational statistics, the latter objective even noted in Internal Revenue Code 6108(a) [2]. SOI has sought ways to improve the quality and timeliness of its tax return information while fulfilling the requests of its primary customers. Over time, it incrementally improved not only the statistical abstraction of information from Federal tax returns, but also the statistical operations associated with producing such information. Moreover, among its various processing tasks, SOI identified the monitoring of its samples of returns from the point of selection to the point of delivery back to the warehouse storage facilities as an essential part of its strategy in achieving its mission.

Because SOI functions within a larger bureaucracy, one of its recurring challenges is coordination among the different staffs laboring at tasks at different phases of the SOI workflow process [3]. For example, in May 2006, the Internal Revenue Service (IRS) awarded a contract to a private company to manage the files function at the IRS submission processing centers [4]. This company will store and maintain all the paper documents taxpayers file at each center for an established period after the completion of IRS "pipeline" processing. It will ship the documents to one of the Federal Records Centers at the end of this period, and fulfill requests from IRS offices that need to examine tax and information returns for either administrative or statistical purposes [5]. SOI is one of the major "downstream" requesters of these stored documents since it produces its mandated annual income, financial, and tax information from weekly samples of Federal tax and information returns, which the IRS usually processes during the previous week [6].

A concern this particular competitive sourcing initiative raises is whether SOI will control within 2 weeks of selection all of the documents in its weekly samples, and not lose some of the returns to other IRS functions requesting *by chance* the same return [7]. On the other hand, the company may introduce new inventory methods or delivery techniques with benefits to SOI, such as interchanges of record information about the pulled returns with one of the SOI databases. Of course, this is not the first time SOI has faced a challenge associated with changes in the way the IRS accepts, controls, and processes tax and information returns. Differences in objectives frequently occur between "pipeline processing" and "postpipeline processing" functions, such as SOI. Ironically, the company will return to an earlier mode of operation SOI replaced through its Total Quality Organization (TQO) initiatives in the early 1990s, shipping "cycles" (or large groups) of returns to the SOI edit sites, instead of program-specific workgroups that SOI units in files supplied to the SOI edit unit editors [8].

This paper is a case study of the infrastructure SOI developed to monitor its samples and deal with unexpected events in a bureaucratic setting. It focuses on what happens after the SOI sampling programs select returns for a project (or study). In addition, it provides an account of the SOI efforts to improve the monitoring of its samples of Federal tax and information returns, part of a "Golden Age" in SOI history. Can regular monitoring of the returns in the various samples decrease the length of time SOI controls returns, or reduce the length of time it finds missing returns in the samples, or reduce the length of time it delivers data to its primary customers? Based on interviews, participant observations, documents, and physical information, the paper shows how SOI operating procedures and information databases, and coordination among different staffs, monitor and verify the control and timely processing of specific sets of returns. In the first section of the paper, we provide a brief historical perspective about SOI consolidation efforts and technological advances. Then, we describe the SOI workflow process in the second section. In the third section, we spell out some of the SOI statistical operations and procedures that systematically monitor the SOI workflow process. The fourth section looks at

the application of management and statistical concepts to the development of the SOI workflow process; and, then, we conclude with several findings and remarks on how SOI is shaping its future.

▶ Consolidation of Work and Technological Advances

SOI performed most of its preliminary statistical abstraction, data transcription, and error correction in National Office, district offices (after World War II for a period of time before the expansion in the number of service centers across the country), and the few service centers in operation, but moved operations to the centers as their number increased. Service centers not only processed but also began storing the paper returns in support of other IRS programs, such as Examination, before final consignment to one of the Federal Records Centers. IRS personnel at the different SOI sites, who were available to edit SOI samples once regular pipeline processing work subsided or ended, used paper edit and error register sheets to abstract information from the returns, while National Office analysts produced aggregate statistics and tables from the perfected data for customers [9].

In the 1980s, under the direction of Fritz Scheuren, SOI adopted the Total Quality Organization (TQO) methodology to improve its operations at the service centers and in National Office, primarily in response to a request from analysts in the Office of Tax Analysis (OTA) and Joint Committee on Taxation (JCT) for *earlier* deliveries of SOI data. SOI analysts identified vital activities and formed cross-functional teams to work on these issues. The staffs in the different branches in SOI National Office looked for ways to develop work processes and data systems that could improve the quality and timeliness of the tax return information they produced for each of the SOI programs within the boundaries of regular IRS pipeline processing. The research included traveling to the service centers to meet with employees for the purpose of identifying, prioritizing, and recommending improvements in SOI control and processing of returns in its various samples [10]. According to Scheuren, "[t]he focus on process quality that Deming and Juran urge, while not really new, is having a revolutionary impact on us, especially in its emphasis on continuous improvement or "Kaizen," as the Japanese call it…. Examples [include] more flexible and dynamic approaches to data capture, cleaning, and completion" [11].

From this analysis, Scheuren and others on his staff hypothesized that consolidating SOI editing operations at particular IRS service centers would free up resources (staffing, travel, and training), improve editing (abstraction) productivity and quality, and enhance its presence as a data producer within the community of Federal statistical agencies. In May 1990, SOI notified the now ten IRS service centers that it planned to consolidate edit processing for the SOI Corporation and Individual Tax Return programs in six service centers [12]. Four centers would only pull, control, and ship returns to one or more of the six processing centers (down to five in 1992) [13]. In general, the number of returns service centers processed for all of the SOI studies was much smaller than the volume of returns the centers processed for tax liability, administrative, and informational purposes. Competing with other functions for skilled tax examiners to work the SOI programs at the centers, as well as arguing about what IRS or SOI programs merited attention first, were frequent occurrences before the consolidation initiative.

Concentrating the editing function at six service centers led to the formation of additional units of SOI editors (former tax examiners and data transcribers) at some of these sites and the growth in the volume of available work at all the sites [14]. Most of these edit units were now dedicated to processing only the returns in SOI samples year round. SOI ensured the volume in each of the six processing centers was sufficient to support an SOI edit unit working full-time on SOI work. Besides the formation of SOI edit units, SOI created "SOI control units," at least in name, in each of the ten centers' files warehouses to support its edit units. After regular pipeline processing, each of the centers stored for about 2 years its portion of the total population of returns that filers mailed each year. An SOI control unit consisted of a small group of service center employees, usually working in a miscellaneous unit in the files, whose major tasks were the control, processing, and shipping of returns in SOI samples to the SOI edit units and refiling returns after edit units completed pro-

cessing these returns. SOI discovered a truly dedicated group of employees, who shared their files expertise and experience in searching for and finding missing returns, as well as assisting National Office analysts in finding additional information about certain returns [15].

While one National Office cross-functional team was working on the consolidation initiative, other teams were developing new online computer applications and installing new hardware at the centers, solely dedicated to SOI processing. Beginning in 1991, SOI procured and installed hardware upgrades and telecommunication equipment for support of online editing, at the Cincinnati and Ogden service centers, and in National Office. Telecommunication lines connected online terminals for the editors in each of the processing centers to the SOI minicomputers in Cincinnati and Ogden, designated SOI minicomputer hub sites. The integration of editing, data transcription, and error correction into a single operation with these online terminals began with several smaller SOI studies (Partnerships, Exempt Organizations, Controlled Foreign Corporations, Foreign Tax Credit, and Individual Sales of Capital Assets) and expanded to the major Corporation and Individual Returns programs. Online editing brought significant improvements in productivity, timeliness, and quality because editors spent much less time waiting for nightly batch-mode feedback on errors and corrections and much more time processing completely sets of the same type of return [16]. Groups of tax examiners became experienced subject-matter experts on how filers completed forms, as well as knowledgeable about the content of the forms in question. Having honed their skills from frequent and consistent editing of a large number of the same type of return, they accelerated processing and improved the quality of the final product—perfected and more meaningful return information [17].

The availability of returns to edit on a continuous flow basis was an important concern now that service centers increased the size of their SOI edit staffs, and in some cases improved the grade structure, to deal with the increase in the volume of work. Would the edit units have enough work? Would the editors' work habits outpace the delivery of new returns to process? Would waiting for work adversely affect the earlier training and skill levels of the editors? Managers in the SOI edit units identified one of the requirements for successful execution of the new plan as timely delivery of a sufficient amount of returns. Timely delivery of work supported the efforts of centers to commit employees to SOI projects the entire year, *so long as SOI work was available*. Consequently, another National Office team developed an online database application, called the SOI Automated Control System (SOIACS), to monitor, first the shipment of 1040 returns, then all returns [18]. A next-generation version of the application, now named STARTS, would facilitate the "systematic control" of 1040 returns some service centers would ship to other centers for edit processing, as well as the movement of returns between an edit unit and control unit within the same center [19]. Subsequently, when operational, the application had a computer terminal and printer located in the files of each of the ten service centers and the edit units [20]. It connected the control units with the edit units and both with National Office.

Soon after implementation of the application, an edit unit manager's need to know what returns to edit first (i.e., the editing priority) surpassed the need for timely delivery of returns because SOI began committing to deliver data to its customers by specific dates during the year. The centers needed meaningful information to answer this and other questions. For example, a question an SOI edit unit manager might raise is, "Which returns in the cycle (weekly pull) should we process first?" But a new SOI files clerk might ask, "If another IRS function has the return, can I pick another one on the same shelf (for SOI)?" SOI editors might ask, "What returns do I edit?" or "Where do I move this money amount?" An SOI National Office statistician might ask, "Can we ask the centers to locate the missing returns?" An SOI economist might ask, "Can the centers edit more of the Type XYZ returns (for example, Sample Code 20 or Cross-Sectional returns) before the deadline?" Finally, an SOI scanner might ask, "How do I replace the illegible page?" These questions demanded better monitoring not only of the physical location of the returns while en route to the edit units, but also better visualization of the metainformation of the returns—i.e., information that describes the information about a sampled return [21]. Now that SOI created an IT backbone to support its workflow process, managers asked for more details about what actually was in a cycle of returns [22].

▶ SOI Workflow Process

Compared to IRS administrative processing, which captures some information from all of the filed tax returns, SOI studies collect much more information from samples of returns through its transcription and editing. SOI editors add value to the administrative record information the IRS collects. This additional value makes it imperative to control and monitor the samples and continuously improve the entire SOI workflow process to guarantee consistency over time. Similarly, information about the processing tasks adds value to the corresponding returns that flow through the workflow process. The results of the efforts of the TQO teams in collecting information at each phase of the process about the processing tasks; the performers of these tasks; the relative order of the tasks; the possible synchronization of some of the tasks; the flow of information in support of the tasks; and the tracking of the tasks, was not only a better understanding of the process, but also a cache of aggregated information.

The SOI workflow process is the general term for the movement of samples of "documents" or "containers of information" (e.g., paper returns, electronic records, and digitized images), through the SOI sampling, controlling, and editing processes [23]. Each of these three major subprocesses, or phases, relate to specific tasks that personnel at the service centers and in National Office execute to produce statistics for publication and delivery to customers. Both operating procedures and computer systems support the efforts of the people involved at each of the phases of the process. This convergence of procedures, databases, and people forms an underlying base, or infrastructure, for the functioning of the workflow process.

The process begins when a project analyst adds a new tax or information form to an existing study or initiates a new study with an SOI customer. After the SOI sampling programs at the IRS computing center, or the Ogden Submission Processing Center, selects returns for a particular study, the programs then create sets of output files for loading into both IRS and SOI databases [24]. Phases of the process include selecting documents, pulling documents, monitoring the success rate of pulling documents, finding missing returns, storing documents, scanning documents, photocopying documents, ordering documents, shipping documents, editing documents, managing documents in the edit unit, and releasing documents back to files. The process involves constant change and update. For example, under the new competitive sourcing initiative, the SOI edit units at the centers will assume tasks the SOI control units once performed after the contractor begins managing the Files function at the centers. The infrastructure alleviates some of the problems associated with such a change.

▶ SOI Monitoring Operations

The Statistics of Income Automated Return Tracking System (STARTS) is the framework for management of returns and digitized records as they move through the various phases of the SOI workflow process at the centers. This process control system is a structured set of related components (people, procedures, processes, subsystems, databases, reports, etc.) SOI established to accomplish the major task of monitoring its samples from the point of selection to the point of delivery back to files. STARTS (the system) consists of online database applications, as well as standardized business processes, work instructions, forms, and reports, all of which give the different staffs at the centers and in National Office increased visibility into the operations at the centers.

The SOI sampling program, sample selection sheets, document chargeout forms, pulled returns, shelved returns, and shipped workgroups of returns, comprise part of a "signal" system for securing and delivering the correct returns in an SOI sample to the right service center for processing at the right time. The other part is the database, developed for predictable and manageable record keeping.

Database Management System

Borrowing from manufacturing operations, which schedule and track the flow of materials through a process, STARTS (the database application) gives online access to real-time data about one return, or a group of returns (cycles, workgroups, scanned sets, photocopied sets, etc.). Combining aspects of transaction processing, management information, decision support, and

expert systems, the database is a collection of information about SOI samples, which users manage and utilize when making decisions about planning, organizing, and controlling the processing of the samples [25]. Top-level managers are concerned with planning: Will the center meet the corporation program 75-percent cutoff on the scheduled date? Middle-level managers are concerned with organizing: Can the editors in Unit 5 handle the consolidated 1120 returns? Front-line managers are concerned with controlling: Are the editors; documents, scanned images, or electronic records; and inventory and edit applications available to begin editing the corporation returns?

Convergence of Aggregated Information

Because STARTS (the database application) stores sample information and provides a traceable record of user transactions or interchanges with that information, one example of its functioning is worth noting here. A section of the Internal Revenue Manual (IRM) notes the date the centers must supply transcribed and edited 1040 return information to National Office for "Advance Data" delivery to OTA and JCT. One year earlier, mathematical statisticians produced the sampling specifications for the computer specialists who wrote the programs that selected returns for the sample. Among the possible inputs, the application reads and stores return information that the sampling program at the IRS computing center loaded into the SOI sample control files, or the "One-Week Followup" date a clerk entered in the STARTS cycle control screen. The application applies a set of logic statements (or SOI business rules) to the loaded records, such as, if the Level Code is equal to "1," or the Continuous Work History Study (CWHS) Code is equal to "1," assign the return to the "Cross-Sectional" category, or if the sample code of that return is a specific value within a certain range, assign it, as well, to an additional category, called "Complex" edit. Possible outputs include the application generating and displaying inventory totals, such as the number of "Complex Cross-Sectional" returns, which are available for the SOI edit unit manager to order, or permitting the placement of a user-defined set of these "Complex Cross-Sectional" returns into a STARTS editor workgroup.

▶ Application of Management and Statistical Concepts

A "Golden Age of SOI Development" occurred at the end of the 1980s and the beginning of the 1990s in SOI National Office and the centers, which resulted in an infrastructure that is still in place today. Inhouse "quality" teams of economists, management and program analysts, statisticians, center managers, editors, clerks, and information technology specialists collaborated in the design, development, application, and maintenance of this infrastructure. Based on the research of American experts such as Frederick Winslow Taylor, Frank Bunker Gilbreth, Walter Shewhart, and of the War Department's Training Within Industry, SOI learned that continuous incremental improvements benefit an organization [26].

Value

SOI increased the value of the tax returns in its samples not only for its customers, but also for its suppliers at the service centers (see Table 1).

Table 1—Added Value At Each Phase of Workflow

Pull and control documents	Document information Location information Cycle information Pull information
Store documents	Warehouse information Center information Time information Processing information
Order and ship documents	Return information Project information Edit priority information Edit site information Workgroup information Center information Complexity information Deadline information
Process documents	Edit information Scan information Photocopy information Critical case information Split-screen information
Release documents	Quality review information Refiling information

SOI assigned information, based on descriptive statistics from different operational sources, to each return record to expedite processing. Identifying and storing information about a return, its edit status, and its extra-processing requirements in a database made the fulfillment of requests for any of this information much easier. For example, the set of all possible outcomes of an operation at a particular phase of the process determined whether a return was released immediately after editing, instead of scanned. Consequently, a supply chain concept replaced the original "shipping" concept. The SOI infrastructure moved not only documents, electronic records, or digitized images, but also information from unit to unit, center to center, headquarters to field office.

Complexity

The purpose of the process control system shifted from one where the principal activity is moving documents from one center to another to one where the activity is helping the centers meet the program completion deadlines, which National Office analysts set to provide timely tax return data to its customers. SOI managed complexity, sometimes even reducing it, when it assigned returns in the various project samples to a series of categories. Combinations of these categories made it possible for the managers to break down the amorphous cycles of returns into pieces that are easier to control and work with. Since it is necessary to edit some returns before others, the STARTS application provided the capability to order specific sets of returns, placing them in specific sets of editor workgroups. These combinations supplemented the strata the math statisticians created for sampling.

Standardization

The STARTS application allows SOI to standardize certain processing tasks across the projects and the service centers. It acts as a decoder that helps personnel in National Office, the SOI edit units, and the SOI control units to understand each other's variants of sample processing. The corresponding system makes these different actors work together through the interchange of information. They have to follow certain rules to avoid miscommunication and guarantee that both the SOI edit units and SOI control units know in advance from the information in the database application what each should provide as updates or requests and what each should expect back as responses. When an edit unit orders 20 editor workgroups in which each workgroup contains ten "Priority 1" corporation returns, it expects the SOI control unit to assemble and send 200 such returns for distribution to five editors. Because the SOI control unit marks a return as "missing" in STARTS if it does not control that return, only what is in its control is available for the SOI edit unit to order in STARTS.

Kaizen

The consolidation efforts changed SOI into an organization that continues to apply time-compressed, action-oriented improvement methods to its various projects. Many of the components and functions of the STARTS application were the result of the energy generated through users' participation, creativity, and the pressure to produce rapidly tangible results.

► Conclusion

The formation of cross-functional teams at the centers, and between the centers and National Office, and the development of a monitoring system and corresponding just-in-time electronic database application (i.e., STARTS) brought a very strong focus on the entire SOI workflow process. No function could make a change that affected another function unless they had buy-in from that function. Managers, editors, clerks, statisticians, economists, analysts, and computer specialists looked at samples from beginning to end, not just a particular phase. The teams monitored the status of returns as they "flowed" through the workflow process.

When the private company begins managing the IRS files warehouses at the centers in late 2006 and sends the first batch of pulled returns to the SOI edit units, days before the arrival, SOI National Office and its SOI edit units across the country will know what returns the SOI sampling programs selected for the various studies. Unfortunately, the company will not exchange electronic records with STARTS per the contract. In addition, SOI will no longer have a presence

in the files warehouses per the IRS performance work statement. SOI personnel both in National Office and at the edit units at the centers will not know the contents of the shipments until the SOI edit units can open the boxes or scan the carts. If the company transmitted an electronic version of the shipment manifest for loading into the STARTS database application, then the SOI edit units might consider shelving the returns in workgroups for easy distribution to the editors, instead of storing in a traditional files manner (e.g., cycle or type of return).

In the future, if an SOI edit unit runs low on work, the STARTS database application could recognize this situation in the inventory and order more. Because this application stores record information for each return in the sample, whether processed as paper, an electronic record, or a digitized image, SOI can easily repurpose the record content, making it accessible from a variety of devices.

The database application increased the availability and use of data, consequently helping to improve each center's decisionmaking and visualize, synchronize, and automate phases of the workflow process. The power in STARTS reports and screens is that they display accurate, consistent, and timely data. SOI built a reporting system so that managers know in real time how they are meeting the needs of SOI customers. The application replaced transactions done by phone, fax, or mail. It replaced collecting and storing data manually in their own way.

In the late 1980s, SOI developed online data entry and verification applications, which linked IRS processing sites across the country through a network of computer terminals and databases. It applied this information network concept to the control and monitoring of its samples. This connectivity and the value-added information embedded in each sample record allowed SOI personnel to monitor the status of each tax and information return as it moved through the different phases of the SOI workflow process from the files warehouses to its edit units and back. Incorporating a wide range of information about the sampling criteria, the study objectives and requirements, and the logistical demands associated with processing enhanced the meaning of the samples to the centers (suppliers) and National Office analysts (producers) and assured an acceleration of the collection of data and the delivery of the final products to SOI customers. Monitoring daily the number of missing and available returns can increase the likelihood the quality of the data is high [27].

▶ Acknowledgments

The views expressed in this paper represent the opinions and conclusions of the author and do not necessarily represent those of the Internal Revenue Service. The author thanks John Czajka for his comments of an earlier draft of this paper. Any errors that remain are the responsibility of the author.

▶ Endnotes

[1] In addition to the Office of Tax Analysis and the Joint Committee on Taxation, another important customer is the Bureau of Economic Analysis.

[2] National Research Council (2005), *Principles and Practices for a Federal Statistical Agency, Third Edition*, Committee on National Statistics, Margaret E. Martin, Miron L. Straf, and Constance F. Citro, editors, Division of Behavioral and Social Sciences and Education, The National Academies Press, Washington, DC, p. 25. In addition, see 26 USC Sec. 6108, Statistical publications and studies, which describes the SOI mandate.

[3] The SOI workflow process is the interchange of documents, record information, and tasks through the SOI sampling, controlling, and editing processes.

[4] As a stakeholder and customer, SOI hopes to meet with company representatives and the IRS Files Government Project Management Office to discuss pertinent issues about its samples. After announcing the awarding of the contract, the IRS announced two positions, one a senior manager position, the other a supervisory quality assurance specialist. While a company assumed responsibility for the work performed in files, it

is necessary to manage the relationship between this company and other IRS offices and check the quality of the company's work, etc.

[5] The company will operate at the IRS facilities in Methuen, MA, Fresno, CA, Norcross, GA, Austin, TX, Ogden, UT, Kansas City, MO, Florence, KY, and Philadelphia, PA. The records centers are part of the National Archives and Records Administration. They store the records of a Federal agency.

[6] In addition, SOI is a major requester of electronic records, which include electronically-filed records.

[7] Competitors for documents include four different business operating divisions: Large and Mid-Size Business (LMSB), Small Business/ Self-Employed (SB/SE), Wage and Investment (W&I), and Tax-Exempt and Government Entities (TEGE).

[8] The acronym "TQO" refers to Total Quality Organization, a commitment on the part of an organization to advocate quality and continuous improvement in all its tasks.

[9] The general term, "regular pipeline processing," refers to the actions of IRS workers who handle tax and information returns from the time the documents first arrive at an IRS service center through the posting of information at the IRS Computing Center and finally the shelving of the documents in the files area.

[10] SOI wove supplier and customer data into the process improvements. It captured any available information relevant to the SOI projects at the centers.

[11] Scheuren, F. (1991), Comment on "The Federal Statistical System's Response to Emerging Data Needs" by Jack E. Triplett, *Journal of Economic and Social Measurement*, IOS Press, Volume 17, Numbers 3, 4, p. 190.

[12] The 1990 plan for distributing work to the remaining six processing centers had Andover and Brookhaven centers shipping their individual and corporation returns to the center in Ogden. Memphis shipped its individual returns to the Austin center and corporation returns to the center in Cincinnati. Philadelphia shipped both individual and corporation returns to Cincinnati. The Atlanta, Fresno, and Kansas City centers continued to process their samples of individual and corporation returns. Doug Shearer and Dan Trevors coordinated the plans and issued regular status reports to keep management informed of the activities involved in this consolidation. For the Individual program, the consolidation was effective beginning with the Cycle 9053 End-of-Year Tickler (EOYTICK) processing for the Tax Year (TY) l989 Study and continued with the TY 1990 Study, which began with the selection of returns in Martinsburg Computing Center (MCC) Cycle 9104 (January 1991). Consolidation of the Corporation program began earlier with the TY 1989 study commencing only in Atlanta, Austin, Cincinnati, Fresno, Kansas City, and Ogden in August 1990. The nonprocessing centers began shipping their corporation returns to the edit sites later in the year per SOI notification. Beginning in 1992, the edit processing of the returns in the Individual and Corporation programs resided in only five centers, when SOI discontinued editing at the Fresno center.

[13] The centers were located in Andover, MA, Brookhaven, NY, Memphis, TN, and Philadelphia, PA. A team of managers from National Office traveled to these centers to discuss issues and concerns of the managers, editors, and clerks.

[14] SOI editors abstracted information from returns, including moving some information to the correct fields on the returns. Tax examiners in non-SOI units at the centers checked and prepared for data transcribing those fields on the returns the IRS deemed important in determining tax liability.

[15] Clerks in the SOI control units did not edit returns. Instead, they pulled returns, looked for missing returns, photocopied returns, scanned returns, packaged returns, and shipped returns to list just some of their duties. One manager commented: "I am a Unit Supervisor in a large unit. I have IMF SOI, AIMS, Cycle, Quality Review … as well as pulling and refiling. SOI is just a part of this unit. We have maintained a record of high accuracy and very few missing documents for a few years. This [is] … due to the integrity, dependability, and dedication of the staff assigned to SOI. They have accomplished a lot with very few people. So, what STARTS means to me is reflected in what the staff commented on … If they are happy and satisfied and feel that STARTS helps them perform their duties more efficiently and accurately due to the increased speed and easier access, then I am happy. If they feel that STARTS helps them maintain a low missing record, and this record is reflected on the SOI reports for Andover, then I am happy with STARTS. I do not use STARTS myself, but I do review the reports that these employees generate."

[16] Editors usually waited the next day to receive feedback because centers scheduled SOI batch programs around regular pipeline batch jobs.

[17] It is difficult for an editor to maintain his or her skill level if he or she moves frequently from one project to another, though the frequent changes may guarantee work for that employee.

[18] The developers considered SOIACS the first step in building a system to manage its samples in an online environment. SOI planned to build subsystems to manage quality, resources, and sample selection as part of the modernization effort because the service center statisticians were retiring or service center management considered them irrelevant. Dan Trevors of the Quality Support Team and Doug Shearer of the Coordination Team shared responsibility for developing the SOI controlling and shipping process. Linda Taylor of the Distributed Processing System Team provided hardware support. The SOI operating branches, as well as the service center files and edit operations, defined, collected, and presented the user requirements. A manager's comment: "The STARTS system is a valuable tool used on a daily basis. It helps track the work … as well as when it is edited within the edit teams. When a return is marked missing and we find it attached to another return, we are able to go to the remarks [screen] at that time to document the condition. The STARTS system is also used to look up prior-year information. If an EIN is the only information you have to track component parts of a separated 1504C return, the STARTS system can provide much information on this. This helps us to locate additional return parts in order to edit a more complete document. STARTS provides many options in ordering the work. It is broken down by return type, three asset class categories, and the sample code only selection of returns. This gives management the necessary range to order specific types of work at all times but is especially helpful when nearing various project completion dates. As transition continues here in Ogden, we are very interested in the future STARTS process and the new and evolving ways in which we will utilize the system. We look forward to the changes and future training that is available to all leads as well as the clerks and managers."

[19] National Office analysts held a planning session with service center personnel the week of June 18, 1990, at the Austin Service Center to collect ideas, customer needs, and specific requirements for the SOI Automated Control System (SOIACS). Back in National Office, the team reviewed the requirements, analyzed the consequences of implementing a control system, and wrote descriptive and detailed requirements and specifications, which bridged the requirements and the design of the application. Cincinnati Service Center assumed primary responsibility for the Oracle program development of this new application, with Don Flynn as the lead programmer. Tentative plans involved piloting the application in one processing center and one

nonprocessing center in the spring of 1991 for the Individual returns project. The SOI programming staffs at the Cincinnati and Ogden Service Centers developed the next generation of the application, which National Office renamed the Statistics of Income Automated Return Tracking System (STARTS). The Cincinnati staff developed and maintained the Individual Master File (IMF) version of STARTS, while the Ogden staff programmed and supported the Business Master File (BMF) version. In 2000, both programming staffs converted the text-based applications to a graphical user interface (GUI) application.

[20] Connections between the center terminals and the host minicomputer in Cincinnati occurred through PACNET.

[21] In the case of tax returns in SOI samples, this is metainformation about relational database properties; data warehousing; business intelligence; general IT; IT metadata management; file systems; and image, program, project, and study schedules.

[22] SOI assigned information to each return: project, sample, files location, edit site, editor, delivery dates, level of edit complexity, document source (paper, electronic, or image). One result was a sample redesign, which embedded a panel within the annual cross-sectional samples. The STARTS application still distinguishes these two sets of returns. See Czajka, J. and Walker, B. (1990), Combining Panel and Cross-Sectional Selection in an Annual Sample of Tax Returns, *1989 Proceedings of the American Statistical Association, Section on Survey Research Methods*.

[23] The use of digital images, instead of paper, as source documents for editing is a new phase in the SOI workflow process. Other SOI processes include data cleaning and completion, weighting and estimation, and publishing tables and user analyses.

[24] Systems acceptability testing (SAT) occurs before the computing centers execute the SOI sampling programs. Sample design and sample selection are topics for further discussion in other papers.

[25] Stair, R.M. (1992), Principles of Information Systems: A Managerial Approach, Boyd and Fraser Publishing Company, Boston.

[26] Maurer, R. (2004), One Small Step Can Change Your Life: The Kaizen Way, Workman Publishing Company, New York.

[27] Improving data quality through editing, imputation, and record linkage is impossible if the administrative records that contain the data are unavailable or incomprehensible.

Customer Satisfaction Initiatives at IRS's Statistics of Income: Using Surveys To Improve Customer Service

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IRS's Statistics of Income (SOI) Division conducts statistical studies on the operations of tax laws and publishes annual reports, including the quarterly *SOI Bulletin*, which includes statistics produced from tax and information returns. SOI's Statistical Information Services (SIS) office responds to thousands of data and information requests annually by providing SOI data along with technical assistance. To ensure that customer needs are being met through the SIS office and through its flagship publication, SOI has been measuring customer satisfaction for both via customer satisfaction surveys. These surveys are part of SOI's commitment to use survey results to improve customer service. This paper will focus on three aspects of these surveys: the process by which we surveyed our customers, the findings from the surveys, and the steps we are taking to use the results to further improve our products and services.

In the first section of the paper, background information on the SOI Division and its SIS office will be presented. The second section will describe the methodology used to survey SIS customers, present selected findings from the past 4 years of surveys, and describe how SOI is using these results to identify areas for improvement. Similarly, the third section will describe the methodology, present a summary of the findings, and briefly discuss some of the steps that SOI staff are taking to improve the *SOI Bulletin*. Finally, next steps to improve SOI products and services in response to survey findings will be discussed.

▶ Background

Congress created the Statistics of Income Division 90 years ago in the Revenue Act of 1916, some 3 years after the enactment of the modern income tax in 1913. Since that time, the Internal Revenue Code has included virtually the same language mandating the preparation of statistics. Section 6108 of the Code currently states that "…the Secretary (of the Treasury) shall prepare and publish not less than annually statistics reasonably available with respect to the operations of the internal revenue laws, including classifications of taxpayers and of income, the amounts claimed or allowed as deductions, exemptions, and credits and other facts deemed pertinent and valuable."

SOI's mission is to collect, analyze, and disseminate information on Federal taxation for the Office of Tax Analysis, Congressional committees, the Internal Revenue Service in its administration of the tax laws, other organizations engaged in economic and financial analysis, and the general public. Its mission is similar to that of other Federal statistical agencies—that is, to collect and process data so that they become useful and meaningful information. However, SOI collects data from tax returns rather than through surveys, as do most other statistical agencies. These data are processed and provided to customers in the form of tabulations or microdata files. Although the IRS uses SOI data, the primary uses for SOI data are outside of IRS, in policy analyses designed to study the effects of new or proposed tax laws and in evaluating the functioning of the U.S. economy.

▶ SOI Products and Services

Throughout its long history, SOI's main emphasis has been individual and corporation income tax information. SOI began publishing data with the 1916 *Statistics of Income*, which reported individual and corporation statistics. Beginning in 1936, for Tax Year 1934, individual and corporation income taxes are each reported separately in annual "complete" reports (*Individual Income Tax Returns* and *Corporation Income Tax Returns*, respectively). The annual *Corporation Source Book* provides detailed balance sheet, income statement, and tax information for major and minor industry sectors by asset size. Over the years, SOI has increased its studies and publications to meet the needs of its customers. Introduced in 1981, the SOI flagship quarterly *Statistics of Income Bulletin* presents the most recent data and related articles on completed studies and

a historical section featuring time series data on a variety of tax-related subjects.

SOI also periodically publishes compendiums of research on nonprofit organizations, estate taxation, and personal wealth. Research articles presented at professional conferences, namely the American Statistical Association and the National Tax Association, are published annually or biannually in the methodology report series, *Special Studies in Federal Tax Statistics*. Beginning with the 1998 issue, SOI took over publishing the *IRS Data Book,* a fiscal year report that presents statistical data on the administration of the U.S. tax system.

SOI produces the following microdata files: Individual Public-Use Files; Exempt Organizations Records; and Private Foundations (and Charitable Trusts) records, all of which are available for a fee. Before release of the Individual Public-Use microdata, SOI follows security guidelines and edits the files to protect the confidentiality of individual taxpayers to prevent disclosure of taxpayer information. Tax returns for both the exempt organizations and private foundations are publicly available. Because of their size, these products are available on a CD-ROM or magnetic tape directly from SOI. Exempt organization microdata files have recently been released to the public via the World Wide Web (www.irs.gov/taxstats).

Public awareness of SOI products and easy access to them have gradually increased over the years. The establishment of the Statistical Information Services office that responds to data and information requests has helped raise the visibility of SOI products. With the introduction of the IRS World Wide Web 10 years ago, SOI's products became more widely used. They may be found at: www.irs.gov/taxstats. TaxStats includes statistics for individuals, businesses, charitable and exempt organizations, IRS operations, budget, compliance, and a variety of other topics. Currently, over 6,000 files reside on TaxStats, and this number continues to increase.

▶ Statistical Information Services

The Statistical Information Services (SIS) office was established in 1989 as part of efforts to streamline the SOI organization. From the beginning, the SIS mission was straightforward: Provide accurate and timely data along with excellent customer support and technical guidance. Although the number of customers and variety of requests have changed since then, the SIS staff still strives to fulfill this mission after 17 years.

When the SIS office was set up, a telephone, paper reports and publications, index cards with contact information, and a fax machine were its primary tools. Word spread quickly, and, soon, the SIS office was inundated with requests, many of whose answers were readily available from published data. When customer requests involved data unavailable from SOI, the SIS staff made every effort to fulfill requests by providing information or contacts from other sources. In the early years of SIS operations, 4,000 to 5,000 information requests were received annually. Over the years, the tools have been greatly improved, and more data are readily available directly to the public. An electronic management system—the Response Processing System (RPS)—tracks customer information and details of data requests. While the number of information requests has leveled off with the availability of data on TaxStats, the complexity of information requests has increased significantly. Many of these requests require extensive research, some supported by SOI subject-matter analysts.

Over 2,400 information requests were received in Calendar Year 2005 from a broad range of customers. The customers are as widely varied as the information they request, from a private citizen requesting data on car dealerships to a Congressional request for alternative minimum tax data. Consultants and researchers were the largest group with 23.5 percent of the requests. Academia and the Internal Revenue Service were the second and third largest groups with 13.5 percent and 12.9 percent, respectively. In Calendar Year 2005, most information requests (50.4 percent) were received by phone, followed closely by 48.2 percent received by e-mail. The SIS office also receives information requests via fax, letters, and walk-in customers.

▶ SIS Customer Satisfaction Survey

How is the SIS office meeting its goal of providing accurate and timely data along with excellent customer

support and technical guidance? Although the SIS office has received positive feedback from many of its customers over the years, is this the complete picture? What about the many SIS customers, especially one-time customers, who do not provide any feedback? In 2003, at the suggestion of SOI Director Tom Petska, the SIS office administered its first survey to measure customer satisfaction. Prior to the SIS survey, SOI surveyed its primary customers (Treasury's Office of Tax Analysis, the Congressional Joint Committee on Taxation, and the Department of Commerce's Bureau of Economic Analysis). The SIS survey was an expansion of SOI's efforts to measure customer satisfaction and to use customer input to improve service.

Administering the Survey

SOI mathematical statistician Kevin Cecco and, later, Diane Milleville, in close consultation with the SIS staff, designed the SIS surveys. Following the Office of Management and Budget's approval, the first SIS survey was administered in 2003. After assisting the customer with an inquiry, an SIS staff member provided a survey by e-mail or fax and asked for the customer to complete the survey related to the customer's most recent inquiry.

For the first survey in 2003, the survey recipients were selected randomly from the daily roster of calls and e-mails. The SIS office planned to survey one of every four customers from January through July 2003. However, the target number of customers surveyed was not reached in July, and the survey was extended an additional month.

Over the years, changes were made to improve the survey administration process. Diane Milleville and Information Technology Specialist Elizabeth Nelson, who provides RPS technical support, both helped improve the process. Surveys were imbedded in an e-mail, thus eliminating the additional step of downloading the survey file. Every customer was sent a survey, eliminating difficulties with the random selection process. Customers surveyed were tracked in RPS, which eliminated the need for SIS staff to manually track them.

Beginning with the 2004 survey, response options were revised to bring the SIS survey in line with a set of measures used by SOI's parent organization, Research, Analysis, and Statistics (RAS). Known as "balanced measures," these criteria were designed to measure how well RAS meets its goals. To maintain consistent measures throughout all divisions of RAS, including SOI, some SIS survey questions and response options were changed to include these measures.

Findings

Table 1 highlights response rates for the 4 years the SIS survey was administered. Initially, the SIS office's goal was to achieve a response rate of 50 percent. SIS planned to survey approximately 400 customers with the expectation that it would receive 200 responses. Although SIS fell short of distributing 400 surveys by 28 percent, it was quite satisfied with the 49-percent response rate. However, after the first survey in 2003, the response rate dropped 7 percentage points in 2004, but has increased to 44 percent in 2006. The number of Government surveys sent to customers has increased over the years, and this may also contribute to the declining response rate. Although SIS would like to have a higher response rate, it is pleased with its results to date. However, it will continue efforts to improve its survey instrument and its methods for administering it.

Table 1—Response Rates for SIS Survey, 2003-2006

Year	Surveys distributed	Number of respondents	Response rate
2003	288	142	49%
2004	425	181	43%
2005	300	125	42%
2006	271	119	44%

Table 2 presents the respondents by job function for each of the 4 years the survey was administered. For 2003, 2004, and 2006, the top 4 categories—consultant/research, State/local government, academic, and IRS employee (excluding those classified as "other") accounted for over 57 percent of survey respondents. For 2005, some 3 of the top 4 categories were the same; Federal Government replaced State/local government as the fourth category. Collectively, these accounted for 53.2 percent of survey respondents. In an effort to

improve the SIS customer job function categories, some changes were made during the 4 years the survey was administered. In 2004, the nonprofit category was added. In 2006, the library, marketing, and realtor categories were substituted for the corporation category which was eliminated.

There were some differences noted between job functions reported by SIS survey respondents and the general population of SIS customers. SIS compared responses for job function reported by survey respondents and recorded by SIS staff in the Response Processing System (RPS) during the time period in which the SIS surveys were administered. Overall, the differences were generally small for most job categories. An exception was the private citizen category, which ranged from 12 to 2 percentage points higher (for 2003 and 2006, respectively) in RPS than in survey responses. These differences may be a function of respondents' self-classification versus classification by an SIS staff member.

Table 2—Percentage Distribution of SIS Survey Respondents by Job Function, 2003-2006

Job function	Year			
	2003	2004	2005	2006
Total	**100.0**	**100.0**	**100.0**	**100.0**
Consultant/Research	19.4	17.8	15.3	17.1
State/Local government	14.4	13.9	8.1	10.1
Academic	13.7	13.3	13.7	15.1
IRS employee	10.1	12.8	12.9	14.2
Media	7.9	5.6	5.7	5.0
Corporation	7.2	8.3	10.5	n.a.
Federal Government	5.8	7.2	11.3	7.5
Private citizen	4.3	6.7	2.4	3.4
Tax Preparation/ Accounting firm	2.9	1.7	3.2	5.0
Association/Society	2.2	0.6	1.6	0.0
Congress	0.7	1.1	0.8	2.6
Law firm	--	2.8	0.8	1.7
Nonprofit	n.a.	4.4	4.8	5.9
Library	n.a.	n.a.	n.a.	5.9
Marketing	n.a.	n.a.	n.a.	1.7
Realtor	n.a.	n.a.	n.a.	1.7
Other	11.5	3.9	8.9	2.5

n.a. -- not available

The first survey was designed with 17 questions in 2003. Over the 4 years, some questions were removed, while others were added. Overall, the number of questions decreased to a total of 12 for the 2006 survey (see Appendix). Survey questions focusing on 3 issues are discussed below.

Table 3 presents the customer's expectation of timeliness for receiving a response to an information request in the 2003 survey and actual timeliness in response to questions for the 2004-2006 surveys. Note that the 2003 question is different from the question included in the 2004-2006 surveys. The 2003 question asks when the customer *expected to receive* a response, but the 2004-2006 question asks when a response *was received*. Response options for all 4 years are the same. By changing the wording of the question, SIS was able to obtain more useful information from its customers. The expected response time (in the 2003 survey) was significantly greater than the actual response time (in the 2004 survey.) Some 36 percent expected a response on the same business day in the 2003 survey. However, over 70 percent actually received their responses on the same business day (in the 2004 survey). For 2004 through 2006, a response was received in 3 business days or less 93 percent to 96 percent of the time.

SIS compared the response time for survey respondents to the response time recorded in RPS by SIS staff using the time period that SIS surveys were administered in 2004-2006. Response time of 1 day or less reported by survey respondents ranged from 74.2 percent to 62.3 percent (for 2005 and 2006 respectively). In contrast, the response time of 1 day or less reported in RPS was 93.8 percent or higher for 2004-2006. The SIS staff generally responds to customers within 1 business day as indicated in RPS. However, a completed request including additional research may take 2-3 days. This is indicated by 26.1 percent to 30.7 percent of survey respondents reporting a response time of 2-3 business days. The response time gap between survey responses and RPS may be the difference between making an initial contact and delivering the completed information to the customer.

Table 3—Response Timeliness for SIS, 2003-2006				
Percentage of respondents indicating . . .				
Survey question	Response options	In 2003		
When did you expect to receive a response?	Same day	36.0		
	2-3 business days	52.5		
	4-5 business days	8.6		
	6 or more business days	2.9		
Percentage of respondents indicating . . .				
Survey question	Response options	In		
		2004	2005	2006
When did you receive a response?	Same day	70.6	74.2	62.3
	2-3 business days	26.1	23.4	30.7
	4-5 business days	1.7	2.4	3.5
	6 or more business days	1.7	--	3.5

Table 4 presents the issue of meeting customer needs. In 2004, the question and the response options were changed to reflect the RAS balanced measures. The 2003 question asked if SOI's product(s)/data satisfied customer needs. The 2004-2006 question asks if the product(s) or services(s) provided met customer needs. The major difference between the 2003 question and the 2004-2006 question is the response options. In the 2003 survey, there is no option for a "middle ground" between the "disagree options" and the "agree options." Instead, a "not applicable" option is listed at the end after "strongly agree." Beginning with the 2004 survey, a "not sure/neither" option is available between the "disagree options" and the "agree options." During the 4 years of the surveys, the percentage of respondents who agreed or strongly agreed that their needs were met ranged from 76.5 percent in 2004 to 82.5 percent in 2005.

Table 4—SIS Met Customer Needs, 2003-2006				
Percentage of respondents indicating . . .				
Survey question	Response options	In 2003		
SOI's product(s)/data satisfied your needs.	Strongly disagree	5.1		
	Disagree	8.0		
	Agree	30.4		
	Strongly agree	51.4		
	Not applicable	5.1		
Percentage of respondents indicating . . .				
Survey question	Response options	In		
		2004	2005	2006
The product(s) or service(s) provided met your needs.	Strongly disagree	6.9	5.0	5.3
	Disagree	6.9	5.0	3.5
	Not sure/neither	9.7	7.5	12.3
	Agree	33.1	29.2	33.3
	Strongly agree	43.4	53.3	45.6

Table 5 presents customers' overall satisfaction with the most recent response they received from SIS. For all 4 years, the question was the same, but, beginning with the 2004 survey, the response options were changed to reflect RAS balanced measures. Therefore, responses are not comparable between 2003 and the 2004-2006 responses. However, for all 4 years, the satisfaction rate remained high. Respondents who were satisfied or very satisfied ranged from 85.9 percent in 2004 to 91.6 percent in 2005.

Table 5—Overall Satisfaction With SIS, 2003-2006				
Percentage of respondents indicating . . .				
Survey question	Response options	In 2003		
Rate your overall satisfaction with your most recent data request.	Very low	0.7		
	Low	1.4		
	Average	10.1		
	High	34.8		
	Very high	52.9		
Percentage of respondents indicating . . .				
Survey question	Response options	In		
		2004	2005	2006
Rate your overall satisfaction with your most recent data request.	Totally dissatisfied	0.6	3.4	1.7
	Dissatisfied	3.5	0.8	2.6
	Neither	9.9	4.2	7.8
	Satisfied	41.5	41.2	33.9
	Totally satisfied	44.4	50.4	53.9

The surveys each year also included open-ended questions asking for further explanations, recommendations, and suggestions for improving service to SIS customers. The information gleaned from responses to these open-ended questions has been exceptionally useful. Several respondents suggested adding the missing years in SOI historical tables, published in the *Statistics of Income Bulletin* and also released on TaxStats. In these historical tables, the most current 5 years were shown, and, for earlier years, only every fifth year was shown. Data classified by locality are SIS's most frequently requested products. SOI, in conjunction with the Census Bureau, produces county-to-county and State-to-State migration data, along with county income data. SOI also produces Zip Code data. Not surprisingly, respondents requested more locality data. Some

respondents, for example, requested earned income tax credit and alternative minimum tax data by county or Zip Code and migration data classified by occupation. Respondents also requested that locality data or the *Corporation Source Book* be made available on TaxStats. These products have been available on a reimbursable basis from SOI.

Changes Planned or Implemented

Based on the input received from SIS customers, the SIS office has made some changes over the past 3 years. The SIS office conducted a benchmarking trip to the SIS's counterpart at the U.S. Department of Transportation and is looking into other factfinding trips. After the first survey was conducted, the SIS office worked with an Information Technology Specialist to more effectively track customer requests and information about its customers.

SOI has also made improvements to its products and services by eliminating breaks in time series data for many of its tables. In selected *SOI Bulletin* historical tables, data for sequential years are published as space allows. On TaxStats where no space limitation exists, SOI is looking into adding more years of historical data by inserting data for missing years. SOI has also begun adding more data to TaxStats. This year, SOI added the 2000-2003 issues of the *Corporation Source Book*.

▶ SOI Bulletin Survey

The SOI Division's long history of publishing stems from its original mandate in 1916. Over the years, the number of publications and the amount of time and effort to publish them have grown, but considerably less time has been spent evaluating the content, frequency, and dissemination of the publications. Three years ago, these tasks were the charge for a new workgroup that involved senior SOI staff and 3 members of SOI's Advisory Panel [1]. Initially, this group undertook to review the content and frequency of all SOI publications; examine how it could make them more useful; look at methods of advertising and disseminating; and look at what it is not publishing that perhaps it should.

Ultimately, the workgroup's efforts turned to improving the quality of SOI's most visible publication—the quarterly *SOI Bulletin*—and the efficiency of the *Bulletin* production process. Two methods were used—focus groups and a customer satisfaction survey. The focus groups were conducted to learn how authors and reviewers perceive the writing and review process, and to solicit ideas for changes in the writing and review process. The customer satisfaction survey was administered to better understand how SOI customers use the *Bulletin,* how satisfied they are with the contents, how useful the various features of the *Bulletin* are to them, and how it should be improved. The remainder of this section of the paper will be devoted to the *Bulletin* itself, describing the survey process, summarizing the key findings, and, finally, telling how SOI is using the survey results to improve the publication.

About the SOI Bulletin

Twenty-five years ago, in the summer of 1981, the first issue of the *Statistics of Income Bulletin* was published. It was initially created as the vehicle for disseminating more limited data on topics formerly covered by separate reports, as well as to provide the results of the growing number of special projects. The first *SOI Bulletin* was 46 pages and included just 3 articles—on individual income tax returns, sole proprietorship returns, and partnership returns. Recently, SOI Division published the 100th *Bulletin* (Spring 2006, Volume 25, Number 4), which included 6 articles; 23 selected historical and other data tables; sections on sampling methodology, projects and contacts, and products and services; and an index of selected previously published articles. SOI is currently working on the first issue of its 26th year (Summer 2006, Volume 26, Number 1). The average size of the report for 2005 was 310 pages.

Today's *Bulletin* is issued quarterly, in March, June, September, and December and provides the earliest published annual financial statistics obtained from the various types of tax and information returns filed, as well as information from periodic or special analytical studies of particular interest to students of the U.S. tax system, tax policymakers, and tax administrators. It also includes personal income and tax data by State and

historical data for selected types of taxpayers, in addition to data on tax collections and refunds and on other tax-related items. Much work goes into producing each issue of the *Bulletin*, but it was not clear whether it was meeting customers' needs. Thus, a survey was designed to collect critical information on how customers felt about the *Bulletin*.

Administering the Survey

Once again, SOI Division mathematical statisticians Kevin Cecco and Diane Milleville were called upon to assist in developing the survey. The result was a relatively brief and visually engaging, 15-question customer survey, which was subsequently cleared for use by the Office of Management and Budget. Following OMB's approval, the survey was then administered to *SOI Bulletin* customers in several ways.

The survey was sent directly via e-mail to SOI's main customers at the Department of Treasury's Office of Tax Analysis, the Congress's Joint Committee on Taxation, and the Commerce Department's Bureau of Economic Analysis, as well as to all members of SOI's Advisory Panel. The survey was also included in the Summer 2004 and Fall 2004 issues of the *SOI Bulletin* for customers to remove, fill out, and either e-mail or fax back to SOI. As a further outreach to potential *SOI Bulletin* customers, an SOI Advisory Panel member facilitated the dissemination of the survey via the Federation of Tax Administrators (FTA) list serve in January 2005.

Following a reasonable amount of time after publishing the Fall 2004 *Bulletin* and time allowed for FTA members to reply, the responses were compiled and analyzed. In all, 52 surveys were returned. The majority of respondents were from groups SOI targeted. Only 9 respondents filled out the survey from the *Bulletin* itself. To put these numbers in perspective, it should be noted that, for the Fall and Summer issues that year, approximately 2,000 copies of each were printed. Of these, about 400 copies were sent to internal IRS and Treasury Department offices, about 1,250 copies were provided to the Government Printing Office (GPO) for subscribers and the Federal Depository Libraries, and about 350 copies were for the SOI Division for internal purposes. Because just 52 responses were received, a major concern was that responses might not be representative of all users, meaning this information should probably not be the basis for any final decision concerning the *Bulletin*. Also, it was not possible to conduct a nonresponse analysis, because the majority of the *Bulletin* copies are distributed by the GPO, and SOI does not know who the customers are. In addition, SOI decided not to continue to include the survey in subsequent issues of the *Bulletin* for several reasons—1) the responses were likely to be low again; 2) the OMB approval process was required for each issue of the *Bulletin,* and, with a low response rate, it would be more difficult to justify including it in the report; and 3) the OMB approval process had just become much longer, taking about 5 weeks instead of 2 weeks. Nevertheless, SOI did have the results from 52 surveys to evaluate, and, after consulting with the mathematical statisticians advising us on this effort, they recommended that SOI work with the results it has and use another vehicle to focus on a particular part of the *Bulletin,* e.g., another focus group, should SOI decide to solicit additional customer feedback. The findings are presented below.

Findings

Type of respondents. Over one-third of the respondents (36 percent) were affiliated with State and local governments. Another 18 percent indicated a Federal Government affiliation, while 17 percent had a Congressional affiliation. Nearly one-third of all responses came from members of the FTA list serve.

Use of other SOI products. The three most heavily used SOI products other than the *SOI Bulletin* were the *Corporation Source Book,* the *IRS Data Book,* and the Individual complete report—used by 40 percent-50 percent of all respondents. A little over one-third of respondents also indicated they used the Corporation complete report. About one-fourth of all respondents use *Special Studies in Federal Tax Statistics*, public-use microdata files, and special tabulations. Twenty percent or less said they use other SOI products.

How respondents receive the *Bulletin*. Half of all respondents receive the *Bulletin* through a subscription. Another 20 percent receive it directly from the SOI Division.

Frequency of use. Of the 49 who responded to how frequently they use the *Bulletin*, 37 (about 76 percent) use it 4 times a year. Only 8 percent use it once a year.

Overall satisfaction. Of the 49 who responded, 86 percent were satisfied or totally satisfied with the *SOI Bulletin;* only 2 respondents were dissatisfied, while 5 were neither satisfied nor dissatisfied.

Use of specific features. Of the 8 features listed (from the Bulletin Board column in the front of the report through the index on the inside back cover), and checking all that apply, the Selected Historical and Other Data section was by far the most frequently used—90 percent of survey respondents, compared to 67 percent who said they use the featured articles and 38 percent who use the data releases. An equal number (about 25 percent of respondents) use each of the remaining features, except for the Bulletin Board, which less than 8 percent indicated they use.

Suggestions for change. When asked to check boxes regarding possible changes to the *Bulletin*, nearly half of all respondents indicated they would like to see more articles on topics of current interest. They also indicated an interest in shorter articles focused on key findings (nearly 37 percent). About one-fourth of respondents said they would like more details on methodologies and samples. For the response "Other," 8 survey respondents offered varied suggestions, such as adding links to data and explanatory material on the Web, including more longitudinal data, and reporting medians as well as averages and measures of variability.

How to publish sections: print, Web, or both. This question dealt with the component parts of an article or data release and asked respondents whether they preferred the parts to be provided in print only, posted to the Web only, or to be available in both places. About two-thirds of respondents preferred that the tables be provided in both mediums; nearly half or more than half of respondents indicated that they preferred most parts of an article to be published in print and on the Web.

Use of Selected Historical and Other Data section. When asked if they used the Selected Historical and Other Data section, some 90 percent said yes. Of those who said yes, over 93 percent said the tables are useful, and over 84 percent said the footnotes were useful. Of the 2 respondents who answered no to this question, 1 provided additional comments, indicating that publishing the historical tables in every issue was not necessary.

Where to publish historical tables. Nearly 70 percent of those who use the historical tables felt that they should be published in both print and on the Web. And of 19 respondents who answered the question about how often to publish the historical tables, 11 (or about 58 percent) felt that the historical section should appear in all *SOI Bulletin* issues.

Verbatims

The survey also included the following open-ended questions in order to gain additional information about how the information in the *Bulletin* is being used and to seek recommendations and suggestions for improvements. The following summarizes the responses SOI received to the open-ended questions from the survey:

- What is your primary use of the *SOI Bulletin*?

About 60 percent of respondents chose to reply. Verbatim responses covered a number of areas of uses. A few respondents stated that they use the *Bulletin* for "quick look-up of tabulations" or to look up the most recent data on a topic. One respondent identified him/herself as a "scholar and educator with deep interest in the Federal tax system" who reads the *Bulletin* for "keeping up" responsibilities. Another uses the *Bulletin* as a resource for responding to media inquiries. The most recurring themes centered around the *Bulletin* as a source of data for research and for the historical series data. About a third of the answers indicated that the statistics were used for research, revenue estimation, or tax modeling purposes. Another 20 percent were mainly interested specifically in the historical data series that is included in each issue.

- If you use the Selected Historical and Other Data section of the *SOI Bulletin,* which tables do you use, do you find them useful, do you find the accompanying footnotes useful, and how would you improve this section?

About half of the 90 percent of survey respondents who indicated that they use the historical data also told which tables they use of the 23-table section. The majority of those use 7 or more tables in the section, and some specifically stated that they use the annual State data, a 53-page table titled "Table 2—Individual Income and Tax Data by State and Size of Adjusted Gross Income." About 20 percent of those who use the historical data also answered the question about whether they find the tables useful. Several stated they found them useful as a quick reference, while others stated they were difficult to find on the Web. Only 1 person responded to the question about the footnotes, finding them marginally useful because of the limited number of years available. Suggested improvements ranged from only publishing the series once a year to adding more details on the State table, to including many more years of data, to more detailed data by State.

- If you could change one thing about the *SOI Bulletin,* what would it be?

Nearly one-third of respondents chose to weigh in on this question, and the responses offered a few themes for SOI to consider—namely, a more detailed index in order to locate earlier, related articles; more topical, interesting articles as some are rather dull; providing links to related, technical documentation on the Web; and making *Bulletin* tables electronically useable on the Web.

- Please provide any additional comments and/or suggestions you may have concerning the *SOI Bulletin.*

Ten responses were received to this question, about 20 percent of those who responded to the survey. No 2 comments were the same, but 1 area for improvement suggested in several responses was in length of articles. There appears to be more interest in the figures, graphs, and tables. Some asked SOI to consider producing a leaner *Bulletin*, with more interesting writing.

Next Steps

Although the number of responses to the *SOI Bulletin Survey* was less than had been hoped for, SOI feels that the results are a strong indication that it is doing a good job of producing the *SOI Bulletin.* It is a useful resource for looking up data on a specific tax-related topic. The historical data are very useful and an important reason why people use the *Bulletin*. However, it is also clear that there is room for improvement in a number of areas—in improving the writing, e.g., preparing shorter articles focused on key findings and preparing more articles on topics of current interest. Many customers are also interested in more details on methodologies and samples. And another message that came through is an interest in more consecutive years of historical data.

These results, along with the results from focus groups with *Bulletin* authors and technical reviewers, are being used to focus SOI efforts on specific areas of improvement. Recently, SOI has been working with some of the members of SOI's Web Modernization Team with the goal of improving the process of producing and posting tables to the TaxStats Web site, which should also improve the process of producing *Bulletin* articles. One outcome in streamlining this part of the *Bulletin* production process is that we are making data available earlier on TaxStats. The TaxStats Web Team is also working with a contractor on a dynamic tables prototype that will allow users to make their own tables from previously tabulated SOI data. Currently, this is a prototype that allows users to make tables from 2 years of *Corporation Source Book* data. The prototype will run for 4 months, after which SOI will evaluate feedback, costs, etc., to determine how this will fit into SOI's data dissemination strategy.

SOI also plans to address *Bulletin* content issues. Working more closely with managers, authors might want to refresh their articles by shortening them, by becoming more familiar with relevant tax and economic literature, by soliciting ideas from senior staff from Treasury's Office of Tax Analysis and other customers, and by coauthoring articles with senior staff or outside experts. SOI will seek to assist authors in accessing the tax and economic literature by establishing an electronic index of the SOI library and arranging a briefing on electronic research from a sister organization in IRS. SOI will also assemble a collection of examples of

good *Bulletin* articles and other descriptive papers to aid newer authors.

SOI will continue to work on improvements to the *Bulletin*, as evidenced by current efforts to get consensus from our senior managers on a plan to improve the *Bulletin* production process, followed by incremental improvements in content and quality of the articles and tables. In so doing, SOI is committed to responding to the recommendations and suggestions of customers.

▶ Summary and Conclusion

As discussed, the Statistics of Income Division is using surveys to improve the methods of conducting business, with the emphasis on providing top-quality service to its customers. The SIS Survey questions dealt with communication, characteristics of staff, opinions of products, and overall satisfaction. When surveying *SOI Bulletin* customers, questions dealt with characteristics of the customer and their use of this publication, content issues, suggestions for improvement, and overall satisfaction. Administering surveys and examining the findings over the past several years have shown SOI how well it is doing in improving products and services and have helped guide efforts to make improvements in these areas. For both the *SOI Bulletin* and SIS surveys, specific suggestions included in *verbatims* related to SOI current products have been particularly useful. The Statistical Information Services office has definitely benefited from the surveys over the past 3 years. The SIS survey has helped maintain focus on the SIS goal of outstanding customer service. To continue to improve its service, the SIS made a benchmarking trip and is looking into other factfinding trips. The SIS office also made enhancements to its electronic tracking system (RPS) to more effectively track requests as well as information about its customers. Overall, the responses received from the *SOI Bulletin* Survey have been useful in helping direct current efforts to improve the *Bulletin*. For example, it is clear that SOI customers want to continue to have Historical and other data tables available in both the printed publication and on SOI's TaxStats Web site. SOI staff are currently working on guidelines for making tables more usable for customers who intend to download and work with the data SOI provides. In addition, SOI is working on improving the publication process itself as well as desktop publishing tools to improve the layout process. It also intends to work with subject-matter experts and mathematical statisticians on content issues, e.g., including more articles on topics of current interest and more information about the statistical significance of reported trends, especially when the reported changes are small in magnitude.

Measuring customer satisfaction will continue to be a major priority for SOI. A commitment to collecting and evaluating customer satisfaction data will ensure that SOI does not lose its focus on critical issues that impact its customers. An emphasis on collecting customer satisfaction data will reinforce the SOI culture of providing outstanding service to customers. As is evident from the data presented in this paper, SOI has done a good job of exceeding the expectations of its customers. However, SOI should not rest on its successes, but rather work even harder to ensure that it meets or exceeds customer expectations.

▶ Endnotes

[1] "Recent Efforts To Maximize Benefits From the Statistics of Income Advisory Panel," by Tom Petska and Beth Kilss, *Special Studies in Federal Tax Statistics: 2003,* Internal Revenue Service, pp. 87-93, 2004

Appendix—SIS Survey Questions, 2003-2006

Survey question	Year question included in SIS survey			
	2003	2004	2005	2006
Which of the following best describes your function?	X	X	X	X
How did you initially learn about the SOI SIS office?	X			
How did you initially learn about the SIS office?		X	X	X
How often do you contact our office?	X			
How often do you contact the SIS office?		X	X	X
How did you contact us?				X
Was the first contact with SIS with a (1) person; (2) voice message				X
Was the voice message (1) informative; (2) user-friendly; (3) okay as is; (4) needs improvement by _____ .				X
Did we satisfy your data request? (If only partially or not at all, please explain why in the space provided below.)	X			
Did the SIS satisfy your data request?		X	X	
Did the SIS satisfy your data request? (If only partially or not at all, please explain why in the space provided below.)				X
When did you expect to receive a response from us?	X			
When did you receive a response?		X	X	
When did you receive a response regarding your most recent data request?				X
How did we respond to your data request?				X
Our staff was focused on determining and satisfying your needs.	X			
The SIS staff was focused on determining and satisfying your needs.		X	X	
SOI's product(s)/data satisfied your needs.	X			
The product(s) or services (s) provided met your needs.		X	X	X
SOI's product(s)/data was received timely.	X			
How often do you retrieve data from the SOI Tax Stats Web site?	X	X	X	
The SOI Tax Stats Web site is user-friendly.	X			
The SOI Tax Stats Web site is user-friendly. Why or why not?		X	X	
The Tax Stats Web site would be more useful if SOI considered the following (1) adding more data; (2) deleting data; (3) adding links to other data; (4) having a sophisticated search engine; (5) allowing "create your own" tables; (6) adding more viewable tables; (7) other.	X			
The information from the SOI Tax Stats Web site met your needs.		X	X	
If you could change one thing about the SOI Tax Stats Web site, what would it be?		X	X	
How would you prefer to receive products/files from SOI?	X			
If given the opportunity, would you be interested in receiving notice of future data/product releases from SOI?	X			
What types of new products/data releases would you be most interested in receiving?	X	X	X	X
Please rate your overall satisfaction with your most recent data request.	X	X	X	X
If you could change one thing about your experience with the SIS office, what would it be?				X
Please list any other Web sites that you use to gather statistical information.	X			
Please provide comments and/or suggestions on ways we may better serve your data needs.	X	X	X	X

Performance Measurement within the Statistics of Income Division

Kevin Cecco, Internal Revenue Service

Developing performance measures continues to play an important role for many of the Federal statistical agencies. Federal statistical agencies produce critical data to inform public and private decisionmakers about a range of topics of interest, including the economy, the population, and other pertinent statistics. The ability of statistical agencies to make appropriate decisions about the statistical data they produce depends critically on the availability of relevant, innovative, and timely performance measures. The Federal statistical community remains on alert for opportunities to strengthen these measures, when necessary.

For Federal statistical programs to effectively benefit their data users, the underlying data systems must be viewed as credible. In order to ensure this credibility, Federal statistical agencies have worked very hard to develop high-quality standards, as well as maintain integrity and efficiency in the production of data. As the collectors and providers of these basic statistics, the responsible agencies act as data stewards, balancing public and private decisionmakers' needs for information with legal and ethical obligations to minimize reporting burden, respect respondents' privacy, and protect the confidentiality of the data provided to the Government.

To reach this goal, Federal statistical agencies have focused on developing and measuring performance in the critical areas of quality, program performance, relevance, and timeliness. Lastly, customer satisfaction is quite often used as a means of measuring the usefulness of products and services provided by Federal statistical agencies. Performance measures form the basis for evaluating such areas as how efficiently Federal agencies provide services, how well taxpayer dollars are spent, and assessing whether Federal agencies are meeting their mission requirements.

▶ Understanding Performance Measures

In general terms, a performance measure is a quantitative or a qualitative measure derived from a series of observed facts that can reveal relative positions in a given area. When evaluated at regular intervals, the measure can point out the positive or negative trends and changes over time. Performance measures are also useful in drawing attention to particular issues that pertain directly to organizational mission achievement. They can also be helpful in setting policy priorities for a Federal agency.

There are several pros and cons related to performance measures. These include:

Pros:

- Can summarize complex issues in simple terms for supporting decisionmakers.
- Are easier to interpret than trying to find a trend among larger sets of data.
- Facilitate communication with appropriate target audiences.
- Promote accountability and credibility.

Cons:

- May send misleading messages if they are poorly constructed or misinterpreted.
- May be misused if the construction process is not transparent and lacks sound statistical or conceptual principles.

▶ Constructing Performance Measures

There are countless sources of information on how statistical agencies should construct solid performance measures. Provided below are four guidelines that should be followed when creating and implementing performance measures. Each step is important for statistically sound and defensible measures. Equally important is the notion of ensuring that all four guidelines are followed in an orderly and cohesive process. Choices made in one step can have important implications for other steps.

1. *Developing a Solid Foundation:* A sound framework is the starting point in formulating performance measures. The framework of measures should be built in a manner that correlates with the mission of an organization, as well as aligns with strategic goals and organizational objectives. The framework should be precise, articulating the purpose of the statistical agency.

2. *Selecting Quality Data:* The strengths and weaknesses of performance measures are largely based on the quality of the underlying data. Ideally, measures should be formulated based on their relevance, analytical soundness, timeliness, and availability. While the development of performance measures must be guided by the framework of useful indicators, the data selection process can be very subjective as there is no specific and generally accepted method for developing measures. More importantly, the inability to obtain relevant data may also limit a statistical agency from building sound and defensible performance measures.

3. *Identifying the Right Performance Measures:* Over the past decade, there has been a renewed effort in developing meaningful performance measures. Unfortunately, performance measures are sometimes selected in an arbitrary manner. This can lead to measures which confuse and mislead decisionmakers and the general public. The underlying nature of the data needs to be carefully assessed before constructors can develop the "right" measures.

4. *Presenting and Disseminating:* The way performance measures are presented is not a trivial issue. Performance measures must be able to communicate an accurate and persuasive picture to decisionmakers and organizational leaders. The representation of performance measures should provide clear messages without obscuring individual data points. There are many interesting ways of disseminating critical information, such as developing innovative balanced scorecards. These offer the general public the means to clearly show evidence of improving or declining performance. Statistical agencies should always strive to be independent and unbiased when presenting and disseminating performance measurement results.

▶ Performance Standards within the Federal Statistical Community

Statistical agencies maintain the quality of their data or information products, as well as their credibility, by developing meaningful performance measures for their organizations. Federal statistical agencies have collaborated on developing a meaningful set of performance measures for use under the Government Performance and Results Act and in completing the Administration's Program Assessment Rating Tool (PART). These statistical agencies have agreed that there are six conceptual dimensions within two general areas of focus that are key to measuring and monitoring statistical programs.

The first area of focus is Product Quality, encompassing the traditional dimensions of relevance, accuracy, and timeliness. The second area of focus is Program Performance, encompassing the dimensions of cost, dissemination, and mission achievement.

Provided below is a brief review of these six quality dimensions, split between Product Quality and Program Performance.

Product Quality: Statistical agencies agree that product quality includes many attributes, including *relevance*, *accuracy,* and *timeliness*. The basic measures in this group relate to the quality of specific products, thereby providing actionable information to key stakeholders.

These are ''outcome-oriented'' measures and are critical to the usability of these products. Statistical agencies establish goals and evaluate how well targets are met. In some sense, relevance relates to ''doing the right things,'' while accuracy and timeliness relate to ''doing things right.''

1. *Relevance*: Qualitative or quantitative descriptions of the degree to which products and services are useful and responsive to users' needs. Relevance of data products and analytic reports may be monitored through a professional review process and ongoing contacts with data users. Product relevance may be indicated by customer satisfaction with product content, information from customers about product use, demonstration of product improvements, comparability with other data series, agency responses to customer suggestions for improvement, new or customized products or services, frequency of use, or responses to data requests from users (including policymakers).

2. *Accuracy*: Qualitative or quantitative measures of important features of correctness, validity, and reliability of data and information products measured as degree of closeness to target values. For statistical data, accuracy may be defined as the degree of closeness to the target value and measured as sampling error and various aspects of nonsampling error (e.g., response rates, size of revisions, coverage, and edit performance). For analysis products, accuracy may be the quality of the reasoning, reasonableness of assumptions, and clarity of the exposition, typically measured and monitored through review processes. In addition, accuracy is assessed and improved by internal reviews, comparisons of data among different surveys, linkages of survey data to administrative records, redesigns of surveys, or expansions of sample sizes.

3. *Timeliness*: Qualitative or quantitative measure of timing of information releases. Timeliness may be measured as time from the close of the reference period to the release of information, or customer satisfaction with timeliness. Timeliness may also be measured as how well agencies meet scheduled and publicized release dates, expressed as a percentage of release dates met.

Program Performance: Statistical agencies agree that program performance encompasses balancing the dimensions of cost, dissemination, and mission accomplishment for the agency as a whole; operating efficiently and effectively; ensuring that customers receive the information they need; and serving the information needs of the Nation. Costs of products or programs may be used to develop efficiency measures. Dissemination involves making sure customers receive the information they need via the most appropriate mechanisms. Mission achievement means that the information program makes a difference. Hence, three key dimensions are being used to indicate program performance: *cost* (input), *dissemination* (output), and *mission achievement* (outcome).

4. *Cost:* Quantitative measure of the dollar amount to produce data products or services. The development and use of financial performance measures within the Federal Government are an established goal; the intent of such measures is to determine the ''true costs'' of various programs or alternative modes of operation at the Federal level. Examples of cost data include full costs of products or programs, return on investment, dollar value of efficiencies, and ratios of cost to products distributed.

5. *Dissemination:* Qualitative or quantitative information on the availability, accessibility, and distribution of products and services. Most agencies have goals to improve product accessibility, particularly through the Internet. Typical measures include: on-demand requests fulfilled, product downloads, degree of accessibility, customer satisfaction with ease of use, number of participants at user conferences, citations of agency data in the media, number of Internet user sessions, number of formats in which data are available, amount of technical support provided to data users, exhibits to inform the public about information products, issuance of newsletters describing products, and usability testing of Web sites.

6. *Mission Achievement*: Qualitative or quantitative information about the effect of, or satisfaction with, statistical programs. For Government statistical programs, this dimension responds to the question—have we achieved our objectives and met the expectations of our stakeholders? Under this dimension, statistical programs document their contributions to the goals and missions of parent departments and other agencies, the Administration, Congress, and information users in the private sector and the general public. For statistical programs, this broad dimension involves meeting recognized societal information needs; it also addresses the linkage between statistical outputs and programmatic outcomes.

▶ Performance Standards within the Internal Revenue Service Statistics of Income Division

The mission of the Statistics of Income (SOI) Division is to collect, analyze, and disseminate information on Federal taxation for the Treasury Department's Office of Tax Analysis, Congressional Committees, the Internal Revenue Service in its administration of the tax laws, other organizations engaged in economic and financial analysis, and the general public. To accomplish the mission, the SOI provides statistical data to be used strictly in accordance with, and subject to, the limitations of the disclosure provision of the IRS Code.

The SOI Division worked with others within IRS to develop 12 performance measures. The measures cover various areas of operation and attempt to magnify the level of service provided to our primary stakeholders. In creating the performance measures, the group worked very hard to ensure that the measures were all-encompassing within the four strategic goals of SOI, including becoming our customers' preferred source, attracting and challenging high-quality employees, making a difference in tax administration, and increasing visibility of the SOI Division.

▶ Twelve SOI Performance Measures

What follows is a summary of the 12 performance measures. Specifically, a definition is provided, as well as a synopsis of results over the past 3 years.

Measures 1 and 2 are collected from customer satisfaction surveys that are administered to our critical stakeholders in OTA, JCT, and BEA, as well as selected customers and employees throughout IRS.

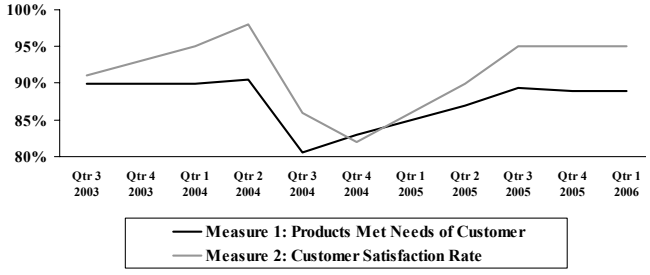
1. *Percentage of customers who feel the product or service met their needs:*

Include a question on a customer satisfaction survey asking: "Did the product(s) or service(s) provided to your organization meet your needs."

2. *Overall RAS Customer Satisfaction rate:*

Include a question on a customer satisfaction survey asking: "Please rate your overall satisfaction with SOI."

Measures 1 and 2–Product Met Needs of Customer and Customer Satisfaction Rates



- Results from the chart show fairly comparable rates between Measures 1 and 2 over the past 3 years
- Since this measure captures results from five different customer surveys, relevance and satisfaction rates vary quarter by quarter.

3. *Overall Employee Satisfaction Scores from the Employee Survey:*

Definition: The grand mean score from 12 questions found on IRS's annual employee satisfaction survey.

Measure 3–Employee Satisfaction

Measure captures the annual Gallup Grand Mean Score across Q12 questions for SOI:

	2003	2004	2005
Grand Mean Score	3.99	3.86	3.81

Results show a slight decline in employee satisfaction over the past three years

4. *RAS Attrition rates:*

Definition: Attrition rate is defined as the total number of employees who have a break in service from IRS within a given fiscal year divided by the total number of employees (part and full-time) on the rolls at the beginning of a fiscal year.

Measure 4–RAS Attrition Rate

Attrition rate is defined as the number of employees who have a break in service from IRS within a given fiscal year divided by the number of employees on rolls at the beginning of the fiscal year.

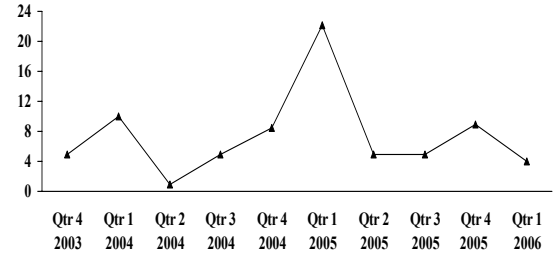
Results:

2003	2004	2005
4.70 %	3.80 %	4.40 %

5. *Number of applicants per job opening:*

Definition: The total number of unique applicants received for each job announcement. This includes all applications received by the servicing personnel specialist.

Measure 5–Number of Applicants per Job Opening

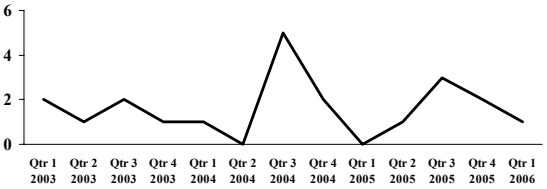


Number of applicants per job opening has fluctuated significantly over the past 3 years. On average over the past 3 years, SOI receives approximately seven applicants per job announcement.

6. *Number of Senior Leadership Briefings:*

Definition: Tally of senior leadership team briefings. Senior leaders are defined as individuals and comprise 23 senior IRS executives.

Measure 6–Number of Senior Leadership Briefings

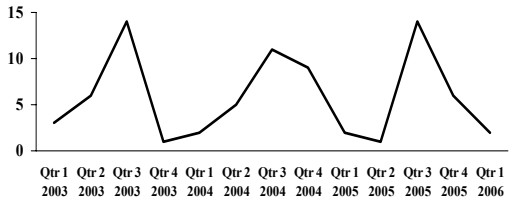


IRS Senior Leadership Group consists of 23 executives across the Service. The graphic shows a relatively small, yet inconsistent, number of Leadership briefings over the past 3 years.

7. *Number of Presentations Given Outside the Service:*

Definition: The number of program presentations given to groups and/or individuals outside the Service. Each briefing will count as one (e.g., if an organization briefs multiple customers at the same time, that will count as one briefing).

Measure 7–Number of Presentations Given Outside the Service

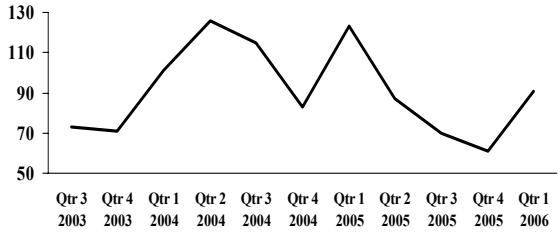


Such audiences for presentations include GAO, TIGTA, ASA, and NTA meetings, and various IRS advisory groups. Results show a relatively consistent pattern in the number of presentations over the past 2 years.

8. *Number of New and Repeat Customers:*

Definition: A Customer is defined as an individual person or organization that officially authorizes a product or service. A Repeat Customer is the same individual or organization requesting a new work activity, and a New Customer is a new individual person or organization requesting a new work activity.

Measure 8–Number of New and Repeat Customers

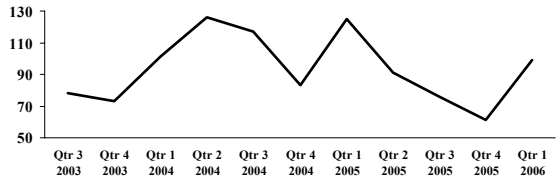


- A customer is defined as an individual or organization authorizing a product or service from RAS. Web activity is not included in this measure.
- Data have fluctuated for this measure over the past 2 years.

9. *Number of data requests, publications, reports, and data sets completed:*

Definition: This measure is a count of work products completed by SOI. It includes four types of work products. It captures: 1) data requests produced from a query from one of the RAS data sets; 2) publications produced according to a regular or routine schedule or as part of normal business operations; 3) reports produced as a result of an analysis; or 4) new data sets produced from existing databases.

Measure 9–Number of Data Requests, Publications, Reports, and Data Sets



Similar to new and repeat customers, the number of data requests, publications, reports, and data sets has bounced around between 75 and 125 per quarter.

10. *TaxStats Internet Activity:*

Definition: The number of visits to the TaxStats Internet site. Visits are defined as the number of times a visitor came to TaxStats within a given period of time.

The number of page views to the TaxStats Internet site. When a visitor accesses a page, it requests all of the hits on that page, including the page itself. In order to report the number of page views, the Web site analysis software separates the page hits from the other hits. These numbers make up the page view metric.

Measure 10–TaxStats Internet Activity

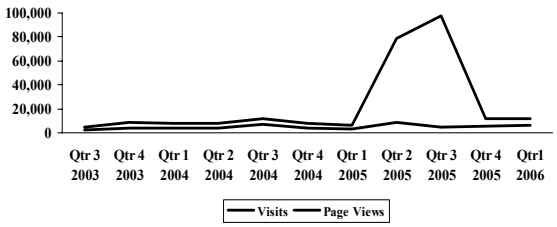
The redesign of the IRS.gov Web site in 2005 might be the prevailing reason for the lack of a spike in TaxStats visits and page views during the 1st Quarter of 2006.

11. *RAS Intranet Web Activity:*

Definition: The number of visits to the RAS Intranet site. Visits are defined as the number of times a visitor came to the RAS Intranet site within a given period of time.

The second part of this measure is the number of page views to the RAS Intranet site. When a visitor accesses a page, it requests all of the hits on that page, including the page itself. In order to report the number of page views, the Web site analysis software separates the page hits from the other hits. These numbers make up the page view metric.

Measure 11–Number of Visits and Page Views on the RAS Web site

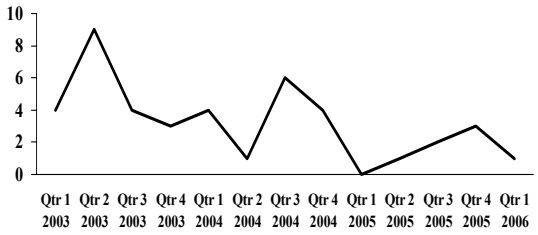


Data for this measure became available to RAS during the 3rd Quarter of 2003. Results clearly reveal an aberration in data. This spike was likely caused by Google search testing in June and July.

12. *Number of mentions of SOI in major media:*

Definition: This indicates media coverage of SOI activities by mass media, such as the *Wall Street Journal, Washington Post, New York Times, and Tax Notes*.

Measure 12–Number of Mentions of RAS in Media



Measure includes citations in the *Wall Street Journal, Washington Post, New York Times, and Tax Notes*. The number of media citations for SOI has remained fairly constant over the past 2 years.

▶ References

Strengthening Federal Statistics, *Analytical Prespectives, Budget of the United States Government, Fiscal Year 2007*, Chapter 4, February 2006.

OECD Working Paper 2005/3, *Handbook on Constructing Composite Indicators: Methodology and User Guide*, August 2005.

3

Broad Quality Issues in Organizations

Milleville

Tying Web Site Performance to Mission Achievement in the Federal Government

Diane M. Milleville, Internal Revenue Service

As the World Wide Web (WWW) continues to expand, both in size and in how it is accessed, so does the Federal Government's dependence on it as a gateway for reaching the American public, who increasingly rely on the Web to obtain information. The role of the WWW in how Federal agencies interact with their customers has changed dramatically over the years. Federal Web sites are fairly extensive, containing a wealth of information targeted to a variety of audiences.

While agencies have been utilizing the Web to disseminate information for years, little, in comparison, has been done to understand and evaluate how effective these Web sites are when it comes to agency mission achievement. However, with the costs associated with Federal Web sites, it is imperative that each agency ensure that its Web site makes a meaningful contribution toward achieving its mission.

As with most things, that is easier said than done. The Government placed greater emphasis on this task, having issued an assortment of documents that each addresses the topic in different ways, but did not develop a concise guide to address the most important aspects of mission achievement assessment and how Webmasters can apply it to their own sites, leaving this undertaking largely undefined and Webmasters at a loss of direction. In an effort to help Webmasters with various tasks, the Web Manager's Advisory Council, a group of Web managers from all areas of the Federal Government, created task groups to develop guidance that contained as much detail as possible, while remaining general enough to apply to any Federal site.

Among these task groups was the Performance Measures and Mission Achievement (PMMA) task group [1], which developed a detailed single-source guide to show how a Web site contributes to mission achievement [2]. The guide condenses the vast amount of information on this topic into a step-by-step process to show mission achievement through Web site performance, while also meeting Government performance measure commitments. It was designed for both Web managers who are more advanced in their efforts, as well as for managers who are just beginning the process. Following the guide, every Federal Web manager should be able to demonstrate how their respective Web sites contribute to their agency's missions.

▶ Performance Measurement as a Requirement

General performance measures are not new to the Federal Government. Since the early 90s, various Government initiatives have emphasized the importance of measuring performance of Federal programs. Each initiative addresses performance measures in a slightly different manner. Some added additional requirements, building on previous initiatives and improving areas that were lacking, while others reinvented the idea of Government performance measurement. But each edict has one thing in common: holding Federal programs accountable to the American public.

In 1993, the Government Performance and Results Act mandated that Federal performance be measured and results reported publicly, in an effort to make all agencies accountable to the American public. This Act, which is considered to be the most significant advance in bringing accountability to Government programs [3], mandated that Federal performance be measured and results be reported publicly.

Since 1993, the Federal Government has added additional requirements, which have built upon the Government Performance and Results Act. This includes the Program Assessment Rating Tool (PART), which was introduced in the Fiscal Year 2004 budget. PART assesses a program's effectiveness and demands that Federal programs show results in order to earn financial support. The Office of Management and Budget Circular A-130, *Management's Responsibility for Internal Controls*, called for the institution of performance measures that monitor actual performance as compared to expected results.

There is no lack of information when it comes to *what* agencies need to evaluate. The problem is that the Federal Government does not provide much guidance in terms of *how* agencies can evaluate their programs. This is especially true for measuring Web site effectiveness.

▶ How To Show Mission Achievement

Determining how to show mission achievement through Web site performance is not easy, especially with the lack of guidance available. Web managers are familiar with common Web performance metrics that cover visitor traffic (including visits and page views). And while such information is valuable, these types of broad measures alone cannot be used to demonstrate mission achievement.

Before a Web site manager begins this process, he or she should understand that not all aspects of a Federal Web site must demonstrate mission achievement. It is acceptable to provide features on a Web site that do not relate to an agency's mission.

Another thing to keep in mind is that agencies do not need an extensive amount of metrics in order to show mission achievement. Well-developed, quality metrics will provide much more valuable information than a report full of every metric the manager could think of.

Since there is much to consider before jumping into actual performance metrics, the PMMA task group decided that the easiest way to prove mission achievement is to break the process up into steps. These steps are:

- Review and understand agency mission statement;
- Identify mission categories;
- Identify related business models;
- Map existing Web services to business models; and
- Develop metrics that compliment business models.

Each step leads into the next. By working through each step, Web managers will be able to determine which aspects of the site are most important and will be able to match metrics to these specific areas.

▶ Step 1—Understand Mission Statement

The key to showing mission achievement is to first have a comprehensive understanding of the agency mission statement. It is important to note that, although the topic here is "mission achievement," the goals and purpose of an agency are not solely detailed within the agency's mission. Other important documents covering strategic planning and vision also contain pertinent information about an agency and should be included in this process. The Web manager should review these documents and highlight words and phrases that are most important to the agency.

Example: To show that IRS.gov contributes to IRS mission achievement, the Web manager should gather the IRS mission statement, vision, and goals, as well as any other important documents or publications containing information on IRS goals. By reviewing these documents, the Web manager would see that the IRS focuses on educating taxpayers about their tax obligations, ensuring that all taxpayers pay their fair share of taxes and that the agency concentrates on minimizing the amount it spends when collecting tax payments [4]. Key topics from this step are "educa-

tion," "compliance," and "fiscal performance and cost containment."

▶ Step 2—Identify Mission Categories

Since the number of topics from the mission statement and supporting documents can be quite large, the PMMA task group decided to group topics into mission categories to help generalize the process for all Federal agencies. The mission categories are based on the "modes of delivery" as described in the Federal Enterprise Architecture's Business Reference Model [5]. The "modes of delivery" detail the different ways in which the Government carries out its purpose. This organization lends itself easily to the categorization of mission statements.

The modes are divided into two areas: Government service delivery and financial vehicles. Government service delivery modes involve how agencies provide services to citizens, while financial vehicle modes involve monetary transactions. Categories of Government service delivery modes are: knowledge and creation management; public goods creation and management; regulatory compliance and enforcement; and direct services for citizens. Financial vehicle modes include: Federal finance assistance; credit and insurance; and transfers to States and local governments.

Example: The IRS Web manager identified three topics in step one. By referring to the guidance provided on mission categories, he or she would be able to map each of the three topics identified to a specific mission category. The topics match as follows:

Education	Knowledge and Creation Management
Compliance	Direct Services to Citizens
Fiscal Performance and Cost Containment	Regulatory Compliance and Enforcement

▶ Step 3—Identify Business Models

Each mission category relates to various business models. The PMMA task group created a matrix that allows Web managers to easily map mission categories to the business models with which they are most often associated. The matrix also indicates how often each model is used to support a mission category (indicated by: H-High, M-Medium, L-Low).

It is important to note that some mission categories may share the same business models. When this happens, the Web manager should pay special attention to the models that are repeated, since those are the ones most relevant to the agency's mission. The Web manager does not need to use all business models identified in this step. He or she should use the frequency of use indicators to decide where to start.

For certain agencies, business models that are used infrequently among Federal agencies may be more relevant than ones that are marked with medium or high. In this case, the Web manager should focus on the more appropriate model, regardless of general usage frequency.

Example: The three mission categories identified in the previous step relate to eight different business models: interactive tools, targeted education, e-commerce, reduce costs, recruitment, nonfinancial transactions, print forms available, and news/information. With so many models, the Web manager may feel overwhelmed and unsure where he or she should start. Within this list though, three models appear multiple times: targeted education (3), interactive tools (2), and e-commerce (2). Since these occur multiple times, the Web manager should focus on these three models, at least at the beginning of the process. Then, if the Web manager wants to explore more options, he or she can return to the full list.

▶ Step 4—Match Web Services to Business Models

Once the Web manager has identified the business models on which he or she should focus, the next step is to evaluate existing Web site services and determine

which services complement each business model. These services will be the ones that the agency evaluates, using results to show how the site contributes to mission achievement. Web service types can include general information, publications and forms available for download, and customized tools designed to help the customer obtain specific information, among others. As previously stated, not all services on the Web site will directly support the agency's mission.

Example: The IRS.gov Web manager should focus on each model separately. Beginning with targeted education, he or she should compile a list of all items or areas of the site that are related to educating taxpayers. This can include providing electronic versions of forms, publications, and instructions online, as well as tax tips.

For interactive tools, the manager should determine what, if any, tools are on IRS.gov. Current interactive tools include: withholding calculator, alternative minimum tax assistant, and the refund status tool.

Finally, there is e-commerce. IRS does not currently engage in e-commerce activities on its Web site. However, it does provide access to e-file partners and free file alliance companies; hence, the site encourages e-commerce. And this type of activity enhances the IRS's ability to collect tax revenue. Therefore, the IRS Web manager should evaluate how the site is impacting tax collection.

▶ Step 5—Select Appropriate Performance Metrics

Now that the Web manager has made it through the first four steps, he or she is ready and prepared to start thinking about performance measures. Having completed the other steps in the process, the Web manager will be more familiar with the agency's overall mission and goals and will be able to more easily identify metrics that will show mission achievement.

The PMMA task group recommends that Web managers use Victor Basili's Goal Question Metric approach. Using this method, the manager first sets a goal for each model and then derives questions for each goal. Finally, he or she will develop metrics for each question (most likely, there will be multiple metrics used to answer one question).

Once the manager has a metric in mind, he or she should ask the following two questions: 1) What will be done with this information? and 2) What kind of action will be taken based on this information? If the answer is "nothing" or "none," the metric is not worth tracking. It is important that the information collected be of value to the organization. If it is not, a different measure should be selected instead.

After a metric is selected, time must be spent to define the metric—what it covers, what should be collected and how, and what do the results mean. All of this should be done prior to implementation; however, it may be necessary to collect some information for a baseline before the agency can define results.

Example: Targeted Education

Goal: Reduce costs as a result of providing educational and instructional materials online.

Question: How do the costs for providing targeted education online compare with other materials?

Metric: The amount of money saved by not mailing hard-copy information.

Things to consider: Which materials should be included in this measure? How much would it cost to send out each of the materials in this measure?

Data to collect: The number of downloads per each type included.

Savings: For each material, the cost of mailing the item multiplied by the number of downloads associated with each item.

Example: Interactive Tools

Goal: Reduce costs of processing paper versions by providing online tools for frequently requested items.

Question: How much money is saved by customers using online tools instead of filing paper requests?

Metric: The amount of money saved by customers using online tools as compared to using paper versions.

Things to consider: Which tools should be included in this measure? How much would it cost to process hard copies of the items included in this measure?

Data to collect: The number of completed transactions per each tool included.

Savings: For the number of times each tool was used, multiply the cost of the online tool and the cost of processing hard copies, separately. Calculate the difference.

Example: E-commerce

Goal: Streamline and reduce the costs of the collection of tax returns through increased use of e-file.

Question: What are the direct cost savings from processing electronic returns?

Metric: The amount of money saved by processing an e-file return instead of a paper return.

Things to consider: What aspects are involved in processing both e-file and paper returns? How much does it cost to process a print return? How much does it cost to process an e-file return?

Data to collect: The number of e-filed returns.

Savings: For the number of returns e-filed, multiply the cost of processing a paper return and an e-filed return, separately. Calculate the difference.

▶ Next Steps

The process is not complete once the Web manager has selected metrics related to agency-specific goals. Although selecting these metrics was the assigned task, there are several other things that should be considered. First, all terms associated with each metric must be clearly defined. These definitions should be agreed upon and deemed official. This is key because loosely defined terms may lead to misinterpretation.

Limitations for each metric should be identified and clearly explained. If a Web manager does not fully understand the limitations associated with each metric, the reported result may not be accurate, and misinterpretation will most likely occur. While some limitations may have a small impact on data, others may contribute to an agency's inability to collect certain data.

Cookie usage is one of the most pressing limitations for Federal Web sites. A cookie is a small text file placed on a customer's computer hard drive by a Web server. This file allows the Web server to identify individual computers—permitting a company to recognize returning users, track online purchases, or maintain and serve customized Web pages.

There are two types of cookies that can be used on a site: session cookies and persistent cookies. Session cookies have a short life-span; they are placed on the user's computer when he or she lands on the site and expire shortly after the visit concludes. Persistent cookies remain on the customer's computer for much longer. The length of time is defined by the Web site, but could be 30 or more years.

The Federal Government generally prohibits the use of persistent cookies on all Government Web sites. Federal agencies may be granted permission to use persistent cookies on their Web sites if they can demonstrate: "a compelling need to gather site user data; ensure appropriate and publicly disclosed privacy safeguards for handling site data, as well as information collected through cookies; and obtain personal approval by the agency head [6]." While the first two requirements are relatively easy to demonstrate, the third one is not easy to obtain. Within the Federal Government, there is a negative connotation associated with any cookie use, which makes it almost impossible to acquire personal approval for cookie usage from the head of an agency. Without persistent cookies, Federal agencies cannot collect certain data

for metrics, including visit frequency, unique visitors, and first-time versus repeat visitors, among others.

Next, the Web manager should determine how often data for each metric should be collected. Sometimes, it will make sense to assess metrics monthly, while other metrics may only need to be assessed on a quarterly or yearly basis. For some metrics, it may be useful to collect data for a few different timeframes. This type of analysis may show different trends, or it may help determine what drives a certain trend.

Prior to data collection implementation, the agency should determine what will be done if a metric shows negative results. It is important to determine the consequences for poor performance early on, instead of putting it off until it occurs. Establishing a plan for how to handle negative results will help an agency quickly respond to (and hopefully recover from) poor performance results.

▶ The Education Process

With the implementation of any new program, there should also be an education process. Education of both employees who work on the Web site and management who will use the results to make decisions or present the information to others is essential when it comes to Web site performance metrics. Many people assume they know what the different metrics mean, but they often do not have a good understanding of the terms, associated limitations, or interpretation issues that may exist.

"Web hits" are a prime example of why education is important. Many people do not know what a Web hit is. They assume that it is the leading metric that shows how many people come to a site in a given timeframe. What they do not realize is that hits and visits are not synonymous. A hit is any element called by a Web browser when requesting a Web page. This includes images, animation, audio, video, downloads, documents, and the page itself, among other items. One single page may produce 30 or more hits each time it is requested. It turns out that this inflated number has no significant use outside of showing the Web manager what the server workload is like during a given timeframe.

When developing metrics, it is of the utmost importance to spend time educating everyone who will be using the information. This process is essential because misreported or misinterpreted data may lead to poor decisions, and will highlight a lack of understanding among the agency.

▶ Developing a Report

Results from selected metrics should not be reported individually, but instead in a comprehensive report. The type of report is up to the agency. The report could be a single page, a detailed report that includes charts and graphs, a dashboard-style report, a balanced scorecard-style report, or any other style that matches the information presented. Incorporating all Web site performance metrics into one report will help the audience see the global view of the Web site and how each aspect contributes to mission achievement.

It is always important to keep the audience in mind when deciding on the report style. It may be necessary to develop a few different reports, each tailored to a different audience. For example, agency executives who need this information may want a short report, perhaps a dashboard, while the Web manager will most likely want as much detail as possible, requiring a very different report.

In any and all reports, data reported should be presented in a simple and clear manner. Graphics and charts that are used in reports should be carefully considered; while some graphics look visually interesting, they may not truly reflect the results and may mislead the audience, which could lead to poor decisionmaking.

In addition to the results, the report should also include a statement of intent, definitions for all metrics and associated terms, and explanations of all data collection and interpretation limitations. Someone

who fully understands the metrics should also provide some analysis of the results to help with interpretation. These additional areas will help reinforce the education initially provided and will help ensure that decisions and actions taken based on the information in the report will be appropriate to the results shown.

▶ Conclusions

Although the idea of linking Web site performance measures to mission achievement sounds daunting, breaking the process into steps makes the task more straightforward. Each step also builds the Web manager's understanding of how the Web site relates to the agency's mission; this will help the Web manager select the best metrics possible.

When it comes to showing mission achievement through performance measures, there is much more involved than just selecting metrics and collecting data. Agencies must thoroughly understand the metrics they select, the data collection method they use, and any (and all) data collection and interpretation limitations that exist. In addition, the agency should spend time educating end users of the results; everyone should understand what can and cannot be determined from the information collected.

Education is, and should be, a permanent part of this process. After an initial explanation of the selected performance measures package, the agency should continue to remind users of definitions, limitations, and interpretation issues by including explanations in all reports produced. This is the best safeguard in ensuring that results will not be misinterpreted or misused.

Finally, agencies should continuously evaluate and reevaluate performance metrics. If the agency's focus changes, the performance metrics should change to accommodate the new focus. Web managers should also examine the metrics on an annual basis to determine if the information derived from the metrics is what was originally intended. This will certify that statements included in performance reports are accurate.

By developing performance metrics that demonstrate mission achievement, agencies will not only be able to assess the resources spent on Web sites, but will also prove themselves financially responsible to the American public. In turn, this information will help raise the public's confidence in the Federal Government as a whole.

▶ Endnotes

[1] The PMMA task group is an interagency group created by the Web Managers Advisory Council.

[2] The full guide is available on the First Gov Web site: http://www.firstgov.gov/webcontent/improving/evaluating/mission.shtml

[3] Budget of The United States Government, Fiscal Year 2004. Section: Rating the Performance of Federal Programs. Available: http://www.whitehouse.gov/omb/budget/fy2004/performance.html

[4] Department of Treasury (2005), *Internal Revenue Service 2005 Data Book*, Table 31. Available: http://www.irs.gov/pub/irs-soi/05db31ps.xls

[5] FY07 Budget Formulation FEA Consolidated Reference Model Document (May 2005). Available: http://www.whitehouse.gov/omb/egov/documents/CRM.PDF

[6] Office of Management and Budget (2000), "Cookies Letter." Available: http://www.whitehouse.gov/omb/inforeg/cookies_letter90500.html

4

Survey-Based Estimation

Henry ◆ Valliant

Comparing Strategies To Estimate a Measure of Heteroscedasticity

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Estimating totals is often a survey sampling objective. With a model-based approach, one factor that can affect the variance and bias of estimated totals is the superpopulation structure. We consider cases where a dependent variable's variance is proportional to some power of the independent variable. Various strategies that are conceivable in this case include: (1) selection of a pilot sample to make preliminary structural parameter estimates, (2) selection of a main sample based on either pilot results or educated guesses about population parameters, and (3) use of either a model-based or design-based estimator of the total. For various sample designs, sizes, and estimators, alternative strategies for estimating values of that variance power are compared for simulated population data. The strategies' effects on estimates of totals and their variances are then evaluated.

This paper is organized into six sections. After the introduction, the second section contains descriptions of our superpopulation model and generated populations. The third section includes our simulation setup details, while results are discussed in the fourth section. Conclusions, limitations, and future considerations are in the fifth section and references in the sixth section.

▶ Superpopulation Model and Generated Populations

Model Theory

Given a study variable of interest Y and an auxiliary variable X, we consider a superpopulation with the following structure:

$$E_M(y_i \mid x_i) = \beta_0 + \beta_1 x_i$$
$$Var_M(y_i \mid x_i) = \sigma^2 x_i^{\gamma} \qquad (2.1)$$

The x_i's are assumed to be known for each unit i in the finite population. The exponent γ in model (2.1)'s conditional variance has been referred to as a *measure of heteroscedasticity* (Foreman, 1995), or *coefficient of heteroscedasticity* (Brewer, 2002). This parameter is of interest since a reasonable γ estimate produces nearly optimal sample designs and estimators of totals and their variances (Theorem 4.2.1, Valliant, Dorfman, and Royall, 2000).

Applications of models like (2.1) include companies using cost segregation to report depreciable assets on their Internal Revenue Service Tax Form 1120 (e.g., Allen and Foster, 2005 and Strobel, 2002) and comparing inventory data values versus actual values (e.g., Roshwalb, 1987 and Godfrey et al., 1984).

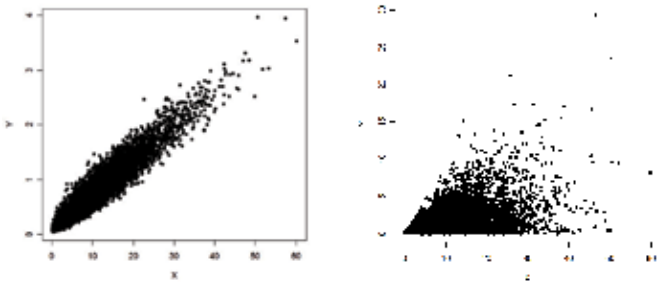
Given generated population data, our goal is to use various strategies to draw samples and estimate γ from them, then examine the impact of these strategies on the estimation of totals and their variances.

Generated Populations

We created two unstratified versions of the population described in Hansen et al. (1983, denoted HMT hereafter), since it follows model (2.1). We chose γ equal to 3/4 and 2 for populations of 10,000 units. Figures 1 and 2 show the population X, Y for each generated population (note a difference in Y-scales):

Figure 1—Generated Populations

$\gamma = 3/4$ $\gamma = 2$



The first population has a relatively strong dependence between y and x, while the second one has a much weaker relationship. Note that these populations have a small non-zero intercept, which resulted in some model-based estimators being biased in the earlier HMT study.

▶ Simulation Setup

This section describes the details of our simulation study, including working models, sample designs, simulation strategies, and the method of estimating γ.

Models

Using Valliant et al.'s (2000) notation, we based estimators of totals on the following two working models:

$$M(1,1:x^{\gamma}) \tag{3.1}$$
$$M(x^{\gamma/2},x^{\gamma}:x^{\gamma}) \tag{3.2}$$

Model (3.1) is the correct working model, i.e., the one equivalent to model (2.1). Model (3.2) is associated with the following superpopulation structure:

$$\begin{aligned} E_M(y_i \mid x_i) &= \beta_{1/2}x_i^{\gamma/2} + \beta_1 x_i^{\gamma} \\ Var_M(y_i \mid x_i) &= \sigma^2 x_i^{\gamma} \end{aligned} \tag{3.3}$$

Working model (3.3) is called the minimal model (Valliant et al., 2000, p. 100) associated with the above conditional variance. If (2.1) were unknown, but the intercept is small, working model (3.3) may be a reasonable starting place for determining a sample size.

When the variance of y_i is proportional to x_i^{γ} and $E_M(y_i \mid x_i)$ is a linear combination of auxiliaries, one of which is x_i^{γ}, two important optimality results hold: (1) The selection probabilities that minimize the anticipated variance of the general regression (GREG) estimator are proportional to x_i^{γ} (Särndal, Swensson, and Wretman, 1992, sec. 12.2); and (2) The optimal model-based sample will have a certain type of weighted balance that also depends on x_i^{γ} (Valliant et al., 2000, sec. 4.2.1). An optimal, weighted balanced sample can be approximated by a probability-proportional-to- x_i^{γ} sample, denoted $pp(\sqrt{x^{\gamma}})$.

There is often a huge incentive to use optimal samples and estimators in the applications we consider due to high data collection costs. In a cost segregation study, for example, experts may be needed to assign capital goods to depreciation classes (e.g., 5, 7, 15, or 39-year). Assessments can be time-consuming and expensive; so, the smaller the sample size that yields desired precision, the better.

Sample Designs

For each unit i in the population, we consider four without replacement (*wor*) sample designs:

(1) *srswor*: simple random sampling.
(2) *ppswor*: the Hartley-Rao (1962) method with probabilities of selection proportional to a measure of size (MOS).
(3) *ppstrat*: strata are formed in the population by cumulating an MOS and forming strata with equal total size. An srswor of one unit is selected from each stratum.
(4) *wtd bal*: weighted balanced sampling. *Ppswor* samples using an MOS are selected that satisfy particular conditions on the population and sample moments of x_i.

For each of these designs, we drew 1,000 samples of 100 and 500 units. When the MOS is $\sqrt{x^{\hat{\gamma}}}$, the *ppstrat* design approximates optimal $pp(\sqrt{x^{\gamma}})$ selection and *wtd bal* $\sqrt{x^{\gamma}}$ sampling. It is similar to "deep stratification" (e.g., Bryant et al., 1960; Cochran, 1977, pp. 124-126; Sitter and Skinner, 1994), which is used in accounting applications (Batcher and Liu, 2002). More specific details on these designs are given in pages 66-67 of Valliant et al. (2000).

Strategies

The strategies we examined consisted of selecting a pilot study to get a preliminary estimate of γ followed by a main sample or only selecting a main sample. Both options were crossed with the possibility of rounding γ or not. Thus, our main comparisons concern four strategies:

A: draw a $pp(\sqrt{x})$ pilot of 50 units, estimate γ, and select a main sample using *pp* $(\sqrt{x^{\hat{\gamma}}})$, *ppstrat* $(\sqrt{x^{\hat{\gamma}}})$, and *wtd bal* $(\sqrt{x^{\hat{\gamma}}})$ samples.
B: draw *srswor*, *ppswor* $(\sqrt{x})$, *ppstrat* $(\sqrt{x})$, and *wtd bal* $(\sqrt{x})$ main samples only and estimate γ in each.
C: strategy A, rounding $\hat{\gamma}$ to the nearest one-half.
D: strategy B, rounding $\hat{\gamma}$ to the nearest one-half.

By definition, there is no *srswor* used for strategies A and C. Also, B and D correspond to assuming $\gamma = 1$

for selecting the *ppswor*, *ppstrat*, and *wtd bal* samples, which does not match our population γ's, but will be a reasonable advance choice for sampling in many populations. We consider the rounding in C and D to see if reducing variability in the $\hat{\gamma}$'s leads to improved estimates of totals and variances.

Estimation of γ

To estimate γ, following Roshwalb (1987), we iteratively fit a given working model and regressed the log of the squared residuals on $\log(x)$ as follows:

$$\log(r_i^2) = \alpha + \gamma \log(x_i),$$

and repeated the process until $\hat{\gamma}$ stabilized.

For all strategies, if $\hat{\gamma} \le 0$, then it was forced to one, which corresponds to $pp(\sqrt{x})$ sampling. Rejected alternatives included forcing $\hat{\gamma} = 0$, implying homoscedasticity, or dropping these samples, both of which are unrealistic. Table 1 shows the number of these occurrences for the $\gamma = 3/4$ population (there were less than 5 cases for each strategy for the $\gamma = 2$ population). Also, for all strategies, if $\hat{\gamma} > 3$, then it was forced to equal three to avoid unreasonably large $\hat{\gamma}$'s. Table 2 contains the number of these occurrences for the $\hat{\gamma} = 2$ population (there were none of these cases for the $\gamma = 3/4$ population).

In Table 1, strategies A and B's numbers are the number of negative $\hat{\gamma}$'s. For C and D, the numbers include cases where small positive $\hat{\gamma}$'s were rounded down to zero. The numbers in parentheses are the number of negative $\hat{\gamma}$'s. The rounding used for C and D leads to fewer negative estimates than in A and B, but rounding does not offer overall improvement. Strategies B and D produced fewer negative $\hat{\gamma}$'s than A and C since B and D use 100 and 500 units, as opposed to pilot samples of size 50 in A and C. Also, depending on the strategy, there were at least three times as many negative $\hat{\gamma}$'s using model (3.2) versus using (3.1).

Table 1—Number of Times $\hat{\gamma} \to 1$, $\gamma = 3/4$ Population

Strategy	*Design*	$M(1,1:x^{\gamma})$		$M(x^{\gamma/2},x^{\gamma}:x^{\gamma})$	
		pilot n=50		*pilot n=50*	
A	*ppswor*	52	67	159	171
	ppstrat	56	56	164	199
	wtd bal	60	59	167	181
C	*ppswor*	157 (18)	134 (28)	263 (98)	243 (122)
	ppstrat	129 (20)	150 (25)	256 (83)	275 (114)
	wtd bal	136 (24)	142 (24)	252 (63)	267 (105)
		n=100	*n=500*	*n=100*	*n=500*
B	*srswor*	8	0	68	3
	ppswor	16	0	93	5
	ppstrat	11	0	81	5
	wtd bal	12	0	92	3
D	*srswor*	43 (2)	0	158 (40)	30 (0)
	ppswor	67 (2)	0	179 (52)	43 (1)
	ppstrat	53 (2)	0	191 (50)	23 (0)
	wtd bal	59 (2)	0	184 (52)	34 (0)

In Table 2, Strategies B and D produced fewer large $\hat{\gamma}$'s than A and C. Rounding in C and D also produced fewer large $\hat{\gamma}$. There were at least twice as many large $\hat{\gamma}$'s when using model (3.1) versus model (3.2).

Table 2—Number of Times $\hat{\gamma} \to 3$, $\gamma = 2$ Population

Strategy	*Design*	$M(1,1:x^{\gamma})$		$M(x^{\gamma/2},x^{\gamma}:x^{\gamma})$	
		pilot n=50		*pilot n=50*	
A	*ppswor*	73	73	21	21
	ppstrat	61	51	22	18
	wtd bal	81	63	28	24
C	*ppswor*	39	46	9	6
	ppstrat	32	36	8	8
	wtd bal	27	32	14	10
		n=100	*n=500*	*n=100*	*n=500*
B	*srswor*	7	0	2	0
	ppswor	7	0	2	0
	ppstrat	12	0	1	0
	wtd bal	5	0	3	0
D	*srswor*	2	0	0	0
	ppswor	2	0	1	0
	ppstrat	3	0	0	0
	wtd bal	2	0	1	0

Estimation of Totals

We consider three kinds of estimators for totals: the *Horvitz-Thompson* (HT) estimator, *best linear unbiased predictors* (BLUP), and *general regression estimators* (GREG). The HT estimator is given by

$$\hat{T}_{\pi} = \sum_{i \in s} y_i / \pi_i,$$

where π_i is the probability of selection for unit *i*.

The general form of the BLUP estimator is

$$\hat{T} = \sum_{i \in s} y_i + \sum_{i \notin s} \mathbf{x}_i' \hat{\boldsymbol{\beta}},$$

where $\mathbf{x}_i' \hat{\boldsymbol{\beta}}$ is the prediction for y_i using the working model and set of units in the population that are not

in the sample (denoted by $i \notin s$) and $\boldsymbol{\beta}$ is estimated using the sample units ($i \in s$). For example, following Valliant et al.'s (2000) notation, the BLUP using the correct model is

$$\hat{T}(1,1:x^{\gamma}) = \sum_{i\in s} y_i + \sum_{i\notin s} \mathbf{x}_i'\hat{\boldsymbol{\beta}},$$

where $\hat{\boldsymbol{\beta}} = (\mathbf{X_s}'\mathbf{V_{ss}^{-1}}\mathbf{X_s})^{-1}\mathbf{X_s}'\mathbf{V_{ss}^{-1}}\mathbf{y_s}$, $\mathbf{X_s}$ is an *n*x2 matrix with rows $(1, x_i)$, $\mathbf{V_{ss}} = diag(x_i^{\gamma})$, and $\mathbf{y_s}$ is the *n*-vector of sample data.

The general form of the GREG estimator is

$$\hat{T}_{GR} = \sum_{i\in s} g_i y_i,$$

where g_i is the "g-weight" for unit *i* (Särndal et al., 1992).

These estimators combined with the two working models and true value of γ and estimates of γ lead to nine totals. For model (3.1), we have $\hat{T}(1,1:x^{\gamma})$, and $\hat{T}(1,1:x^{\hat{\gamma}})$, $\hat{T}_{GR}(1,1:x^{\gamma})$, and $\hat{T}_{GR}(1,1:x^{\hat{\gamma}})$. The estimators $\hat{T}(x^{\gamma/2}, x^{\gamma}:x^{\gamma})$, $\hat{T}(x^{\hat{\gamma}/2}, x^{\hat{\gamma}}:x^{\hat{\gamma}})$, $\hat{T}_{GR}(x^{\gamma/2}, x^{\gamma}:x^{\gamma})$, and are $\hat{T}_{GR}(x^{\hat{\gamma}/2}, x^{\hat{\gamma}}:x^{\hat{\gamma}})$ for model (3.2). $\hat{T}_{\pi}$ is the ninth. Note that the true γ is not available in any real situation; estimators computed using γ serve as a comparison standard for the other choices.

Variance Estimation

For the HT estimator, the variance estimator is:

$$\mathrm{var}_0(\hat{T}_{\pi}) = (1 - n/N)\frac{n}{n-1}\sum_{i\in s}\left(y_i/\pi_i - 1/n\sum_{i\in s} y_i/\pi_i\right)^2.$$

This variance expression assumes with replacement sampling, but uses the finite population correction adjustment $1-n/N$ to approximately account for *wor* sampling. Since the sampling fractions are small, the bias is negligible (Wolter, 1985, sec. 2.4.5).

The following is the *basic model variance* estimate for the BLUP estimators:

$$\mathrm{var}_1(\hat{T}) = \sum_{i\in s} a_i^2 r_i^2 + \left(\sum_{i\notin s} x_i^{\gamma}\right)\left(\sum_{i\in s} x_i^{\gamma}\right)^{-1}\sum_{i\in s} r_i^2,$$

where a_i is the "model weight" involving x_i in the working model and r_i is the residual for unit *i*.

We also include a robust *leverage-adjusted variance* estimate for the BLUP's:

$$\mathrm{var}_2(\hat{T}) = \sum_{i\in s}\frac{a_i^2 r_i^2}{1-h_{ii}} + \left(\sum_{i\notin s} x_i^{\gamma}\right)\left(\sum_{i\in s} x_i^{\gamma}\right)^{-1}\sum_{i\in s} r_i^2,$$

where h_{ii} is the leverage for unit *i*. The identical second term in both model variances accounts for variability in population units not in the sample.

For the GREG's, we include the following variance estimators (e.g., see Valliant, 2002, expression 2.4):

$$\mathrm{var}_3(\hat{T}_{GR}) = \left(1-\frac{n}{N}\right)\sum_{i\in s}\frac{g_i^2 r_i^2}{\pi_i^2}$$

$$\mathrm{var}_4(\hat{T}_{GR}) = \left(1-\frac{n}{N}\right)\sum_{i\in s}\frac{g_i^2 r_i^2}{\pi_i^2(1-h_{ii})}.$$

The same variances were used for all sample designs, except for the *ppstrat* design-based variances for the HT and GREG estimators, where successive pairs of sample units were grouped, variances were calculated within each stratum, and strata variances were cumulated. Since both working models were specified over all strata, the model variance formulae var_1 and var_2 were used for samples selected using *ppstrat* sampling in estimating the variance of the BLUP.

► Simulation Results

Estimates

We calculated the average $\hat{\gamma}$ over each set of 1,000 samples drawn from both populations. Results are only summarized here.

When $\gamma = 3/4$, strategies B and D had more nearly unbiased estimates than A and C due to the smaller pilot sample sizes in the latter two. The rounding in strategies C and D made the average $\hat{\gamma}$'s further from the true value, since $\hat{\gamma}$'s close to three-fourths were either rounded down to one-half or up to one.

When $\gamma = 2$, the average $\hat{\gamma}$'s were closer to the true values. There was not much difference between the average $\hat{\gamma}$'s for the pilot study strategies A and C versus the no-pilot strategies B and D. The rounding also did not make much of a difference. Using the correct model (3.1) rather than (3.2) resulted in $\hat{\gamma}$'s closer to the true value, as might be expected.

Total and Variance Estimates

Our primary focus is how estimating γ effects estimates of totals and their variances. Tables 5 and 6 at the end of this paper include the root mean square error (RMSE) and 95-percent confidence interval (CI) coverage of each of the nine total estimators based on samples of size 100 drawn from the $\gamma = 3/4$ and $\gamma = 2$ populations, respectively (similar generalizations held for the samples of size 500, which are omitted due to length). Both tables are organized such that the HT estimates are first, followed by the BLUP and GREG totals produced using the true γ value (which resulted in identical results for strategies B and D), then those that used $\hat{\gamma}$'s. Relative biases (Relbias) are not shown in the tables but are briefly mentioned below.

For the $\gamma = 3/4$ population, where the true total is 7,174.74, all estimators were approximately unbiased over the 1,000 samples since the largest Relbias value was -0.41 percent for $\hat{T}(x^{\hat{\gamma}/2}, x^{\hat{\gamma}} : x^{\hat{\gamma}})$ using strategy B and *wtd bal* ($\sqrt{x}$) samples. For all strategies, using the correct working model (2.1) versus model (3.2) resulted in lower Relbias and RMSE values and CI coverage closer to 95 percent, though differences are not drastic. With model (3.2), using the GREG estimator resulted in improvements in all three measures over the equivalent BLUP estimators. Comparing strategies, there are slight improvements in the Relbias, RMSE, and CI coverage of strategy B over A and D over C, so that using the small pilot studies does not lead to any improvements. While the rounding of the pilot $\hat{\gamma}$'s in C offers improvements in the measures over A's, that is not the case in strategies B and D. For the sample designs, results from the *ppstrat* samples seem to be most favorable. For these populations, *wtd bal* sampling based on $\sqrt{x}$ in the main sample for Strategy B is suboptimal since the variance of neither population is proportional to *x*. Nonetheless, *ppstrat* ($\sqrt{x}$) is still reasonably efficient. As expected in these types of populations, the RMSE's when sampling by *srswor* are uniformly worse than those for the other designs in strategies B and D.

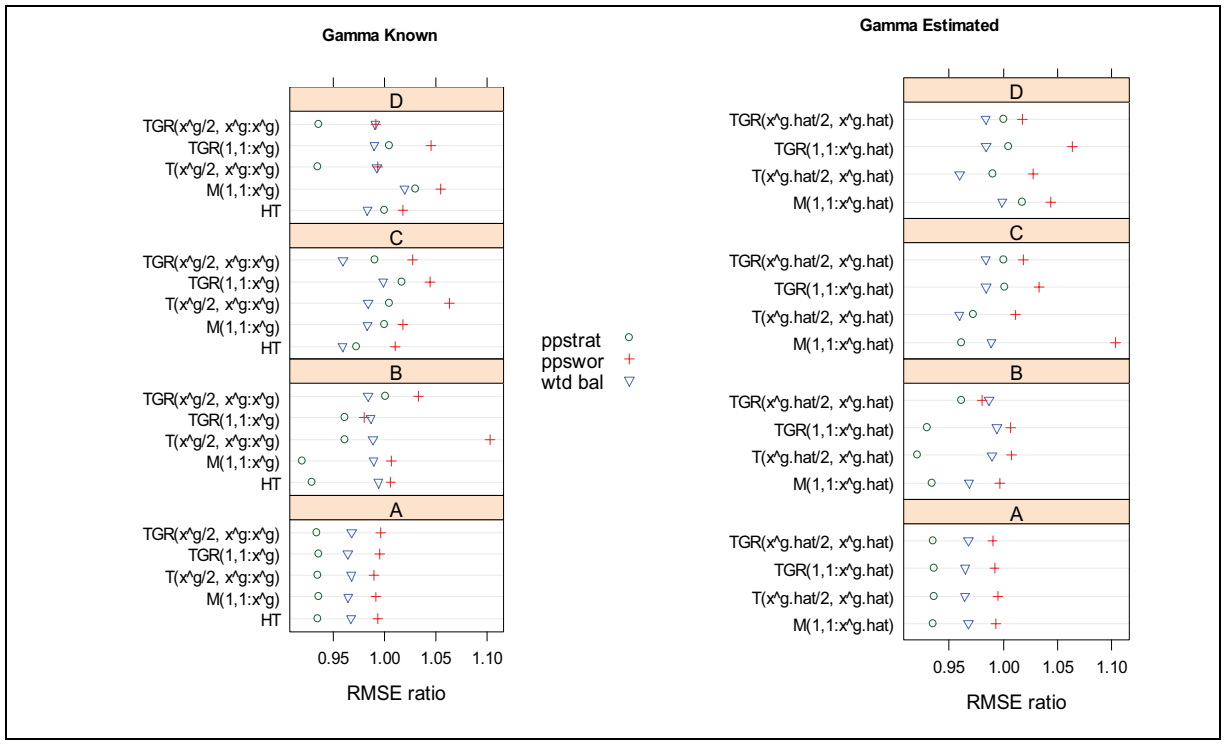
For the $\gamma = 2$ population, which had a total of 14,304.74, the largest Relbias value was 1.29 percent. Again, using the correct working model led to improved results, in terms of lower Relbias and RMSE values and CI coverage closer to 95 percent; there are slight gains in using the GREG estimator with model (3.2). Here, there is a notable (but not drastic) drop in the overall CI coverages compared to the $\gamma = 3/4$ population, the lowest being 91.7 percent. The most striking difference in RMSE values are the gains achieved with the pilot strategies over the corresponding nonpilot ones. For example, the RMSE for the combination ($\hat{T}_{GR}(1,1 : x^{\hat{\gamma}})$, A, *ppstrat*) is 1,186.76, while the RMSE for ($\hat{T}_{GR}(1,1 : x^{\hat{\gamma}})$, B, ppstrat) is 1,289.02. That is, using a pilot leads to an RMSE that is about 92.1 percent of that of using no pilot.

Figure 2 on the following page displays the ratios for the $\gamma = 2$ population of RMSE's of the various estimators and sampling plans to the RMSE of the combination of $\hat{T}_{GR}(1,1 : x^{\hat{\gamma}})$, B, *ppstrat*, with estimated γ for *n* = 100. This combination was selected as the reference since (a) *ppstrat* is a popular plan in practice, and (b) the GREG estimator $\hat{T}_{GR}(1,1 : x^{\hat{\gamma}})$ is one that is used by conservative practitioners because it is approximately design-unbiased while still taking advantage of the *y*-*x* relationship. The left and right panels show the ratios for estimators that use the true γ and an estimated γ. When the true gamma is used in estimation, but a pilot study is conducted to determine how to select the main sample, the most efficient method of sampling is *ppstrat*. In the (*ppstrat*, pilot) case, all estimators have about the same RMSE.

The right-hand panel gives the more realistic comparisons among combinations that could be used in practice. Conducting a pilot study with strategy A (no rounding) followed by a *ppstrat* ($\sqrt{x^{\hat{\gamma}}}$) main sample yielded a 4- to 8-percent reduction in RMSE compared to the reference combination described above. Rounding in strategy C reduces the gains from doing a pilot. Weighted balance on an estimated γ has no advantage over the reference combination.

If no pilot is conducted (strategies B and D), then *wtd bal* ($\sqrt{x}$) is the most efficient scheme, but *ppstrat* ($\sqrt{x}$) is very competitive. The rounding in strategy D leads to virtually the same results as B. Among the estimators, the model-based choice $\hat{T}(x^{\hat{\gamma}/2}, x^{\hat{\gamma}} : x^{\hat{\gamma}})$ and the GREG $\hat{T}_{GR}(x^{\hat{\gamma}/2}, x^{\hat{\gamma}} : x^{\hat{\gamma}})$ are somewhat worse than the others, although differences are not extreme.

Figure 2—Ratios of RMSE's for estimators and sampling plans to the RMSE for $\hat{T}_{GR}(1,1:x^{\hat{\gamma}})$, B, ppstrat, with estimated γ, $\gamma = 2$ population, n=100.



In all cases, unrestricted *ppswor* sampling was the poorest performer, regardless of whether γ was known or estimated.

▶ General Conclusions, Limitations, and Future Considerations

We investigated some alternative strategies for sampling and estimation in populations where there is one target variable *y*, whose total is to be estimated, and one auxiliary *x*, which is known for every unit in the population. The variance of y is known to increase as *x* increases, but the exact form of the variance is unknown to the sampler. Modeling the variance as $Var_M(y_i \mid x_i) = \sigma^2 x_i^{\gamma}$ is assumed to be a good approximation to reality. We studied three options that might be considered for this type of problem: design of a pilot sample, design of a main sample, and selection of an estimator.

We obtained ambiguous results on whether a pilot study, designed to get a preliminary estimate of γ, would be worthwhile. For our versions of the HMT population, the smaller pilot studies gave more negative $\hat{\gamma}$'s and more biased ones on average. In the less variable population we studied, conducting a pilot did not consistently give lower root mean square errors for the totals than using only a main sample with an educated guess about the size of γ. Rounding $\hat{\gamma}$'s, to the nearest half was not particularly helpful or harmful in estimating totals. Small root mean square error improvements came from reducing the variability in the $\hat{\gamma}$'s, in strategies C and D, for the less variable population ($\gamma = 3/4$), but the opposite was true in the more variable population ($\gamma = 2$). Thus, when the focus is on estimating γ, a pilot study and rounding are not useful. But, if the focus is on estimating totals, a pilot, possibly with rounding, may offer slight MSE improvements, depending on the population variability.

Among the sampling plans we considered, stratification based on cumulative $\sqrt{x^{\hat{\gamma}}}$ or $\sqrt{x}$ rules, denoted *ppstrat* here, were both reasonably efficient. The use of *wtd bal* samples based on $\hat{\gamma}$'s was not effective in reducing the root mean square errors of totals.

A good overall strategy for this type of problem appears to be the following. Select a highly restricted probability proportional to $\sqrt{x}$. This can be accomplished using the cum $(\sqrt{x})$ rule with one or two units selected per stratum. Estimate the total with either a BLUP or a GREG estimator based on a reasonable model for the population at hand. Model (3.2), though incorrect, still fit the data fairly well in the cases we examined. This general approach is similar to ones used by some accounting firms that conduct cost segregation studies.

Any simulation study is, of course, limited. Populations that are less well-behaved than HMT may yield different results. Accounting populations, in particular, often have units with extreme values that need special treatment both when estimating $\hat{\gamma}$ and the population total.

Some future considerations could include variations on the sample size. Brewer (2002) suggests 1,000 as the minimum for estimating gamma with "any reasonable amount of precision." However, in accounting applications, the real interest is on performance in small samples. Pilots of $n = 10$ and main studies of $n = 50$, or even less, are typical. In such cases, weighted balanced samples and model-based estimators may have advantages.

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Table 3—Root Mean Square Error and 95-Percent Confidence Interval Coverage using Design-Based (D), Basic Model (B), and Leverage-Adjusted Model (L) Variances, $\gamma = 3/4$, n=100 for All Strategies

Strategy	**A**			**B**				**C**			**D**			
Design	*ppswor*	*ppstrat*	*wtd bal*	*srswor*	*ppswor*	*ppstrat*	*wtd bal*	*ppswor*	*ppstrat*	*wtd bal*	*srswor*	*ppswor*	*ppstrat*	*wtd bal*
$\hat{T}_{\pi}$														
RMSE	259.02	138.93	134.86	471.34	207.98	139.56	138.40	259.02	138.93	138.44	471.34	207.98	139.56	138.40
95% CI - D	94.9	94.4	100.0	94.0	95.4	94.5	99.8	95.1	94.4	100.0	94.0	95.4	94.5	99.8
$\hat{T}(1,1:x^{\gamma})$														
RMSE	140.33	138.29	133.28	148.36	138.29	138.77	136.98	140.33	138.29	136.27	148.36	138.29	138.77	136.98
95% CI – B	94.1	94.4	94.8	94.1	94.8	94.4	94.6	94.1	94.4	94.6	94.1	94.8	94.4	94.6
95% CI – L	94.4	94.7	94.9	94.4	95.2	94.6	95.0	94.4	94.7	95.0	94.4	95.2	94.6	95.0
$\hat{T}_{GR}(1,1:x^{\gamma})$														
RMSE	140.13	138.28	134.21	149.10	138.55	139.52	137.50	140.13	138.28	136.92	149.10	138.55	139.52	137.50
95% CI – D	94.1	94.3	94.8	94.4	94.5	94.3	94.7	94.1	94.3	94.5	94.4	94.5	94.3	94.7
95% CI – L	94.4	94.5	95.1	94.6	94.8	95.1	95.1	94.4	94.5	95.1	94.6	94.8	95.1	95.1
$\hat{T}(x^{\gamma/2},x^{\gamma}:x^{\gamma})$														
RMSE	146.93	138.18	135.24	155.89	144.42	139.94	139.78	146.93	138.18	139.14	155.89	144.42	139.94	139.78
95% CI – B	94.1	95.3	95.4	94.0	94.8	95.1	95.2	94.1	95.3	95.5	94.0	94.8	95.1	95.2
95% CI – L	94.4	95.7	95.6	94.3	94.9	95.1	96.0	94.4	95.7	95.6	94.3	94.9	95.1	96.0
$\hat{T}_{GR}(x^{\gamma/2},x^{\gamma}:x^{\gamma})$														
RMSE	147.85	138.22	135.15	155.59	144.24	139.49	139.05	147.85	138.22	139.02	155.59	144.24	139.49	139.05
95% CI – D	94.3	94.3	95.4	94.0	94.8	94.4	95.2	94.3	94.3	95.5	94.0	94.8	94.4	92.5
95% CI – L	94.4	94.6	95.6	94.3	95.5	94.9	95.3	94.4	94.6	95.6	94.3	95.5	94.9	95.3
$\hat{T}(1,1:x^{\hat{\gamma}})$														
RMSE	137.87	142.82	137.67	149.61	138.72	139.39	137.70	137.85	139.73	141.16	149.92	138.80	139.12	137.23
95% CI – B	94.3	94.2	94.1	93.8	95.0	94.5	94.8	95.3	94.6	94.9	93.8	94.8	94.6	94.5
95% CI – L	94.5	94.8	94.7	94.3	95.0	95.1	94.9	95.6	94.8	95.2	93.9	95.0	95.0	94.8
$\hat{T}_{GR}(1,1:x^{\hat{\gamma}})$														
RMSE	138.15	143.07	137.98	149.22	138.54	139.54	137.47	137.19	139.78	141.25	149.26	138.51	139.52	137.48
95% CI – D	94.5	94.5	94.9	94.4	94.5	94.4	94.8	95.4	94.9	94.9	94.5	94.5	94.4	94.9
95% CI – L	94.7	94.7	95.1	94.7	94.8	95.0	95.0	95.6	95.0	95.2	94.6	94.8	95.0	95.0
$\hat{T}(x^{\hat{\gamma}/2},x^{\hat{\gamma}}:x^{\hat{\gamma}})$														
RMSE	156.26	145.03	150.80	168.46	165.68	153.98	153.12	148.19	144.89	143.34	159.06	147.89	141.51	142.63
95% CI – B	94.9	95.9	95.3	94.0	93.7	95.3	95.0	94.6	95.7	95.0	94.2	94.3	95.2	95.0
95% CI – L	94.9	96.0	95.4	94.4	94.0	95.4	95.2	94.7	95.9	95.5	94.5	94.5	95.6	95.2
$\hat{T}_{GR}(x^{\hat{\gamma}/2},x^{\hat{\gamma}}:x^{\hat{\gamma}})$														
RMSE	158.14	143.42	150.75	168.24	154.78	141.81	144.09	153.69	141.72	143.14	158.61	145.58	139.32	140.97
95% CI – D	94.5	94.5	95.3	93.9	95.0	94.4	95.7	94.0	94.7	95.0	94.0	94.6	94.4	95.5
95% CI – L	94.7	94.8	95.4	94.3	95.3	95.0	95.8	94.4	95.2	95.6	94.6	94.8	94.9	95.7

Table 4—Root Mean Square Error and 95-Percent Confidence Interval Coverage using Design-Based (D), Basic Model (B), and Leverage-Adjusted Model (L) Variances, $\gamma = 2$, n=100 for All Strategies

Strategy	**A**			**B**				**C**			**D**			
Design	*ppswor*	*ppstrat*	*wtd bal*	*srswor*	*ppswor*	*ppstrat*	*wtd bal*	*ppswor*	*ppstrat*	*wtd bal*	*srswor*	*ppswor*	*ppstrat*	*wtd bal*
$\hat{T}_{\pi}$														
RMSE	1280.39	1205.96	1247.28	1693.63	1331.49	1291.02	1268.66	1280.39	1205.96	1279.58	1693.18	1331.49	1291.02	1268.66
95% CI - D	92.6	94.4	94.2	91.7	94.2	93.2	94.0	92.6	94.4	93.6	91.7	94.2	93.2	94.7
$\hat{T}(1,1:x^{\gamma})$														
RMSE	1278.38	1206.63	1243.64	1334.49	1302.87	1253.61	1236.75	1278.38	1206.63	1277.71	1335.55	1302.87	1253.61	1236.75
95% CI – B	93.1	94.0	93.6	92.9	94.3	93.9	94.6	93.1	94.0	92.5	92.9	94.3	93.9	95.3
95% CI – L	93.5	94.1	94.0	93.2	94.3	94.0	94.7	93.5	94.1	93.2	93.2	94.3	94.0	95.4
$\hat{T}_{GR}(1,1:x^{\gamma})$														
RMSE	1282.87	1206.52	1243.09	1482.90	1312.25	1289.11	1268.04	1282.87	1206.52	1277.18	1484.84	1312.25	1289.11	1268.04
95% CI – D	93.2	94.0	93.7	92.3	93.5	93.2	93.6	93.2	94.0	93.7	92.3	93.5	93.2	94.6
95% CI – L	93.5	94.2	93.9	92.6	93.7	93.3	93.8	93.5	94.2	93.9	92.6	93.7	93.3	94.6
$\hat{T}(x^{\gamma/2},x^{\gamma}:x^{\gamma})$														
RMSE	1276.01	1205.81	1247.71	1594.75	1345.67	1311.31	1287.59	1276.01	1205.81	1279.80	1595.21	1345.67	1311.31	1287.59
95% CI – B	92.4	94.4	93.7	92.8	94.2	93.2	94.4	92.4	94.4	93.7	92.8	94.2	93.2	94.2
95% CI – L	92.8	94.5	93.9	93.3	94.6	94.2	94.6	92.8	94.5	93.9	93.3	94.6	94.2	94.2
$\hat{T}_{GR}(x^{\gamma/2},x^{\gamma}:x^{\gamma})$														
RMSE	1284.85	1204.91	1248.23	1544.90	1370.79	1295.43	1268.39	1284.85	1204.91	1279.76	1545.43	1370.79	1295.43	1268.39
95% CI – D	92.6	94.3	93.7	93.1	94.1	93.0	93.5	92.6	94.3	92.7	93.1	94.1	93.0	94.7
95% CI – L	93.0	94.6	93.9	93.7	94.1	93.3	93.8	93.0	94.6	93.2	93.7	94.1	93.3	94.8
$\hat{T}(1,1:x^{\hat{\gamma}})$														
RMSE	1297.04	1198.12	1281.47	1358.54	1324.69	1276.81	1237.23	1267.80	1246.20	1252.81	1364.39	1327.10	1280.05	1236.12
95% CI – B	93.4	96.1	92.2	91.8	93.3	93.2	94.1	93.4	94.8	93.6	91.8	93.2	93.2	95.2
95% CI – L	93.3	96.3	92.4	91.8	93.5	93.2	94.2	93.7	95.1	93.8	92.0	93.5	93.3	95.3
$\hat{T}_{GR}(1,1:x^{\hat{\gamma}})$														
RMSE	1298.17	1186.76	1275.54	1482.33	1311.79	1289.02	1268.02	1272.01	1230.47	1239.79	1483.95	1311.59	1289.02	1267.99
95% CI – D	93.3	95.7	92.0	92.3	93.7	93.3	93.6	93.4	94.8	93.6	92.2	93.6	93.3	94.6
95% CI – L	93.4	96.1	92.3	92.5	93.8	93.3	93.7	93.6	95.3	93.8	92.5	93.6	93.3	94.6
$\hat{T}(x^{\hat{\gamma}/2},x^{\hat{\gamma}}:x^{\hat{\gamma}})$														
RMSE	1263.57	1239.37	1271.88	1536.34	1359.13	1327.38	1314.23	1293.69	1242.82	1250.31	1541.92	1366.02	1332.87	1315.43
95% CI – B	93.9	93.3	93.0	91.7	93.7	93.0	93.3	94.1	93.8	93.4	91.6	93.6	93.4	94.2
95% CI – L	94.4	93.8	93.5	92.0	93.9	93.5	93.9	94.4	93.9	93.4	91.9	94.1	93.8	94.5
$\hat{T}_{GR}(x^{\hat{\gamma}/2},x^{\hat{\gamma}}:x^{\hat{\gamma}})$														
RMSE	1421.62	1239.20	1274.71	1531.53	1347.67	1295.43	1276.47	1275.41	1243.26	1249.69	1536.62	1350.59	1298.09	1279.59
95% CI – D	93.7	93.4	93.5	91.8	93.5	93.0	93.1	94.1	93.9	93.5	91.7	93.8	93.0	94.5
95% CI – L	93.8	93.6	93.7	92.3	94.0	93.4	93.6	94.2	94.0	93.5	92.2	93.8	93.3	94.8

5

Tax Benefits and Administrative Burdens, Recent Research from the IRS

Gangi ◆ Henry ◆ Raub

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Factors in Estates' Utilization of Special Tax Provisions For Family-Owned Farms and Closely Held Businesses

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With the enactment of several legislative provisions, the U.S. Congress has sought to protect family-owned farms and closely held businesses by lessening the burden of the Federal estate tax, a progressive tax on the transfer of wealth at death. These provisions have included: special use valuation—the valuation of property at its actual use in a family enterprise rather than its full market value; the qualified family-owned business deduction; and the deferral of Federal estate tax liabilities [1]. Special use valuation and the qualified family-owned business deduction each reduce the taxable estate, the amount to which graduated estate tax rates are applied, and, ultimately, an estate's tax liability. The deferral provision allows an estate to defer the portion of estate tax that is attributable to the decedent's closely held business and pay the balance in installments.

In this paper, we present a brief description of Federal estate tax law in effect for the estates of 2001 decedents, as well as an examination of the three business provisions available to these estates. In addition, we presents logistic regression models that examine the relationship between usage of one business provision and other estate characteristics. We also discuss the potential for future research. This paper is an extension of our earlier research that examined the subpopulations of estates that utilize each of the three business provisions and compared them to the subpopulations of estates that do not utilize the provisions [2]. This earlier research also includes a detailed examination of asset composition of estates in each of the subpopulations, as well as an examination of estates' liquidity, the financial capacity of estates to meet Federal estate tax responsibilities and other debts, including mortgages and liens, with only accumulated liquid assets.

For decedents who died in 2001, about 1,800 estates, or 1.7 percent of the estate tax decedent population, elected to use at least one of the three special business provisions. A total of 831 estates elected special use valuation, alone or in combination with the business deduction or deferral of estate taxes; 1,114 estates claimed the qualified family-owned business deduction, alone or in combination with special use or deferral of taxes; and 382 estates elected to defer estate taxes, alone or in combination with the other two business provisions.

Figure A shows the elections and combinations of elections employed by estates of 2001 decedents. Of the estates that elected at least one provision, the predominant election was the qualified family-owned business deduction alone, with 656 estates that claimed the deduction. The second largest election was special use valuation alone, with 425 estates that elected the provision. Estates elected both special use and the qualified family-owned business deduction in 332 cases. Rarely, estates elected all three provisions, only in 21 cases. Some differences by size of gross estate are notable. Of those estates that utilized a special business provision,

Figure A—Election of Special Business Provisions [1], by Size of Total Gross Estate

Size of total gross estate	Total number of estates	Election of business provisions							
		No elections	SUV only	QFOBI only	DOT only	SUV & QFOBI	SUV & DOT	QFOBI & DOT	SUV, QFOBI & DOT
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
All estates	**108,331**	**106,519**	**425**	**656**	**221**	**332**	**52**	**105**	**21**
Small ($675,000 under $2.5 million)	93,322	91,892	385	578	99	303	28	25	12
Medium ($2.5 million under $5 million)	9,977	9,769	28	52	39	25	14	44	6
Large ($5 million under $10 million)	3,454	3,329	**12	21	55	**4	**10	20	**3
Very Large ($10 million or more)	1,578	1,529	**	5	28	**	**	16	**

[1] Special use valuation is abbreviated as SUV, the qualified family-owned business interest deduction is abbreviated as QFOBI, and the deferral of taxes is abbreviated as DOT.

**Data combined to prevent disclosure of individual taxpayer data.

smaller estates tended to elect only the qualified family-owned business deduction, while larger estates tended to elect only the deferral of taxes.

▶ Federal Estate Tax Law and the Decedent Population

The estate of a decedent who, at death, owns assets valued in excess of the estate tax applicable exclusion amount, or filing threshold, must file a Federal estate tax return, Form 706, *U.S. Estate (and Generation-Skipping Transfer) Tax Return.* For decedents who died in 2001, the exclusion amount was $675,000. For estate tax purposes, the value of property included in gross estate is fair market value (FMV), defined as "the price at which the property would change hands between a willing buyer and a willing seller, neither being under any compulsion to buy or to sell and both having reasonable knowledge of all relevant facts," according to Regulation 20.2031-1(b) of the Internal Revenue Code (IRC) [3]. The gross estate consists of all property, whether real or personal, tangible or intangible, including "all property in which the decedent had an interest at the time of his or her death and certain property transferred during the lifetime of the decedent without adequate consideration; certain property held jointly by the decedent with others; property over which the decedent had a general power of appointment; proceeds of certain insurance policies on the decedent's life; dower or curtesy of a surviving spouse; and certain life estate property for which the marital deduction was previously allowed" [4]. Specific items of gross estate include real estate, cash, stocks, bonds, businesses, and decedent-owned life insurance policies, among others. Assets of gross estate are valued at a decedent's date of death, unless the estate's executor or administrator elects to value assets at an alternate valuation date, 6 months from the date of death, described in IRC section 2032. Alternate valuation may be elected only if the value of the estate, as well as the estate tax, is reduced between the date of death and the alternate date. The estate tax return is due 9 months from the date of the decedent's death, although a 6-month filing extension is allowed.

In 2001, an estimated 108,330 individuals died with gross estates above the estate tax exclusion amount. These decedents owned more than $198.8 billion in total assets and reported almost $20.8 billion in net estate tax liability. Decedents for whom an estate tax return was filed represented 4.6 percent of all deaths that occurred for Americans during 2001, according to vital statistics data collected by the U.S. National Center for Health Statistics. Estate tax decedents for whom a tax liability was reported, 49,845, represented 2.1 percent of the American decedent population for 2001 [5].

▶ Data Sources and Limitations

The Statistics of Income Division (SOI) of the Internal Revenue Service (IRS) collects and publishes data from samples of administrative tax and information records. With its annual Estate Tax Study, SOI extracts demographic, financial, and asset data from Federal estate tax returns. These annual studies allow production of a data file for each filing, or calendar, year. By focusing on a single year of death for a period of 3 filing years, the study allows production of periodic year-of-death estimates. A single year of death is examined for 3 years, as 99 percent of all returns for decedents who die in a given year are filed by the end of the second calendar year following the year of death [6]. The Estate Tax Study for the period 2001-2003 concentrates on Year-of-Death 2001, the year of death for which weighted estimates are presented in this paper [7]. Unweighted year-of-death records for decedents who died in 1998, collected during Filing Years 1998-2000, are also included in the section entitled "Logistic Regression Models."

▶ Special Use Valuation

With the Tax Reform Act of 1976, Congress protected U.S. farms and closely held businesses by providing for special use valuation of decedents' interests in real property devoted to such businesses. For estate tax purposes, the value of property included in gross estate, including real property, is generally the fair market value based on property's potential "highest and best use." However, for real property that is used by a decedent or family member in a farm or other business as of the decedent's date of death, as well as in 5 of 8 years preceding death, the executor may elect to value such property at its "qualified," or actual, use in the

business, if certain requirements are met. According to the IRC, the term "family member" may include any ancestor of the decedent; the spouse of the decedent; a lineal descendant of the decedent, decedent's spouse, or parent; or the spouse of any lineal descendant.

In order for an estate to elect special use valuation (SUV), several other conditions must be met: real property must be transferred from the decedent to a qualified family member of the decedent; at least 25 percent of the adjusted value of the gross estate must consist of real property, where adjusted value is defined as fair market value of real property less any debts against the property; at least 50 percent of the adjusted value of the gross estate must consist of real and other business property; and the estate must consent to payment of additional estate tax—"recapture tax"—if, within 10 years of death, the property is sold to an unqualified heir; if the property is no longer used for a qualified purpose; or if the qualified heir ceases to fully participate for more than 3 years in any 8-year period. For estates of decedents who died in 2001, the allowed maximum reduction in value between fair market value and special use value was $800,000 [8].

For 2001, an estimated 831 estates elected SUV for real property (see Figure B). Although this accounted for only 0.8 percent of all estates, it represented about 5.3 percent of estates that reported closely held or agribusiness assets, i.e., those estates that were potentially qualified to elect special use. Of those 831 estates, about half—405 estates—made protective elections of special use. An estate's executor may make a protective election if he or she must file a Federal estate tax return prior to final determination of real property's qualification as special use property. As such, the election is contingent upon property's value as finally determined. Estates with protective elections do not separately report fair market and qualified use values for real property.

Smaller estates were more likely to claim this provision than their larger counterparts. As shown in Figure B, about 0.8 percent of small estates (those with less than $2.5 million in total gross estate) claimed SUV, while only 0.3 percent of their very large counterparts used the provision. Reported fair market value for qualifying property was $377.2 million, and the property value decreased to $189.0 million for qualifying purposes.

▶ Qualified Family-Owned Business Deduction

With the Taxpayer Relief Act (TRA) of 1997, Congress sought to safeguard family-run businesses and provided an estate tax deduction for "qualifying" family-owned business interests included in gross estate and transferred to qualified heirs. Requirements for utilizing the deduction are, with a few exceptions, similar to those for electing special use valuation. The principal place of business must be the United States, and the business entity must not have debt or equity that is tradable on an established securities market or secondary market. In addition, at least 50 percent of the business entity must be owned by the decedent and members of the decedent's family; or 70 percent must be owned by members of two families (and 30 percent

Figure B—Number of Estates, Estates with Potentially Qualifying Assets, and Number that Elected SUV, by Size of Total Gross Estate

Size of total gross estate	Total number of estates	Estates with potentially qualifying assets	Estates that elected SUV	CV [1]
	(1)	(2)	(3)	(4)
All estates	**108,330**	**12,683**	**831**	**12.6%**
Small ($675,000 under $2.5 million)	93,321	10,925	728	14.1%
Medium ($2.5 million under $5 million)	9,977	1,102	74	27.1%
Large ($5 million under $10 million)	3,449	442	23	28.1%
Very Large ($10 million or more)	1,583	214	5	8.3%

[1] Coefficient of variation (CV), the ratio of an estimate's standard error to the estimate, is used to measure the magnitude of potential sampling error. The CVs shown refer to the number of estates that elected SUV.

owned by the decedent and members of the decedent's family); or 90 percent must be owned by three families (and 30 percent owned by the decedent and members of the decedent's family).

Several other requirements must be met, including: the value of the business interest must constitute at least 50 percent of a decedent's total gross estate less deductible debt, expenses, and taxes; and the decedent or family member must have been actively engaged in the business. An additional estate tax is imposed if, within a period of 10 years after the decedent's death and before the qualified heir's death, the heir fails to actively participate in the business for a total of 3 years in any 8-year period [9].

The qualified family-owned business interest deduction (QFOBI), initially set at $675,000 in TRA of 1997, could not exceed $1.3 million when combined with the applicable exclusion. Therefore, as the exclusion increased incrementally from $625,000 in 1998 to $1.5 million in 2004, the maximum allowable deduction decreased and finally disappeared in 2004 [10]. For decedents who died in 2001, the available deduction for qualified family-owned business was $625,000.

Only a small fraction of estates utilized the QFOBI in calculating taxable estate and estate tax liability. For Year-of-Death 2001, an estimated 1,114 estates, or 1.0 percent of the total, claimed the deduction, while small estates made up the majority, 82.3 percent, of those that used the deduction (see Figure C). These 1,114 estates comprised about 7.1 percent of estates that reported closely held or agribusiness assets, i.e., those estates that were potentially qualified to elect QFOBI. The likelihood that an estate would claim the deduction was greater for larger estates. Among all very large estates, 1.5 percent claimed the deduction, while only 1.0 percent of all small estates claimed the deduction. For all estates, the deduction reduced taxable estate by $626.8 million.

▶ Deferral of Tax and Installment Payments

Congress has also enacted legislation that lessens the burden of certain estate tax payments for estates comprised largely of closely held businesses. The legislation provides estates with an alternative to selling closely held interests in order to meet Federal tax responsibilities. Initially, in 1958, Congress introduced installment payments for these estates, and then, in 1976, Congress established rules for deferral of payments. Under the law, an estate's executor can elect to pay estate tax attributable to the business interest in two or more, but not exceeding ten, equal payments and defer tax payments for 5 years, paying only interest on the tax liability during the deferral period.

In order to qualify for deferral of tax and installment payments, at least 35 percent of the value of adjusted gross estate must consist of an interest in a closely held business. Under the law in effect for 2001, the definition of closely held business included three types of entities:

Figure C—Number of Estates, Number with Potentially Qualifying Assets, and Number that Elected QFOBI, by Size of Total Gross Estate

Size of total gross estate	Total number of estates	Estates with potentially qualifying assets	Estates that claimed QFOBI deduction	CV [1]
	(1)	(2)	(3)	(4)
All estates	**108,330**	**15,612**	**1,114**	**10.3%**
Small ($675,000 under $2.5 million)	93,321	11,711	917	12.2%
Medium ($2.5 million under $5 million)	9,977	2,219	127	18.2%
Large ($5 million under $10 million)	3,449	1,056	47	17.6%
Very Large ($10 million or more)	1,583	626	23	0.4%

[1] Coefficient of variation (CV), the ratio of an estimate's standard error to the estimate, is used to measure the magnitude of potential sampling error. The CVs shown refer to the number of estates that elected QFOBI.

Figure D—Number of Estates, Estates with Potentially Qualifying Assets, and Number that Elected DOT, by Size of Total Gross Estate

Size of total gross estate	Total number of estates	Estates with potentially qualifying assets	Estates that elected DOT	CV [1]
	(1)	(2)	(3)	(4)
All estates	**108,330**	**15,612**	**382**	**11.8%**
Small ($675,000 under $2.5 million)	93,321	11,711	147	26.5%
Medium ($2.5 million under $5 million)	9,977	2,219	103	18.7%
Large ($5 million under $10 million)	3,449	1,056	86	13.7%
Very Large ($10 million or more)	1,583	626	46	2.7%

[1] Coefficient of variation (CV), the ratio of an estimate's standard error to the estimate, is used to measure the magnitude of potential sampling error. The CVs shown refer to the number of estates that elected DOT.

(1) sole proprietorships, (2) partnerships, if the estate included 20 percent or more of the partnership interest or if the partnership had 15 or fewer partners, and (3) corporations, if the estate included 20 percent or more of the voting stock of the corporation or if the corporation had 15 or fewer shareholders. An executor's decision to use these payment options is not contingent on the election of special use valuation. However, if the executor elects special use valuation, the same, lower value must be used for determining the deferred tax payments [11].

Relatively few estates for 2001 decedents chose to elect deferral of tax (DOT) due to ownership interests in closely held businesses. As shown in Figure D, an estimated 382 estates, or 0.4 percent of all estates and 2.4 percent of estates that reported closely held and agribusiness assets (potentially qualifying assets), elected to use this provision. Larger estates were much more likely to use the provision than their smaller counterparts. About 0.2 percent of small estates (those with less than $2.5 million in total gross estate) used DOT. This percentage increased dramatically as the size of gross estate increased, as 2.9 percent of the largest estates (those with $10 million or more in total gross estate) used the provision. Estates deferred more than $365.6 million in estate tax, or 58.9 percent of reported tax liabilities for those estates; closely held business assets for which tax was deferred totaled $1.3 billion.

▶ Logistic Regression Models

Using unweighted estate tax records from Years-of-Death 1998 and 2001, we created a data set of 37,179 records. Of these, 211 elected SUV, 389 elected DOT, and 485 elected QFOBI. Next, we determined eligibility criteria for each provision. Ideally, the sample used for the regression analysis should include only estates that were eligible to claim the provisions. This would have allowed for a cleaner analysis of the factors that executors of eligible estates use to determine whether or not to claim a business provision. Unfortunately, eligibility cannot be directly observed in the data, as requirements for claiming the business provisions are numerous and complex, and data reported on estate tax returns are limited.

Unable to observe eligibility directly, we created partial eligibility criteria based on available information. As noted previously, each provision has an eligibility requirement based on the percentage of an estate composed of farms or closely held business assets. Since SOI captures asset type information in its data editing process, it was possible to create a filter to identify potentially eligible records based on the presence of farm or closely held business assets. Using this eligibility criterion resulted in 11,187 records with potentially qualifying assets, about 30 percent of the observations in our data set.

We attempted to further refine our eligibility filters by limiting our data set to returns for which the proportion of assets held in farms or closely held businesses matched the statutory requirements for each provision. The results of this process produced an unacceptable level of classification error (i.e., returns that were determined to be ineligible claimed the provisions), which may have occurred due to the difficulty in correctly coding business asset types during the data collection process.

The Model

Our initial approach was to determine one model for each provision using explanatory variables suggested by prior research. For each estate tax return *i*, we consider the following model on the log-odds of the probability of the taxpayer claiming a provision:

$$\log\left[\frac{1-\pi_i}{\pi_i}\right] = \mathbf{x}_i'\boldsymbol{\beta}$$

where π_i is the probability of taxpayer i using the provision of interest, $\mathbf{x}$ is the matrix of 19 explanatory variables from Figure E, and $\mathbf{b}$ is the vector of slope coefficients for each corresponding x-variable.

We fit our model to each provision separately. Since there is some similarity between the eligibility requirements for the three provisions, the same model was fit to a dichotomous variable that indicates election or non-election of at least one business provision. The results from these four models are displayed in Figure F.

Figure E—Explanatory Variables and Their Definitions

Variable	*Definition*	*Variable*	*Definition*
Age	Age, in years, of decedent at time of death	**Gross estate**	Amount, in millions of dollars, of total gross estate
Married, Single, Widow	Dummy variables indicative of marital status of the decedent at time of death	**Marginal tax rate**	Projected marginal tax rate of estate prior to claiming any of the provisions
Retired	Dummy variable indicating that decedent was retired	**Farm**	Amount, in millions of dollars, of farm assets
Female	Dummy variable indicating that decedent was female	**Closely held**	Amount, in millions of dollars, of total gross estate
Liquidity Cat 1	Dummy variable indicating that estate had a liquidity ratio of 0.25 or less (see endnote 12)	**Year**	Dummy variable indicating that the record was from Year of Death 2001
Liquidity Cat 2	Dummy variable indicating that the estate had a liquidity ratio of 0.25 but less than 1	**Widow*Female**	Interaction variable of Widow and Female
Liquidity Cat 3	Dummy variable indicating that estate had a liquidity ratio of 1.0 but less than 5	**Single*Female**	Interaction variable of Single and Female
Liquidity Cat 4	Dummy variable indicating that estate had a liquidity ratio of 5 or greater	**Married*Female**	Interaction variable of Married and Female
Debts	Amount, in millions of dollars, of debts owed by the estate	**Debts*Farm**	Interaction variable of Debts and Farm
		Age*Retired	Interaction variable of Age and Retired

Figure F—Estimated Coefficients and Standard Errors, by Model

	SUV	QFOBI	DOT	At least one provision
Variables	*Estimate (SE)*	*Estimate (SE)*	*Estimate (SE)*	*Estimate (SE)*
Age	0.000372 (0.00189)	-0.00076 (0.00177)	0.00264 * (0.00126)	0.00136 (0.00118)
Married	0.7441 * (0.3520)	0.7632 * (0.1988)	-0.5220 * (0.2058)	-0.1175 (0.1499)
Single	-0.1422 (0.4826)	-0.2398 (0.2835)	-0.3055 (0.2931)	-0.2407 (0.2151)
Widow	0.7775 * (0.3787)	0.3138 (0.2275)	-0.1933 (0.2397)	-0.0381 (0.1788)
Retired	-2.3365 (1.3810)	-1.6085 (1.0975)	-0.7653 (1.3461)	-1.6585 * (0.8598)
Female	0.1441 (0.5990)	-0.6373 (0.4134)	-0.4038 (0.3947)	-0.6246 * (0.3112)
Liquidity Cat 1	-0.8662 (0.6949)	0.0536 (0.6616)	-0.5644 (0.6462)	-0.0407 (0.5108)
Liquidity Cat 2	-0.6605 * (0.3456)	-0.2500 (0.3297)	-0.5166 (0.3215)	-0.2640 (0.2543)
Liquidity Cat 3	-0.7907 * (0.2336)	-0.7576 * (0.2229)	-1.0798 * (0.2201)	-0.8373 * (0.1718)
Liquidity Cat 4	-0.9110 * (0.3045)	-0.6008 * (0.1946)	-1.2975 * (0.2971)	-0.9322 * (0.1545)
Debts	0.1921 * (0.0714)	0.0703 (0.0633)	0.00549 (0.0208)	-0.0585 (0.0333)
Gross Estate	-0.3828 * (0.0499)	-0.2224 * (0.0335)	0.000567 (0.0022)	-0.00483 * (0.00194)
Marginal tax rate	0.3741 * (0.0486)	0.5248 * (0.0335)	0.2000 * (0.0170)	0.2026 * (0.0138)
Farm	0.5715 * (0.0726)	0.1363 * (0.0535)	0.1302 * (0.0455)	0.1701 * (0.0360)
Closely held	0.0802 (0.0817)	0.1845 * (0.0240)	** **	** **
Year	0.0812 (0.1774)	-0.1835 (0.1222)	-0.3052 (0.1415)	-0.1725 (0.0950)
Widow*Female	-0.0501 (0.6468)	0.2892 (0.4541)	0.4174 (0.4452)	0.5260 (0.3450)
Single*Female	0.1627 (0.9178)	-0.1213 (0.7601)	0.4727 (0.6625)	0.4011 (0.5079)
Married*Female	-0.4426 (0.6729)	0.2409 (0.4614)	-0.4296 (0.5228)	0.1943 (0.3550)
Debts*Farm	-0.0242 (0.0205)	0.0316 * (0.0135)	-0.00779 (0.0131)	-0.00676 (0.0103)
Age*Retired	0.0267 (0.0167)	0.0141 (0.0137)	0.00198 (0.0167)	0.0141 (0.0107)

* Indicates significance at 5 percent

** Variable was excluded from model because inclusion resulted in a model convergence problem

Model Results

Prior to modeling the data, we expected that liquidity would have a strong, inverse relationship with the likelihood of claiming each of the three business provisions, since, for all three provisions, eligibility requires that an estate holds a certain percentage of its assets in farms or closely held businesses, i.e., illiquid assets [12]. As shown in Figure F, the expected outcome was validated, as each of the three single provision models and the combined model have significant, relatively large, negative coefficients for the highest liquidity categories.

Based on our earlier findings, we further expected to find that, *ceteris paribus*, larger estates were less likely to claim the SUV and QFOBI provisions, but more likely to claim the DOT provision. These expectations were partially validated. Gross estate was significant in the SUV and QFOBI models with a negative coefficient. In the DOT model, gross estate had a small, positive coefficient, consistent with expectations, but it was not significant at the 5-percent level. In the combined model, gross estate has a small, but significant negative coefficient.

We also expected that a higher marginal tax rate before claiming any provisions would increase the economic value of claiming a provision and would increase the log-odds. This expectation was validated, as marginal tax rate has a significant, relatively large coefficient in each of the four models. The coefficient is largest in the SUV and QFOBI models, which is unsurprising, given that these two provisions have the effect of directly decreasing the size of taxable estate.

Our expectations about the significance of debt and demographic variables were less defined. The amount of debt held by an estate was significant only in the SUV model, with its positive coefficient that suggests that holding more debt tended to increase the likelihood of claiming this provision, *ceteris paribus*. Interestingly, while debt alone was not significant in the QFOBI model, the interaction of debts and farm assets had a significant, positive coefficient.

Regarding demographic characteristics, age had a significant effect only in the DOT model, with a small, positive coefficient, suggesting that older decedents were more likely to claim this provision. Being married had a significant effect in each of the three single provision models, although the direction of this effect was varied. *Ceteris paribus*, married decedents were more likely to claim the SUV and QFOBI provisions, but less likely to claim the DOT provision. Widowed decedents were also more likely to claim the SUV provision than single or divorced decedents. Gender and retired status had no significant impact in any of the three single provision models, but they were significant in the combined model, with female and retired decedents less likely to claim at least one of the provisions than male decedents and single or married decedents. The significance of gender and retired status in only the combined model may be attributable to the larger number of observations in the subsample of estates that claim one or more provisions.

▶ Conclusions

Our findings reveal that, holding other factors constant, smaller estates were more likely to claim the SUV and QFOBI provisions than their larger counterparts, and that estates facing higher marginal tax rates were more likely to claim each of the three provisions. From a demographic standpoint, being married had a significant impact on the odds of claiming each of the provisions, although the direction of the effect varied. While being married increased the likelihood of claiming SUV or QFOBI, holding other factors constant, it decreased the likelihood of claiming DOT.

While we believe that this research provides a starting point for understanding the factors that influence the utilization of special estate tax provisions for farms and closely held businesses, to expand our understanding of this topic, there are at least three main areas for future research. First, an approach that would specifically model the decisionmaking process that faces the executor of an estate would be enlightening. Ideally, this model would incorporate not only the choice to claim one business provision, but also the choice to claim a combination of business provisions, if eligible for more than one. In addition, the interaction of other choices, such as marital and charitable deductions, should be incorporated into this model, as should some measure of

the financial constraints placed on an estate by claiming these provisions.

Second, when analyzing the characteristics of estates that claim these provisions, time is a factor worth examining. Estate tax returns provide a snapshot of the decedent's assets and debts at the time of death, but reveal no information about these characteristics at earlier points in time. This is particularly relevant to our analysis because we have no way of observing what, if any, choices were purposefully made prior to death so that an estate would qualify for a business provision. While the tax law contains a provision that limits the ability of individuals to shift their assets in a tax-beneficial way prior to death, it is possible that various forms of planning are used by some individuals or their representatives in order to qualify for these beneficial business provisions [13].

Finally, while modeling with records identified by our asset eligibility criteria is clearly superior to modeling with the entire dataset, modeling with only records for estates that are eligible would provide more insight into why estates choose to elect a special business provision. While eligibility cannot be observed in the data currently available, it is possible that future changes to tax law or reporting requirements could obviate this limitation.

▶ Endnotes

[1] Special use valuation and deferral of estate tax liability are available to estates for current deaths. However, the qualified family-owned business deduction was repealed for deaths after 2003.

[2] See Gangi, Martha Eller and Brian G. Raub, "Utilization of Special Estate Tax Provisions for Family-Owned Farms and Closely Held Businesses," *Statistics of Income Bulletin*, Summer 2006, Washington, D.C. This article is also available on SOI's TaxStats Web site at http://www.irs.gov/pub/irs-soi/spestate.pdf.

[3] *United States Tax Reporter, Estate and Gift Taxes*, Volumes I and II, Research Institute of America, 1996. This publication provides an overview of tax law, Internal Revenue Code text, House and Senate committee reports, U.S. Treasury regulations, and a general explanation of the tax code.

[4] *Ibid.*

[5] Population estimates are from "Annual Estimates of the Population for the United States and for Puerto Rico: April 1, 2000, to July 1, 2004," Population Division, U.S. Census, Bureau, December 2004. Total adult deaths represent those of individuals age 20 and over, plus deaths for which age was unavailable. Death statistics are from Volume 52, Number 3, Table 3, Centers for Disease Control and Prevention, National Center for Health Statistics, U.S. Department of Health and Human Services, September 2003.

[6] Because almost 99 percent of all returns for decedents who die in a given year are filed by the end of the second calendar year following the year of death and because the decedent's age at death and the length of time between the decedent's date of death and the filing of an estate tax return are related, it was possible to predict the percentage of unfiled returns within age strata. The sample weights were adjusted accordingly, in order to account for returns for 2001 decedents not filed by the end of the 2003 filing year.

[7] Estate tax returns are sampled while the returns were being processed for administrative purposes, but before any examination. Returns are selected on a flow basis, using a stratified random probability sampling method, whereby the sample rates are preset based on the desired sample size and an estimate of the population. The design for the Year-of-Death 2001 study had three stratification variables: year of death, age at death, and size of total gross estate plus adjusted taxable gifts. Sampling rates ranged from 1 percent to 100 percent. Returns for over half of the strata were selected at the 100-percent rate.

[8] For more information on special use valuation, see Code section 2032A in The Complete Internal Revenue Code, Research Institute of America, July 2001, p. 6,016.

[9] For more information on the qualified family-owned business deduction, see Code section 2057 in The Complete Internal Revenue Code, Research Institute of America, July 2001, p. 6,047.

[10] In the 1997 Act, Congress provided for gradual increase in the lifetime exemption from $625,000 in 1998 to $850,000 in 2004. However, in 2001, Congress enacted legislation in the Economic Growth and Tax Relief Reconciliation Act that completely changed the landscape of estate tax law. As a result, the lifetime exemption, $675,000 in 2000 and 2001, is set to increase to $3.5 million in 2009, and the estate tax disappears entirely for deaths in 2010.

[11] For more information on the deferral of taxes and installment payments, see Code section 6166 in The Complete Internal Revenue Code, Research Institute of America, July 2001, p. 9,125.

[12] Liquidity ratio is defined as liquid assets (cash and cash management accounts, State and local bonds, Federal Government bonds, publicly traded stock, and insurance on the life of the decedent) divided by the projected estate tax liability prior to claiming any business provisions plus debts of the estate.

[13] According to Internal Revenue Code 2057(c), most gifts given within 3 years of a decedent's death are included in adjusted gross estate.

Corporation Life Cycles: Examining Attrition Trends and Return Characteristics in Statistics of Income Cross-Sectional 1120 Samples

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Every year, the Statistics of Income (SOI) Division of the IRS produces a cross-sectional study of 1120 series corporation tax returns based on a weighted sample of the population of certain Forms 1120. The microdata from this study are used to produce tabular data for public dissemination through SOI's Taxstats Web site and many regular and occasional paper publications. SOI also uses these data to produce custom tabulations for internal and external customers in many disciplines.

While these data provide an excellent source for annual financial tabulations and for developing an understanding of the implications of tax policy for the taxpaying public, there is less focus on the implicit longitudinal characteristics of the SOI sample or the changing population of 1120 filers from which SOI draws its sample. This paper examines the extent to which business entities in the SOI sample survive, perish, or appear inconsistently, and to what extent returns from these three categories differ in certain financial characteristics. Examining these issues can provide insight into what types of business entities tend to survive and perish over a period of time and can provide users of SOI tabular data with insight into whether estimates are based on the same entities over time, or a sample that changes with regularity.

▶ The SOI 1120 Sample

Before examining the performance of the SOI sample over a period of years, it is first useful to understand the structure of the cross-sectional SOI sample itself. The SOI study's target population consists of all for-profit corporations that are required to file an 1120 series tax return that is included in the SOI study. SOI studies Forms 1120, 1120-A, 1120-F, 1120-L, 1120-PC, 1120-REIT, 1120-RIC, and 1120-S. The survey population consists of those returns that are selected for the SOI sample and are processed on the IRS Business Master File (BMF). SOI has been using a sample of 1120 series returns to estimate population values for over 50 years. The first SOI sample was implemented for Tax Year 1951, when 41.5 percent of the 1120 fil-

Figure A—Sample and Population Size for SOI 1120 Study 1993–2003

Year	Sample Size	Population Size	Sample as Percentage of Population
1993	91,687	4,340,688	2.11
1994	95,021	4,700,268	2.02
1995	97,461	4,852,305	2.01
1996	94,172	4,968,490	1.90
1997	98,204	5,102,958	1.92
1998	137,600	5,204,810	2.64
1999	140,984	5,315,461	2.65
2000	144,917	5,429,473	2.67
2001	146,479	5,563,781	2.63
2002	145,353	5,701,024	2.55
2003	141,678	5,845,672	2.42

ing population was sampled. In 1951, the total number of Forms 1120 filed was 687,000, and SOI selected 285,000 returns for its study. The sample size as a percentage of the population has fluctuated over time, and, in the last tax year for which data are available, 2003, the SOI sample was 2.4 percent of the total population of over 5.8 million 1120 returns, or 141,678 returns. In the 10 years that are the focus of this paper, the SOI sample size has increased from 91,687 returns in 1993 to 141,678 returns in 2003.

To determine whether an individual return is to be sampled, an algorithm is used to transform the Employer Identification Number (EIN) of the tax return, and a Transform Taxpayer Identification Number (TTIN) is produced. This TTIN can be characterized as a pseudorandom number; the same algorithm is used to produce the TTIN every year, so that the same algorithm applied to the same EIN will produce the same TTIN in any study year. This implies that, with no change in the selection probability of the applicable stratum and no change in the stratum into which the return falls, a return selected in year one should be selected in year two, providing it is present in the population (and providing it has not changed its EIN). The sample is stratified by form type, size of total assets, and income, or in some cases form type and size of total assets alone.

Each stratum is associated with a sampling rate. The sampling rate is multiplied by 10,000 to create a four-digit number between 0000 and 9999. If the last four digits of the TTIN for a given return are less than or equal to this number, the return is selected for the SOI study. For example, the last four digits of a TTIN may equal 3025. If the product of the sampling rate * 10,000 is equal to 7777 (0.7777 * 10,000) for this stratum, the return will be selected for the SOI study. If the product is 2222 (0.2222 * 10,000), the return will not be selected for the SOI study. The stratum's sampling rate determines the probability of a return in that stratum being selected. A higher value of the sampling rate for a given stratum equates to a higher probability of a return in that stratum being selected for the SOI study. This probability can range from a fraction of 1 percent to 100 percent. The rate at which returns are sampled depends on their size (measured in income and/or total assets) and form type. Generally, the sampling rates increase as size increases for all form types. Over the 10 years studied, sampling rates have tended to increase for most size classes and form types, but rates for some strata have declined [1].

This selection process takes place over a 24-month window of time. Typically, more than 15 percent of corporations file tax returns based on a noncalendar year accounting period. Therefore, a selection window of July through the following June is necessary for any given study year. The time necessary is extended further due to optional extensions of the filing deadline which are used by many corporations, and by administrative processing delays on the part of the IRS. A study for Tax Year X is therefore composed of returns selected from July of year X through June of year X+2. Some returns can also be added after this time if their presence in the SOI study is deemed critical [2].

Returns that would meet the sampling criteria may not be selected because they have been filed later than SOI's deadline for selection, because the returns were not available to the SOI Division while being held by another IRS function, or because data processing errors caused the returns to fall into an incorrect stratum [3].

▶ Data Description

In order to study the behavior of returns in the SOI sample, I compiled 10 years of selected data from SOI's cross-sectional 1120 study, Tax Year 1994 to Tax Year 2003. To create the dataset, I first identified all unique EINs in the Tax Year 1993 study. There were 86,632 records in this dataset. I used this file as the "base year" to which I compared SOI studies from other years to determine the presence or absence of the base-year returns in subsequent years. I performed these interyear comparisons by matching datasets on EIN. For the subsequent 10 years of SOI studies from 1994 through 2003, I compiled ten datasets containing selected data items of base-year returns which were selected again in the subsequent years, and ten datasets containing selected data items of base-year returns not selected in the subsequent SOI study years [4].

In each year, I analyzed whether the base-year return was present or not in the SOI sample and compiled

an inventory dataset for each return which represents its life cycle throughout the 10 years. This dataset contained all EINs from the base year and an observation for each subsequent study year, 1994-2003. The observation could take on a value of "0" if the return was not present in the study year, or "1" if the return was present in the study year. The dataset also contained a data item representing the life cycle of the return. This data item was a concatenation of all the study-year observations ("0" or "1") and represented the 10-year pattern of presence or absence for each base-year return. The final data item in the dataset was a sum of all "1" or "0" study-year observations, representing the number of years in which the return appeared in the SOI study from 1994-2003.

I then used the inventory dataset to group the base-year returns into three categories based on a characterization of their life cycles over the 10 years studied. The categories used were Consistent, Inconsistent, and Terminal. I defined a Consistent return as one that is present in at least 8 out of the 10 years analyzed but has not been absent from the sample in the last 2 years, 2002 and 2003 [5]. I defined an Inconsistent return as one that was present in less than 8 years of SOI studies and was not categorized as a Terminal Return. I defined a Terminal return as one whose life cycle pattern matched one of nine specific patterns that indicate a return left the sample and never returned. Figure A shows the patterns used to characterize Terminal returns. A "1" indicates the return is present for the year, and a "0" indicates the return is absent. Each of the ten characters comprising the life cycle pattern represents a study year, 1994-2003.

Because returns can be present in the SOI study and present in the population, absent from the SOI study and absent from the population, or absent from the SOI study but present in the population, I matched files of base-year returns not present in each subsequent year to administrative IRS population files to examine the ultimate status of the returns [6]. In some cases, it could be shown that, although base-year returns were missing from the SOI sample for a subsequent year, they were present in the population of 1120 filers. These returns are in general presumed not to have met the SOI selection criteria for the study year, subject to the limitations of the selection process described previously. In other cases, it could be shown that a base-year return not selected for a subsequent SOI study was not selected because it was no longer present in the population of 1120 filers. It is of use to determine which nonselected base-year returns remained in the population and are available for selection to demonstrate whether a return has simply failed to meet SOI sampling criteria or is in fact no longer required to file an individual 1120 series tax return [7].

Figure B—Criteria for Terminal Return Definition

Life Cycle Patterns Characterizing Terminal Returns
0000000000
1000000000
1100000000
1110000000
1111000000
1111100000
1111110000
1111111000
1111111100

From left to right, each character represents an SOI study year, 1994-2003.

A "0" indicates absence from the SOI study for the year.

A "1" indicates presence in the SOI study for the year.

In order to determine whether Consistent, Inconsistent, and Terminal returns differed qualitatively in terms of their financial characteristics or other characteristics, I compiled these three groups of returns and determined the means of four key financial data items and the age of the entity. I compared the means of the data items and the ages in each category and tested the differences to determine statistical significance. The four financial items compared were Total Receipts, Net Income, Total Assets, and Net Worth [8]. The age of the entity is the number of years between the date of incorporation and the base year, 1993 [9].

▶ Data Analysis

Figure C presents the count of base-year returns present in each subsequent SOI study and filing population from 1994-2003 as well as the percentage of

Figure C—Presence of Base-Year Returns in SOI Sample and Population

SOI Study Year	Base-Year Returns in Sample	Base-Year Returns in Population	Base Year % in Sample [1]	Base Year % in Population [2]
1993	86,632	86,632	100	100
1994	74,303	79,243	85.8	91.5
1995	68,122	75,965	78.6	87.7
1996	60,948	72,585	70.4	83.8
1997	56,465	68,633	65.2	79.2
1998	52,750	57,734	60.9	66.6
1999	48,842	62,674	56.4	72.3
2000	44,728	59,257	51.6	68.4
2001	42,154	53,743	48.7	62.0
2002	39,998	51,683	46.2	59.7
2003	36,159	42,414	41.7	49.0

[1] Percentage of base-year returns remaining in sample.

[2] Percentage of base-year returns remaining in population.

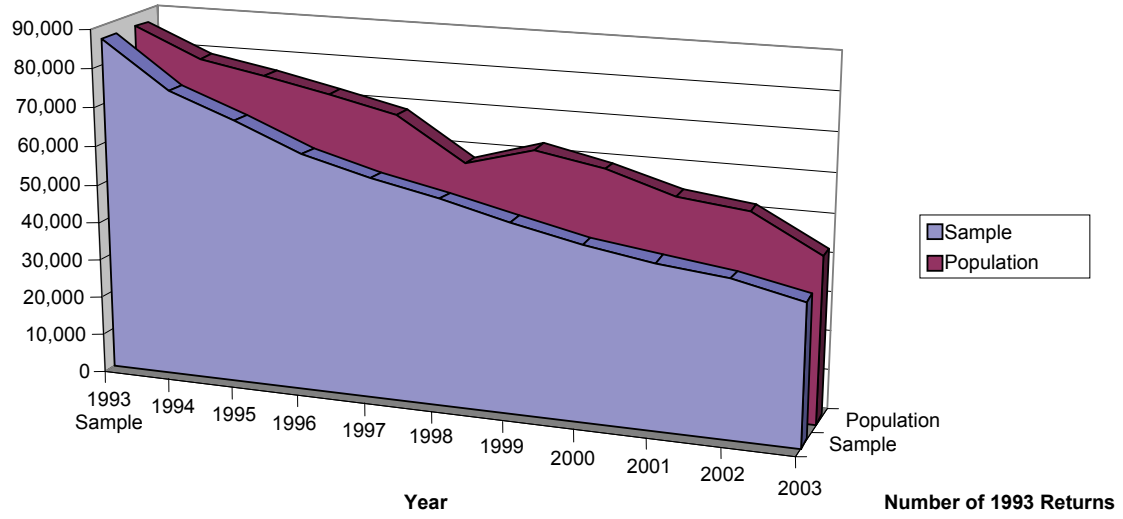
base-year returns present in the sample and population in subsequent years. The same data are represented graphically in Figure D.

In the base year of 1993, some 86,632 returns were selected for the SOI study. The number of base-year returns remaining in the SOI study declined steadily over the 10 years analyzed, with 85.8 percent, or 74,303 of the original base-year returns selected for the 1994 SOI study and only 41.7 percent, or 36,159 of the original base-year returns still present in the most recent SOI study for 2003. The number of base-year returns available to be selected from the population declined in a very similar fashion, with 91.5 percent, or 79,243 of the base-year returns remaining in the population in 1994 and 49.0 percent, or 42,414 returns remaining in the population of 1120 filers in 2003.

The difference in the counts and percentages of base-year returns in the sample and population can be attributed to a number of factors. Returns which exhibit a year-to-year change in total assets and/or income may qualify for a sampling rate different than that applied in a prior year in which the returns were selected for the SOI study. Similarly, a change to the sampling rates for a stratum may cause returns that were selected in that stratum previously to no longer qualify for sample selection based on the values of their TTINs. There are other administrative and processing reasons that may prevent a negligible number of returns from being included in the SOI study. These reasons include rejection by tax examiners from the SOI study, improper coding or processing, unavailability of returns, or late filing of desired returns [10].

Since the difference between the base-year returns present in the sample and population is small and stable throughout the 10-year period, it can be concluded that the majority of returns which leave the SOI study have also left the population of 1120 filers. For example, in 1994, only 5.7 percent (4,940) of base-year returns were absent from the sample but present in the population. In 2003, this percentage had increased to only 7.3 percent (6,255). Although the SOI sample size has increased over the 10-year period studied, sampling rates for various strata have fluctuated. This means that, in addition to any base-year returns with changes in total assets and/or income becoming ineligible for sampling at prevailing rates, changes to the sampling rates in individual strata may make previously eligible returns ineligible. This helps explain why the percentage of base-year returns in the population but not the sample has increased slightly over the 10 years observed. Since larger returns are sampled at a 100-percent rate,

Figure D—Presence of Returns from Base Year



decreases in sampling rates tend to affect strata where smaller returns are located. Any decreases in sampling rates could account for a loss of base-year returns, but only if they are still available in the target population. However, since Figures C and D indicate that the majority of the base-year returns leaving the sample have also left the population, it appears that most of the missing base-year returns have not survived as individual 1120 return filers. They may no longer exist, they may file a non-1120 tax return, or they may be included in the consolidated return of another 1120 filer.

When returns from the base year were grouped into categories based on their life cycle patterns, 37,614 returns were observed to be consistently present in the SOI study from 1993-2003. This category of returns was called Consistent. The number of Inconsistent returns totaled only 9,482, showing that a relatively small number of returns appeared sporadically. The Terminal return category contained a total of 39,536 returns [11].

A pronounced and statistically significant difference in the means of all the data items was observed among the various categories of returns. Figures F, G, and H summarize the means of the various categories. The statistical significance of the differences of the means was determined by performing a t-test using SAS statistical software. The results showed statistical significance above the 99-percent level for comparison of all means among all categories.

The means presented in Figures F, G, and H clearly show that Consistent returns appear on average to be much larger in terms of financial characteristics than either returns that appear in the SOI study only inconsistently or returns that have dropped out of the SOI sample and most likely the population as well. Graphical representations of financial comparisons are shown in Figures J through M in the appendix. When financial items from Consistent returns are compared to those of Terminal returns, all items are larger for Consistent returns by significant margins. Average Total Receipts for Consistent returns are 2.9 times larger than the average for Terminal, Net Income 3.3 times larger, Total Assets 4.8 times larger, and Net Worth 7.5 times larger. The largest differences in the averages are between Consistent and Inconsistent returns. Average Net Worth for Consistent returns is 21.1 times that of Inconsistent. Clearly, the returns that are consistently selected for the SOI sample have higher average levels of assets and income. Although this may seem intuitive since larger returns fall into strata with higher sampling rates, in fact, the design of the sample leads to the same returns being selected each year in each stratum. Therefore, barring changes to the sampling rates of the relevant strata, a small base-year return exhibiting no drop in assets or income and no change in form type would

Figure E—By Type of Return

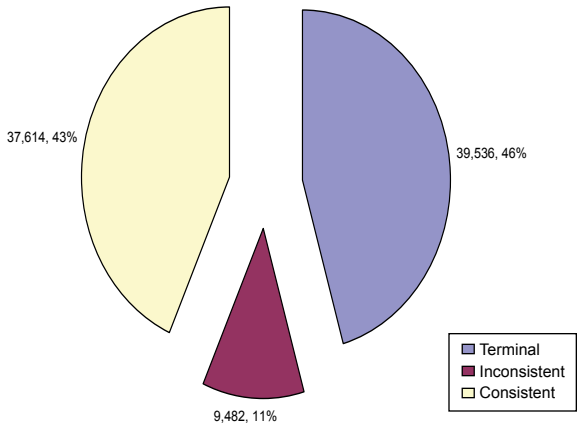


Figure F—Consistent Returns

Variable	N	Mean	Standard Deviation
Total Receipts	37,744	$136,238,155	$1,498,106,574
Net Income	37,744	$8,215,763	$96,288,521
Total Assets	37,744	$304,742,101	$3,776,946,351
Net Worth	37,744	$109,835,169	$902,754,411
Age	37,744	19.4	21.0

Figure G—Inconsistent Returns

Variable	N	Mean	Standard Deviation
Total Receipts	9,459	$25,796,330	$238,476,363
Net Income	9,459	$220,453	$14,196,113
Total Assets	9,459	$37,207,485	$444,127,898
Net Worth	9,459	$6,618,853	$70,868,775
Age	9,459	14.8	16.6

Figure H—Terminal Returns

Variable	N	Mean	Standard Deviation
Total Receipts	39,926	$77,461,225	$814,956,006
Net Income	39,926	$3,222,766	$58,191,247
Total Assets	39,926	$205,827,618	$3,493,116,498
Net Worth	39,926	$43,992,315	$583,865,566
Age	39,926	15.7	19.6

be expected in the sample again, just as would a large return in a stratum with a 100-percent selection rate. In practice, sampling rates for certain strata have declined at times. Most base-year returns that are not selected are demonstrably not in the population, but, for those smaller base-year returns that are in the population and are not selected, sampling rate changes are a possible explanation.

To conduct a more detailed analysis of the three categories of returns, I created another data item called Size. This data item was determined by the size of total assets of the return. Returns with less than $10,000,000 in total assets were defined as "small," returns with between $10,000,000 and $249,999,999 in total assets "medium," and returns with $250,000,000 or more in total assets "large." I then grouped each of the three "consistency" categories of returns into subgroups of small, medium, and large returns to analyze differences in mean financial characteristics and mean age by both consistency and size.

After segmenting returns based on both their consistency and their size, it was observed that large returns made up a considerably higher percentage of consistent returns than they did inconsistent or terminal returns. For consistent returns, 16.6 percent were large, whereas only 1.6 percent and 5.5 percent were large for Inconsistent and Terminal respectively. Conversely, small returns tended to make up a much larger percentage of Inconsistent and Terminal returns, as is indicated by Figure I. The attrition rate was defined as the percentage of returns within each size category—small, medium, and large—which was ultimately classified as Terminal. Large returns had the lowest attrition rate at 26.4 percent, followed by medium-sized returns, (36.4 percent). Small returns had the highest attrition rate at 55.0 percent. This may partially be due to the fluctuating sampling rates for smaller returns, but, since most nonselected returns were also not present in the population, most of these taxpayers did not file individually [12].

Examining Figure I can provide insight into why the averages of selected financial items tend to be much higher for Consistent returns than the other categories. The averages for Consistent returns are based on a much

Figure I—Return Counts by Size and Consistency with Attrition Rate

	Consistent	Inconsistent	Terminal	Attrition Rate
Small	19,041 (50.4%)	6,959 (73.6%)	25,479 (63.8%)	49.5%
Medium	14,719 (39.0%)	2,322 (24.5%)	11,789 (29.5%)	40.9%
Large	3,984 (10.6%)	178 (1.9%)	2,658 (6.7%)	39.0%

Small returns are those with less than $10,000,000 in assets, Medium with $10,000,000 to $249,999,999 in assets, and Large with $250,000,000 or more.

Percentages following counts indicate the percentage of the total count for the group of Consistent, Inconsistent, or Terminal.

Attrition rate is the percentage of the total number of base-year returns in this size category which were categorized as Terminal returns.

higher proportion of large returns than are the other categories. As a function of the definition of large returns, these financial items will tend to be greater on returns with more assets, so that averages based on a higher proportion of large returns will be greater. All means and standard deviations of financial items and ages by consistency and size are reported in the appendix.

In addition to being on average larger in terms of these selected financial items, this comparison indicates that Consistent returns tend to be older than Inconsistent or Terminal returns. Age was defined in years as the base year (1993) minus the year of incorporation. The average age of returns consistently in the SOI study is 19.7 years. The average ages of both Inconsistent and Terminal returns are lower at 14.6 years and 15.9 years, respectively. With most of the base-year returns missing from the SOI study also missing from the population of 1120 filers, the analysis indicates that, on average, business entities that were older in the base year tended to survive longer [13]. Younger returns were more likely to be Inconsistent or Terminal. A graphical comparison of mean ages is shown in Figure N.

Of particular interest is the difference in mean ages of large Consistent, Inconsistent, and Terminal returns. The mean age of large Consistent returns is 20.6 years, while the mean ages of large Inconsistent and Terminal returns are 22.4 years and 24.8 years, respectively. The difference between large Consistent and large Inconsistent returns is not statistically significant, but the difference between large Consistent and large Terminal returns is significant at the 99-percent level. Although returns of all sizes exhibit higher mean ages for Consistent returns than for Inconsistent or Terminal returns, breakouts by size showed that large Consistent returns were younger on average than large Terminal returns.

▶ Conclusions and Further Research

The analysis showed that the majority of base-year returns which left the SOI sample also left the population of 1120 filers, indicating that the SOI sample selects the same entities from year to year when those entities are available in the population. Therefore, even though a small number of returns exited the SOI study due to changes in sampling rates, the conclusions drawn from analysis of the SOI studies largely apply to the population of 1120 filers as well as to the sample. After analyzing 10 years of data from SOI samples and 10 years of population data from IRS Business Master Files, 41.7 percent of the base-year returns were shown to be present in the latest SOI study and 49.0 percent of base-year returns present in the filing population. With the lowest attrition rate of all groups, large business entities are more likely than smaller business entities to remain in the SOI sample and in the filing population. The group of returns defined as Consistent exhibited a larger proportion of returns with $250,000,000 or more in total assets than the other two categories of returns, and large returns made up the smallest proportion of Terminal returns at 5.5 percent. The surviving business entities also tended to be older on average than business entities that fell out of the population or were

Figure J

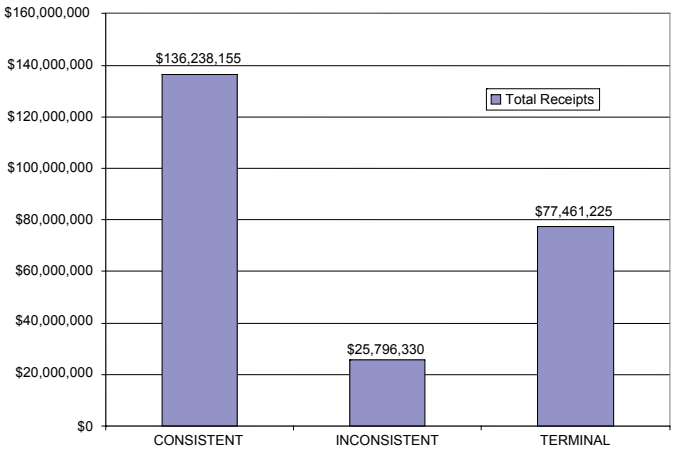


Figure K

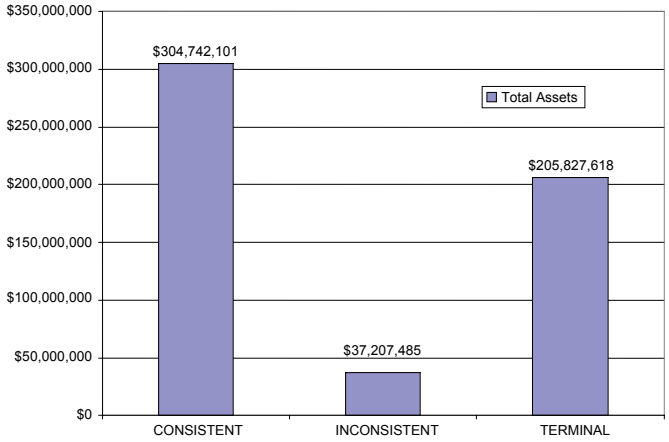


Figure L

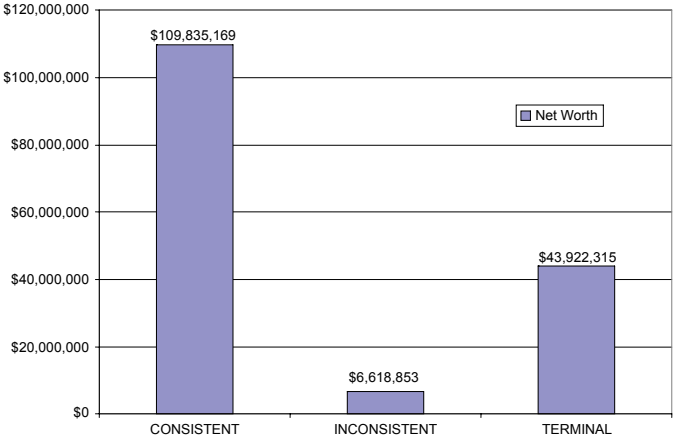


Figure M

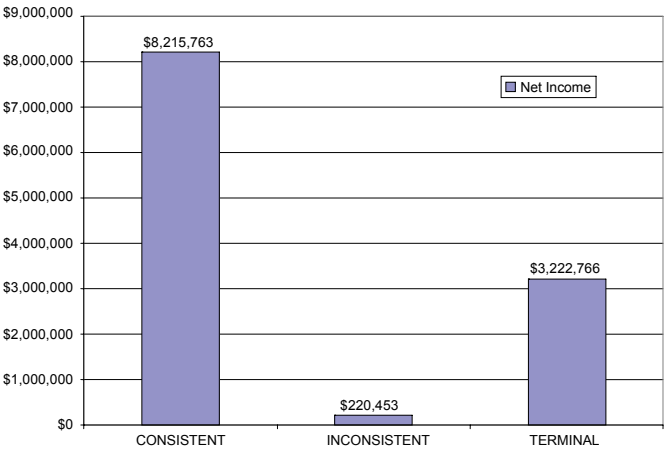
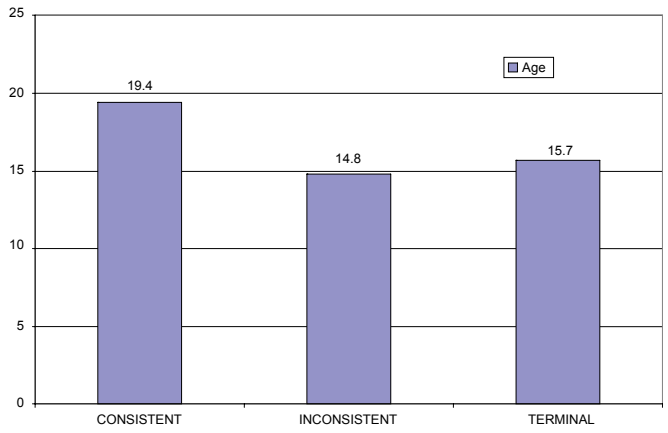


Figure N



not selected for SOI studies. This relationship was not true for the group of large returns however, where Consistent returns were slightly younger on average than Terminal returns.

The next steps in corporation life cycle research will be to define specific reasons for attrition from the SOI sample and population and to more fully explain attrition based on these reasons. This research should include the assembly of corporate family structures capable of accounting for previously individual returns which become part of consolidated groups. A predictive model could be implemented to determine if financial relationships are predictive of presence in the SOI sample or population.

▶ Endnotes

[1] For a complete history of sampling rates for all sizes and form types, see SOI's annual Publication 16, *Corporation Income Tax Returns*.

[2] For an explanation of critical returns, see SOI's annual Publication 16, *Corporation Income Tax Returns*.

[3] For a more detailed description of SOI's sampling process and studies, see the most recent version of SOI's annual Publication 16, *Corporation Income Tax Returns*.

[4] For datasets where the returns were not present in the SOI sample, the data items were populated with values from the most recent SOI study in which the returns were available.

[5] A return that was missing from the population in 2002 and 2003 would qualify as Consistent if it was present in all earlier years because the sum of all presence observations would total eight. A classification of Terminal is more desirable because the return is not present for the latest 2 years and will presumably not return.

[6] SOI maintains a file of return transaction data extracted annually from the BMF. This file contains a code that indicates whether an 1120 return was processed on the BMF for a given EIN at any time in the Processing Year, roughly equivalent to a Calendar Year. The file also contains a tax period indicating the year to which the transaction relates.

[7] The entity formerly filing its own 1120 return may no longer do so because it is included in the consolidated filing of another return or group of returns with a different EIN.

[8] For SOI's definition of financial items, see Publication 16, *Corporation Income Tax Returns*.

[9] Age was calculated and carried through the analysis as of the base year rather than recomputed each year because increasing appearances in SOI studies would correlate directly with increasing age.

[10] For descriptions and counts of unavailable returns, see SOI's Publication 16, *Corporation Income Tax Returns*.

[11] The sum of Consistent, Inconsistent, and Terminal returns does not equal the total of the base-year returns due to legitimate "duplicate" records. Duplicate records can be present in one study when part-year returns are selected in addition to full-year returns.

[12] These entities may be filing a non-1120 type return or may be included in the consolidation of another return or group of returns.

[13] Entities counted as not surviving may be filing a non-1120 type return or may be included in the consolidation of another return or group of returns.

▶ References

Internal Revenue Service, Statistics of Income–2003, *Corporation Income Tax Returns*, Washington, DC, 2005.

Internal Revenue Service, *Statistics of Income Bulletin*, Summer 2006, Washington, DC, 2005.

▶ Appendix

Consistent Returns

Size	Data Item	Mean	Standard Deviation
Small	Total Receipts [1]	$6,371,580.79	$57,384,713.78
	Net Income	$120,879.88	$4,079,558.5
	Total Assets	$1,807,835.87	$2,312,005.37
	Net Worth	$639,986.34	$ 4,270,068.29
	Age	16.4479282	16.6014683
Medium	Total Receipts	$53,895,910.61	$106,779,628
	Net Income	$2,511,693.13	$7,407,540.48
	Total Assets	$69,825,074.13	$57,974,136.63
	Net Worth	$29,494,265.47	$44,890,136.91
	Age	22.7388410	24.0182814
Large	Total Receipts [2,3]	$1,061,133,974	$4,499,784,062
	Net Income [4]	$67,978,026.03	$289,082,191
	Total Assets [2,3]	$2,620,483,834	$11,364,833,471
	Net Worth	$928,540,800	$2,638,900,731
	Age [2]	21.5155622	25.4626241

Inconsistent Returns

Size	Data Item	Mean	Standard Deviation
Small	Total Receipts [5]	$4,077,602.06	$15,518,169.88
	Net Income [5]	-$34,503.10	$1,936,312.34
	Total Assets	$1,479,486.82	$2,162,763.78
	Net Worth [5]	$200,645.81	$4,779,648.44
	Age [5]	13.2152608	14.5542741
Medium	Total Receipts	$41,511,957.43	$79,428,394.05
	Net Income	$-598,765.04	$13,179,286.11
	Total Assets	$43,880,737.74	$44,024,985.24
	Net Worth	$8,721,769.96	$62,242,205.94
	Age [6]	18.8165375	20.1862701
Large	Total Receipts [5]	$669,891,521	$1,583,578,000
	Net Income [5]	$20,874,759.10	$88,900,726.62
	Total Assets [5]	$1,346,959,444	$2,956,099,587
	Net Worth [5]	$230,109,460	$405,911,755
	Age [5]	24.9157303	25.7444784

Footnotes at end of table.

▶ Appendix—Continued

Terminal Returns

Size	Data Item	Mean	Standard Deviation
Small	Total Receipts	$4,952,880.42	$70,038,460.90
	Net Income	-$71,616.51	$6,520,985.17
	Total Assets	$1,382,087.57	$2,069,756.45
	Net Worth	$133,487.37	$5,351,577.13
	Age	12.9184034	14.8322453
Medium	Total Receipts	$47,605,901.58	$95,661,811.13
	Net Income	$1,147,350.28	$9,267,561.22
	Total Assets	$67,945,915.83	$57,212,181.19
	Net Worth	$17,690,263.35	$59,872,085.44
	Age	20.0385105	24.1205414
Large	Total Receipts	$904,927,191	$3,025,364,570
	Net Income	$44,007,051.15	$219,787,529
	Total Assets	$2,777,142,544	$13,275,372,904
	Net Worth	$580,019,080	$2,190,282,973
	Age	23.2558315	29.4368933

Difference across means statistically significant at the 99-percent level unless otherwise noted.
[1] Difference between Consistent and Terminal statistically significant only at the 97-percent level.
[2] Difference between Consistent and Inconsistent not statistically significant.
[3] Difference between Consistent and Terminal not statistically significant.
[4] Difference between Consistent and Inconsistent statistically significant only at the 97-percent level.
[5] Difference between Inconsistent and Terminal not statistically significant.
[6] Difference between Inconsistent and Terminal statistically only at the 97-percent level.

An Analysis of the Free File Program

Michelle S. Chu and Melissa M. Kovalick, Internal Revenue Service

The Restructuring and Reform Act of 1998 (RRA 1998) stated that the Internal Revenue Service (IRS) should set goals to have at least 80 percent of all Federal tax and information returns filed electronically by 2007. There are many benefits of electronically filing tax returns; tax law compliance is improved, the IRS reduces operating costs by reducing the need for human inputs to transcribe data, and transcription errors are eliminated.

The electronic file (e-file) program began in 1986. During the 2006 filing season, an estimated total of 83.1 million tax returns were filed electronically (IRS Document 6186), including individual income, corporate, partnership, excise, and exempt organization tax returns. About 73.0 million individual income tax returns were e-filed during the 2006 filing season.

While many factors affect the growth of the e-file program, this paper focuses on the Free File Program, which provides taxpayers with access to free online tax preparation and e-filing services. Although data on the Free File Program is limited, this paper will present a demographic overview of Free Filers. In addition, an overview and analysis of the Program will be provided.

▶ Overview and History of the Free File Program

The Free File Program was developed in response to President Bush's E-Government initiative and the Office of Management and Budget's EZ Tax Filing Initiative, with the assumption that providing free e-filing services to the majority of taxpayers would help meet the 80-percent e-file target established by RRA 1998. Although some private sector firms offered free e-file services to limited groups of taxpayers in the past, the Free File Program marked an innovative approach by making free services consistently available to the majority of taxpayers on a multiyear basis.

One question that arose during the development of the Free File Program was why the Federal Government would partner with private industry instead of creating its own software for free-file purposes. When the Department of the Treasury announced new efforts to expand the e-file program in January 2002, Secretary Paul O'Neill asked then-IRS Commissioner Charles Rossotti to partner with the private sector. O'Neill stated that it was not his intent "for the IRS to get into the software business, but rather to open a constructive dialogue with those who already have established expertise in this field. In the end, this effort should come up with a better way to save time and money for both taxpayers and the Government" (Office of Public Affairs, PO-964). Since software companies had already proven their knowledge in the area of electronic tax services, working with private industry has several advantages. It encourages competition, gives taxpayers more choices, and reduces costs to the American public.

▶ Benefits and Objectives of the Free File Program

The Free File Program has four main objectives: to increase e-file penetration, provide more free online options to taxpayers, ease tax preparation and filing, and provide greater access to taxpayers. The e-file option offers the advantages of reduced burden on filers and quicker refunds, and the Free File Program exposes these benefits to taxpayers who may have previously prepared and filed paper returns. In addition, promoting the Free File Program on the IRS Web site might alleviate taxpayers' concerns about the security of the e-file process.

On October 30, 2002, the original Free Online Electronic Tax Filing Agreement was signed by the IRS Commissioner and the Manager of the Free File Alliance, LLC. The Free File Alliance is a group of software companies who provide free commercial online tax preparation and e-filing services. The agreement had an

initial term of 3 years, followed by automatic options to renew for successive 2-year periods. When this agreement expired, a revised agreement was signed which extended the terms from October 30, 2005, through October 30, 2009.

As of October 2006, analysis of the Free File Program is limited due to the availability of data. Although the program has been in existence for 4 years, in the initial years, data related to Free-Filed returns were the property of members of the Free File Alliance, not the IRS. The IRS did not begin to identify free-filed returns until the 2006 Filing Season (Tax Year 2005). Limited quantitative data from prior years is available via survey results from studies conducted by Russell Marketing Research and Foote, Cone, and Belding, and volumes of free filers provided by the software companies. However, use of this data is restricted for proprietary reasons. Another constraint is that complete filing season results for 2006 were not available at the time this paper was written. The deadline for Form 4868, *Application for Automatic Extension of Time To File U.S. Individual Income Tax Return,* to be filed was October 16, 2006, and the data used in this analysis were current as of September 26, 2006.

▶ The Free Online Electronic Tax Filing Agreements

The initial agreement between the IRS and the Alliance was executed on October 30, 2002. The arrangement covers a wide array of topics such as performance standards, scope of marketing efforts, terms of terminating the agreement, and the operation of the Alliance Web page. The contract specifies that, in total, Alliance members must provide the free e-filing option to at least 60 percent of all individual income taxpayers during the primary tax filing season (January through April). If the Alliance fails to reach the 60-percent coverage, the group must raise the coverage within a 6-month period. In addition, each individual Alliance member must provide this free service to cover at least 10 percent of the total individual income tax returns filed.

The agreement also addresses disclosure issues, privacy, and security provisions. In order to ensure satisfactory level of quality, the members were required to submit test returns for certification prior to being identified as members of the Alliance on the Web page. In addition, all members must have a security and privacy seal certificate from a third party. The certification process was based on an assessment of the member system's ability to protect taxpayer data and privacy concerns.

The agreement also specifies the guidelines for operating the Alliance Web Page on the IRS site. The IRS will host and maintain the Web page, but the Alliance will determine the final content of the Web site. This includes determining the rank order placement of the links to individual offerings, presence of a link to the free services, and prohibition of advertisements on the Free File Web page. The IRS must be notified if an offering will be unavailable for 5 hours or more, and IRS has the authority to delist a member if its service remains unavailable for more than 24 hours.

Marketing issues are explored in the agreement. Although the IRS will promote the availability of the free services, it will not specifically endorse products. The IRS and the Alliance will also explore ways to support Federal/State filing of returns through the Free File Program. The option of IRS offering free e-filing services also remains open. If the IRS notifies the Alliance of this decision to offer free e-filing services during the primary filing season, the Alliance may terminate the agreement effective April 16.

After three successful filing seasons, the agreement between the IRS and the Alliance was extended for an additional period of 4 years (October 30, 2005, through 2009) with amendments stemming from lessons learned from the first agreement. The new agreement specified an aggregate coverage of 70 percent of taxpayers. The volume of taxpayers eligible to use the free service would change each filing season. In the first year of the new agreement, Filing Season 2006, some 93 million taxpayers qualified to use the service. The IRS will use the most current Adjusted Gross Income (AGI) number that equates to 70 percent of all individual income taxpayers. However, no single alliance member can cover more than 50 percent of total taxpayers. Also new to the agreement was the introduction of Form 4868.

A number of amendments to the program content were included in the new agreement. The first topic addressed Refund Anticipation Loans (RALs). Although less than 1 percent of the 2.8 million Free File users in Tax Year (TY) 2002 opted for RALs, this was one of the key issues addressed in the new agreement. Both parties agreed that RALs may be offered by the members under several guidelines. The offer of free online service cannot be conditional on the purchase of a RAL. The language must clearly indicate that a RAL is a short-term loan and must be repaid within a certain time, independent of the refund issued by IRS. All fees and interest rates associated with RALs must be disclosed. Finally, RALs cannot be promoted, and some Alliance firms will not offer RAL products, thus ensuring that consumers have RAL-free options.

During the first 3 years of the program, IRS relied on the Alliance members to provide the number of returns that were Free Filed through their respective offers. One of the amendments included an agreement that the Alliance members would provide an electronic Free File indicator. In return, the IRS confirmed that they will not build a marketing database or compile company-specific proprietary data. Although the IRS cannot refuse to comply with requests from Governmental agencies and Congress, the IRS will promptly notify the Executive Director of the Alliance if this information is provided. The Alliance members will then have the option to cease providing the indicator. Also, amendments addressed Web site compliance measures and customer satisfaction surveys. The performance standard was placed at a 60-percent acceptance rate, and additional privacy and security issues were addressed.

▶ Free File Volumes

The unprecedented alliance between the IRS and the private sector to offer free e-filing services met with success from the start. In the first year of the program (Filing Season 2003), 2.8 million returns were filed through the 17-member Alliance. The second year resulted in a more than 26-percent increase, with 3.5 million returns filed through the 17-member Alliance. The third and the most recent filing years resulted in 5.1 million Free Filed returns (a 46-percent increase) in TY 2004 and almost 4.0 million returns (a 22-percent decrease) in TY 2005 from the 20-member Alliance.

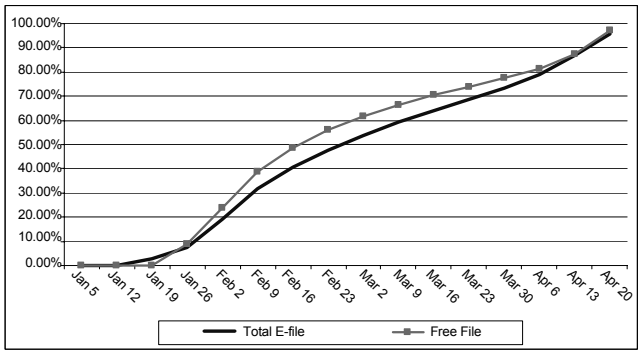
The initial agreement specified a minimum coverage of 60 percent, which the members abided by in the first two filing seasons. In the third year of the program, one of the Alliance members decided to offer the free preparation and filing service to all taxpayers (TIGTA 2006-40-171). Other members followed, and, in TY 2004, all 100 percent of taxpayers had the option to Free File. This was the main contributing factor to the 46-percent increase in Free-Filed returns in Filing Season 2005. This caused some friction among the Alliance members, and the existence of the Alliance was threatened. Hence, one of the amendments included in the new agreement includes the stipulation that no single member can offer more than 50-percent coverage. Since the past filing season represents the first year the IRS started identifying the Free-Filed returns, the consistency of prior-year data cannot be verified for accuracy.

Projections of Free File volumes produced by the IRS indicate that almost 5.0 million returns are expected to be Free Filed in TY 2006. This represents a 25-percent increase from the TY 2005 filing season. The volume is expected to reach almost 6.0 million by TY 2009.

▶ Weekly Trends

Although Free Filers reflect the early filing patterns of the overall e-filers, calculation of the cumulative weekly filing percentages show that the Free Filers generally filed even earlier in the filing season compared to the total electronically-filed returns. The comparisons are based on the TY 2005 filing results. By the end of January, 9 percent of Free Filed returns had been filed compared to less than 8 percent of total e-filed returns. However, the difference increased to over 7 percent in early February and another percentage towards the end of the month. More than half of the Free Filed returns (56 percent) were received by the end of February, versus 48 percent of total e-filed returns. The gap continues to range from 3 percent to almost 8 percent until the end of the primary filing season. By April 20, approximately 97 percent of Free Filed returns, and 95 percent of total e-file returns, were filed.

TY 2005 Cumulative Weekly Filing Percentages



Source: Electronic Tax Administration Data

▶ Tax Year 2004 Demographics

In order to gather more information about Free File Program users, the Electronic Tax Administration within the IRS contracted with Russell Marketing Research and Foote, Cone, and Belding to implement an online survey of taxpayers who Free Filed their TY 2004 individual returns. The purpose of the survey was to obtain results which would be used to further develop marketing campaigns for the Free File Program. Each eight-hundredth Free Filer was asked to complete the online survey. The contractors collected the results which were summarized by research teams within IRS's Wage and Investment Division (W&I Research Project 6-05-08-2-038N).

Although these results provide an overview of Free Filers, they must be interpreted with caution. Participation in the survey was voluntary, and many taxpayers opted not to complete the questionnaire, leading to an estimated response rate of 2 percent. Thirteen of the 20 Free File Alliance members offered the online survey. In addition, not all of the participating companies offered the survey at the start of the filing season, and some companies did not initially follow the skip pattern (offering the survey to the 800th filers). However, by February 14, all 13 Alliance members who participated in the survey were offering it according to the agreed-upon pattern. For the purposes of this paper, only those surveys collected after February 14 are included in the analysis.

According to survey results, 17 percent of taxpayers who Free Filed in Filing Season 2005 were first-time filers. Of the remaining 83 percent who had previously filed Federal income taxes, 29 percent were e-filing for the first time. Some 78 percent of this group of prior paper filers self-prepared their tax returns during the previous filing season. Of the approximately 70 percent of respondents who had used e-file methods during the prior filing season, only 2 percent claimed to have used the TeleFile Program. About 41 percent used tax preparation software, and 15 percent e-filed via tax preparers. The remaining 42 percent stated that they used Free File in the previous year. When questioned about previous use of Free File, 51 percent had used the program in prior years; about 49 percent of those surveyed were first-time Free Filers.

Based on survey responses, Free File participants share certain demographic characteristics. Over half (52 percent) claimed a single filing status. Some 32 percent were married filing jointly, and 14 percent filed as heads of households. The remaining 2 percent were married filing separately or qualifying widows. Some 50 percent of Free Filers were 35 years or younger. About 42 percent had a pretax income of less than $25,000, and 56 percent reported a pretax income of less than $35,000. About 16 percent of survey responders reported that they claimed the Earned Income Tax Credit on their 2004 Federal income tax returns. Almost 90 percent of respondents were owed a refund in Filing Season 2005.

Respondents were also asked about their future plans to e-file tax returns. Some 75 percent stated that they would use e-file again in the future, and an additional 21 percent expressed that they would be likely to e-file future returns. Only 1 percent indicated that they would either file (or probably file) a paper return in upcoming filing seasons.

When asked about how they heard about the Free File Program, responses covered a range of topics. Communication from the IRS was the most likely source for hearing about Free File; some 49 percent of respondents heard about the program from either information on the IRS Web site, tax forms, or IRS mailings. Specific

responses indicated that 35 percent learned about the program from the IRS Web site, and 22 percent heard about it from relatives or colleagues.

▶ TY 2005 Demographics of Free Filers

Analysis of TY 2005 Free Filed returns (which was the first year Free File data were flagged by the IRS) illustrated several interesting characteristics of Free Filers. The data showed that Free Filers are mostly in their twenties with a single filing status and have relatively low AGIs. Most received refunds. About 47 percent of Free Filers were between the ages of 20 to 29, and an additional 12 percent were between the ages of 16 and 19. Some 73 percent of Free Filed returns indicated Single filing status, while 15 percent of returns were Head of Household, and 11 percent were Married Filing Jointly. Over half of the returns had AGI of less than $17,000, while 19 percent had an AGI greater than or equal to $17,000 but less than $25,000, and 17 percent had an AGI greater than $24,999 but less than $35,000. Of the 3.8 million Free Filed returns, 96 percent were refund returns with an average refund amount of $1,300. This compares to 88 percent of total e-filed returns (IRS Document 6187) which were estimated to be refund returns. The data indicated that 34 percent of the returns were the long and more complicated form type (Form 1040). The short form, Form 1040EZ, constituted an additional 38 percent of the returns. Around 5 percent of total electronically-filed individual returns were filed through the Free File Program.

An analysis of how TY 2005 Free Filers filed their tax returns in the previous year (TY 2004) showed that the Free File Program is contributing to the growth of the overall e-file program. As expected, not all Free Filers are first time e-filers. About 66 percent electronically-filed their returns in TY 2004. Some 39 percent of these filed online, while 17 percent used the TeleFile Program, and the remaining 10 percent e-filed via practitioners. However, 17 percent of TY 2005 Free Filers had paper-filed their tax returns in TY 2004. Furthermore, almost 42 percent of this population (TY 2004 paper filers) had V-Coded their returns, meaning that they prepared their returns on the computer but printed the returns and mailed them in as paper returns. In addition, about 18 percent of current Free Filers are new filers who did not file a return in TY 2004, indicating that the Free File Program is attracting new taxpayers to the e-file program.

▶ State Level Data and Participation Rates—Tax Year 2005

An analysis of State-level data (including the District of Columbia) yielded several interesting patterns in terms of Free Filers during the 2006 Filing Season. Although these results are based on one filing season, future studies may result in more conclusive relationships among demographic variables and participation in the program. To calculate the Free File participation rate (FFPR) per State, a ratio was calculated based on each State's number of Free Filed returns as a percentage of that State's total return volume (including paper and electronic volumes). The FFPR for the U.S. was 1.30 percent in TY 2005, with State levels ranging from 4.40 percent in Ohio to 1.64 percent in New York. The average state FFPR was 3.15 percent. The 10 States with the highest FFPR were Ohio, South Dakota, Wisconsin, Maine, West Virginia, Nebraska, Utah, Oklahoma, Idaho, and North Dakota. These States represent a broad range of geographic locations, State sizes, and total populations.

Using age and population data from Global Insight, Inc., it was determined that 3 of the 10 States with the highest FFPRs—Utah, Idaho, and North Dakota—also ranked in the 10 U.S. States with the highest ratio of residents in the "15-to-34-year-old" age range. This range includes teenagers and those entering the workforce for the first time who would be likely to have lower incomes and meet the AGI limit.

State-level per capita income was also analyzed to determine if States with lower per capita incomes had higher FFPRs. West Virginia, Utah, and Idaho were within the 10 states having the lowest per capita incomes, which may indicate that States with lower incomes have more participation in the program, particularly if the States (like Utah and Idaho) also have a high percentage of younger residents. States with the lowest FFPRs tended to have higher per capita income levels. The 6 States with the highest per capita incomes were

the District of Columbia, Connecticut, Massachusetts, New Jersey, Maryland, and New York. With the exception of Massachusetts, the other States with higher per capita incomes were skewed toward having the lowest FFPRs. The District of Columbia was 37th, and the other 4 high-income States ranked in the bottom 10 in terms of FFPR, with New Jersey and New York having the lowest participation rates of all States.

▶ Tax Year 2005 Survey Results—Free Filer Attitudes

For TY 2005, the IRS again contracted with Russell Marketing Research to conduct telephone interviews of Free Filers. The sample consisted of 1,800 Free Filers who were selected from lists provided by the IRS. Although this survey yielded some demographic data similar to the survey efforts of the prior filing season, the objectives were to determine the overall usage and perception of Free File, the usage and evaluation of specific site features, and other learning experiences.

Data collected regarding the overall usage and perception of the Free File Program was highly favorable; some 94 percent of respondents indicated that they would like to use the program again, while 97 percent said they would recommend the program to friends or family. In terms of improving the program, 30 percent of respondents had suggestions for improvement. Among the feedback offered was making Free File easier to use (7 percent), increasing awareness of the program (4 percent), removing the income criteria (4 percent), and providing more information on the tax preparation companies (4 percent).

In terms of ease of using Free File, 60 percent of those surveyed rated the experience as very easy, and 34 percent rated it as somewhat easy. About 1 percent responded that the experience was very difficult. Free Filers who used step-by-step instructions, the frequently asked questions guide, and the "Guide Me to A Service" feature rated the program as easier to use than those who contacted the Help Desk for assistance. Among those who felt that the Free File Program Web site and pages could be improved (18 percent of respondents), 25 percent indicated that the pages should be easier to use and the company selection process could be improved. About 82 percent were satisfied with the Free File pages and did not think the pages could be improved.

Early surveys of taxpayers' attitudes toward e-file indicated some level of concern about the security of online transactions with the IRS (RMR March 2003). However, over half of the respondents (54 percent) felt very confident that the information they provided during the Free File process was secure; 42 percent indicated that they were somewhat confident. Although the majority of responses were highly favorable, increasing the level of confidence in the security of the Free File process represents an area that the IRS and the Alliance can work to improve in the future.

In terms of deciding which provider to use, no one factor appears to dominate the decisionmaking process. Some 21 percent based their decisions on a software company they had used in the past, while 19 percent used a company recommended by family or friends, and 14 percent based their decisions on the criterion that the company's "offer met my needs." Only 11 percent of respondents based their decisions on the company's reputation. Those using the "Guide Me to A Service" feature were far more likely to indicate that the deciding factor in selecting a company was the fact that the company was suggested by this IRS-provided feature. Some 55 percent responded that they would use the same tax provider next year, and 36 percent said that they would probably use the same company again. Only 1 percent said that they would definitely not use the same company again.

Survey results for Filing Season 2006 indicated that more Free Filers learned about the program from family or colleagues (over one-third gave this response) than in Filing Season 2005. About 40 percent cited the IRS as their initial source of information about Free File, a drop from the almost 50 percent who gave this response in the Filing Season 2005 survey. Although 89 percent felt that the initial information they received provided sufficient knowledge of the program, only 49 percent stated that their initial source mentioned the income limit of $50,000 for using the Program.

▶ Conclusion and Future of the Free File Program

Although there is concern that Free File volumes seemed to decline in Filing Season 2006, the program is considered to be an overall success. According to the Electronic Tax Administration Advisory Committee's (ETAAC) 2006 Annual Report to Congress, the Program's most positive accomplishment was attracting 4.0 million taxpayers to the e-file program, including many who would have not otherwise used e-file. This growth occurred at no cost to the IRS, taxpayers, or the American public.

The Treasury Inspector General for Tax Administration (TIGTA) also conducted a review of the Free File Program in 2006. The report agreed that the amended Agreement added new levels of taxpayer protection, security, and performance standards. TIGTA does acknowledge that many of these issues resulted from the unique relationship the IRS must maintain with the private sector for the program to work, with the realization that the IRS cannot entirely control the program. TIGTA also recommends that the IRS improve Free File options offered to Spanish-speaking taxpayers via the IRS Web site.

In response to the TIGTA report, the IRS will conduct a study to evaluate providing a Free File entry portal in Spanish. The IRS will begin discussions with the Multilingual Language Initiative Strategy Office, the Electronic Tax Administration, and representatives from the Free File Alliance to discuss the resources, requirements, and funding needed for this effort. It is anticipated that the decision to provide a Spanish entry portal will be made in 2007.

New for TY 2006, the IRS will offer Form 1040EZ-T, *Claim for Refund of Federal Telephone Excise Tax,* to those taxpayers who will be filing a Federal return for the sole purpose of claiming the TETR. This may result in several hundred thousand Forms 1040EZ-T filed via the Free File Program. The cessation of the TeleFile Program in TY 2004 will also continue to have implications on Free File volumes. As of April 27, 2006, over 650,000 returns that were filed via the TeleFile Program in Filing Season 2005 came in through the Free File Program during Filing Season 2006. This represents almost 20 percent of the total TeleFile returns from Filing Season 2005.

Since its inception, the Free File Program continues to evolve and make valuable contributions to the e-File Program while reducing taxpayer burden. It offers another e-file option when other programs, like TeleFile, end. As the program prepares to offer Forms 1040EZ-T and Spanish language option, it continues to be an innovative arrangement benefiting taxpayers, private companies, and the IRS.

▶ Acknowledgments

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▶ Data Sources

Electronic Tax Administration Research and Analysis System

Free File Volume Estimates, IRS Research, Analysis, and Statistics Division

Global Insight, Inc., *Regional Forecasts—States* Database

IRS Individual Master File

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6

Statistical Dissemination and Communication

Johnson

Standing Out in a Crowd: Improving Customer Utility on a Centrally Administered, Shared Web Site*

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The Internet has become the primary public interface for many statistical organizations, offering opportunities to reach larger audiences with more products than ever before. Often, however, a statistical organization's virtual existence must be shared with other, dissimilar organizations, due either to resource constraints or policy decisions. In countries without a centralized statistical agency, such as the United States, statistical organizations are often housed within much larger agencies whose missions are primarily administrative. In such cases, the needs of the statistical function are often at odds with those of the administrative function. Similar tensions can exist in countries where the statistical functions are centralized. In these cases, subject matter with a relatively small customer base may compete for visibility and resources with topics that have broader appeal. Shared use of a single Web site may reduce flexibility in design and limit the types of products that can be offered. Often, design decisions are driven by the component with the largest customer base and may not optimally serve smaller statistical functions and their customers.

Statistics of Income (SOI), a division of the U.S. Internal Revenue Service (IRS) and the primary source of data on the U.S. tax system, provides an excellent case study for this sort of coexistence. The irs.gov Web site is designed primarily to assist taxpayers in filing their taxes. It contains tax forms, filing instructions, regulatory rulings, and other resources for answering questions about the myriad tax and information reporting requirements that compose the U.S. tax system. It is also home to SOI's Web pages, "TaxStats," which provide public access to more than 4,000 statistical data products and average almost 500,000 downloads per month. This paper will focus on SOI's efforts to improve the TaxStats pages on irs.gov. It will discuss recent redesign efforts and share future plans, all in the context of working within the design limits imposed by a multiuse Web site. The goal is to provide guidance and encouragement for other statistical organizations in similar situations.

▶ Background

The official public IRS Web site, irs.gov, is maintained by a contractor, under the supervision of two organizations within the Service. The Communications and Liaison division (C&L) oversees the general look and feel of the Web site and maintains a set of detailed guidelines for page design, including approved fonts, colors, page formats, writing style, etc. All Web pages and content posted to irs.gov must be created and modified through the Content Management Application (CMA). This tool, through validation checks and the use of dropdown menus, helps ensure that all Web pages comply with the parameters specified in these guidelines. The IRS Electronic Tax Administration division (ETA) oversees the hardware and software aspects of irs.gov. Jointly, these two divisions set standards, plan upgrades, conduct user-testing, and facilitate monthly meetings with irs.gov's major content providers.

Statistics of Income began disseminating data electronically in 1992 via an electronic bulletin board, which was maintained on a personal computer by SOI staff. In 1996, SOI replaced the bulletin board with the TaxStats pages on irs.gov. These pages were organized by subject matter, primarily reflecting SOI's internal structure. Downloads and Web content grew annually, but, by 2003, it became clear that customers, particularly those new to TaxStats, were having difficultly locating products and services. To learn more about customer experiences on TaxStats and to address problems, SOI formed a small, cross-functional "Web team" made up of economists, statisticians, and computer specialists from a diverse array of subject matter areas.

**Johnson, Barry W. (2006), "Standing Out in a Crowd: Improving Customer Utility on a Centrally Administered, Shared Web Site," United Nations Economic Commission for Europe, Work Session on Statistical Dissemination and Communication, http://www.unece.org/stats/documents/2006.09.dissemination.htm.*

▶ Gathering Feedback

Any organization with a Web presence needs to periodically measure how well it is serving its customer base. For SOI, informal feedback provided a catalyst for evaluating the effectiveness of SOI's Web pages. Initially, some of the most useful comments came from customers who contacted its Statistical Information Services (SIS) office after failing to find the information they wanted on TaxStats. Many times, SIS staff were able to help these customers navigate the TaxStats pages to find the information they sought, a clear indication that the Web pages needed improvements. In addition, SOI has a panel of expert tax policy researchers who meet biannually to offer feedback and provide direction to SOI. These users not only provided additional, informal feedback about their experiences using TaxStats, but also became an integral part of the redesign process.

To gather formal information from customers, SOI developed a survey that was given to all callers who contacted SOI's SIS staff [1]. This survey included 11 structured questions and an opportunity for general comments. Questions included general respondent information (occupation, frequency of visits to TaxStats, subject matter interests), general satisfaction with TaxStats (ease of use, quality of products, overall satisfaction), and suggestions for improvements (expanded content, preferred file formats, specific changes to improve navigation). In addition, the survey was administered to the membership of the U.S. National Tax Association, whose participants are considered key users of SOI data, and to SOI's consultants. The results showed that SOI customers had a wide range of occupations but were mainly researchers from universities; Federal, State, or local government employees; or individuals providing consulting or issue advocacy services. In general, customers found SOI products useful and of high quality but often had difficulty locating items on TaxStats. They specifically cited problems with Web page organization. Other comments included requests for more data, especially historic data, and easier-to-use product formats for data tables and articles [2].

In addition to formal and informal customer feedback, irs.gov provided SOI with monthly Web metrics that identified popular products. These metrics were also useful as benchmarks against which redesigned pages could be evaluated. After analyzing data from all sources, it was clear that both page and overall Web site design issues were contributing to user dissatisfaction. Page design problems were generally things that SOI could address directly. Site design problems posed a greater challenge, since these necessitated working with irs.gov personnel to change the structure of irs.gov or modify style guidelines.

▶ Attacking the Problem

Having confirmed that customers were having difficulty finding information on the TaxStats pages of irs.gov, the next step was to identify products that SOI wanted to make available to the public via the Web. This was done through conducting a careful inventory of existing TaxStats content, brainstorming new product offerings, and researching the types of products available from other statistical functions in the U.S. and in other countries. Customer feedback from the surveys was also very important to this process. A few prime customers provided additional input by participating in a card sort exercise.

Card sorting, as applied to information management, is a technique for developing an information structure, as well as suggesting navigation, menus, and possible taxonomies [3]. SOI used its panel of 15 consultants as subjects for this exercise, which was conducted via mail [4]. Each test subject received a package consisting of: 1) slips of paper, each with a single content item printed on it, 2) instructions, and 3) some blank slips of paper for subjects to write in additional content items. Participants were asked to create subgroups from items they perceived as related, by grouping individual cards using rubber bands and paper clips, and then to organize these subgroups into larger categories. Participants then mailed the cards back to SOI, along with any comments or suggestions they wished to add. While response rates were somewhat disappointing, the six subjects who chose to participate represented a range of research interests. Despite their varied interests, the subjects provided results that were surprisingly similar. Each also provided a number of suggestions for new content items. The results of this exercise were

instrumental in developing the structure and content of a prototype for the new TaxStats Web pages.

Another important component of the redesign effort involved examining Web sites of major U.S. and international statistical agencies, as well as a number of commercial Web sites. The team also reviewed articles and research papers that presented guidelines for effective Web pages [5]. At the time, the recently redesigned U.S. Bureau of Labor Statistics (BLS) Web site was particularly helpful, because it is an organization whose mission and scope are similar to those of SOI. Since BLS is renowned for its cognitive research, all its new Web pages were subject to extensive usability tests, the results of which are well documented in a series of papers on Web design and testing [6]. In addition, the BLS Web designers were very generous in sharing their expertise with SOI's Web team.

▶ Developing a Plan

The official irs.gov design guidelines provided three basic page layouts at the time SOI undertook its redesign. All Web pages contained static content, primarily text in HyperText Markup Language (HTML) or documents in Portable Document Format (PDF). As SOI Web team members developed new page layouts, a guiding factor was to keep, as much as possible, the specifics of the designs within the written guidelines established for irs.gov, but, within those guidelines, to be as innovative as possible. Several new layouts were developed, and these were presented to SOI's panel of consultants for feedback. Based on their feedback, SOI developed a working prototype of the new site using Microsoft FrontPage.

While developing the prototype Web pages, SOI met with some of the individuals who oversee irs.gov. At this meeting, SOI presented research results and a detailed short- and long-term vision for TaxStats and unveiled a few prototype pages. An important feature of this presentation was the use as examples of other successful Web pages from organizations with missions similar to that of SOI. A few key factors made this meeting successful. First, SOI had empirical research to show that the current irs.gov TaxStats pages were not serving customers well. Second, SOI was careful to draw a distinction between customers who access tax statistics and those who came to irs.gov in search of tax filing or compliance information.

Third, SOI acknowledged the value of design constraints that had been developed to enhance the experiences of the latter group and provided evidence that these very features were making it difficult for SOI's customers to find the products they needed. Finally, recognizing resource limitations, SOI chose to focus on a limited number of requests for changes in irs.gov policies or practices. The results of this meeting included a clearer understanding of SOI's needs, an agreement to make a significant change to the existing irs.gov page structure, and a promise for continued dialogue.

▶ User Testing

After developing a working prototype Web site, SOI conducted user-testing prior to implementing any actual changes to the TaxStats pages. While the prototype did not have working links for all 4,000 SOI data products, it included examples of all the page styles that SOI was proposing, including several pages with similar functions, but different design features, in the hope that testing would indicate a clear "best" choice. After consulting with professional Web developers and SOI's own staff of statisticians, a series of test tasks were developed. Testing was conducted at the BLS cognitive research laboratory, and a trained facilitator administered these tasks individually to a diverse group of seven test subjects while members of the Web team observed from a separate room [7]. Observers were able to hear each of the test subject's comments, as well as view their facial expressions and all computer key strokes via a computer monitor. Each session was also captured on videotape for further analysis. At the end of each test session, subjects were debriefed using a questionnaire. The test results were used to finalize Web design plans.

▶ Implementation

Once the plan was finalized, Web team members set about the task of programming new Web pages. Hierarchies of pages were developed, and design attributes, such as font sizes, spacing, text justification, grid

styles, and usage, etc., were determined and documented in written guidelines that included instructions and examples to ensure uniformity across pages. Actual programming was performed by individuals with some expertise in the subject matter whenever possible. This ensured that specific content items were correctly categorized and described. To assist in final page design, classroom training in writing for the Web was offered to team members. Once all of the pages were completed, subject matter experts were enlisted to thoroughly test each page for accuracy. In total, nearly 150 pages were developed with more than 4,000 links to content items. The new pages included a new main (home) page and a redesigned left navigation bar. Based on customer feedback, all tabulated data on the site were made available as Microsoft Excel spreadsheets, and all research reports were posted in PDF format, with free readers provided for each. Web pages were nearly all programmed in HTML and were certified as compliant with U.S. standards for accessibility by individuals with disabilities [8].

▶ Future Directions

SOI is currently working to improve several aspects of the TaxStats Web pages. First, while all of the actual TaxStats Web pages are certified as accessible to individuals with disabilities using screenreading software, many of the PDF documents available through those pages are not. SOI is committed to correcting this problem by improving both the techniques used to create the documents and their overall design. The software used to produce SOI documents has recently been upgraded, and SOI is seeking training and advice from desktop publishing experts.

Second, many of the tables on TaxStats contain extra formatting features that are necessary for creating printed publications but that make certain types of analysis difficult. Customers who use these tables for analysis must first remove some formatting features before applying even simple math functions to the data. SOI has just issued draft guidelines for producing researcher-friendly data tables. These guidelines were developed by incorporating extensive feedback from customers.

Third, a prototype application that allows customers to create customized tables from SOI data is being tested on TaxStats. This application uses off-the-shelf software with custom-designed display screens that allow users to access a database containing tabulated SOI data (microdata are not made available due to privacy protection concerns). Users can combine data across different tax years, select variables of interest, and choose categories of data to include in a table, as well as calculate simple descriptive statistics using this application.

Fourth, metadata designed to help users better interpret the data available on TaxStats are being developed. Possible metadata items include tax forms marked to indicate the origin of specific data items, written descriptions of individual data items, and sample selection information, including variance estimates where applicable. Samples of metadata are currently being tested. In addition, SOI is working closely with irs.gov officials to develop a fully articulated taxonomy of TaxStats that, in time, will be used to improve search capabilities and navigation, as well as provide common definitions of concepts and terms across all irs.gov content areas.

▶ Lessons Learned

Statistics of Income's experience in redesigning the TaxStats pages on irs.gov serves as a model for other organizations faced with a Web site that is not specifically designed to serve its customers' needs. The resulting redesigned Web pages, while not cutting-edge, nevertheless have garnered favorable feedback from both regular and new customers. More products are now offered on clearer, better organized pages. Product formats have been standardized and, in some cases, redesigned. The effort was not expensive. In fact, the only direct expense was the cost of sponsoring a Web-writing training class. There were opportunity costs in the time spent on the redesign efforts by employees, but SOI's Web team was careful not to let Web design activities interfere with their day-to-day responsibilities. And as is often the case, the team project brought energy to SOI that provided benefits beyond the successful completion of this specific task. The key to

SOI's success was involving subject matter specialists and customers in all phases of transforming the TaxStats pages. This fostered a sense of commitment to the project, a deeper understanding of customer needs and SOI products, and the creativity needed to work within the constraints of a design framework that initially appeared to be fundamentally unsuitable. Some specific lessons learned include:

a. Gather specific feedback from users in order to thoroughly understand opportunities for improvement. If possible, involve a group of core customers in redesign efforts.

b. Research best practices used by organizations with similar products or customers. Also examine commercial Web sites since these may reflect the most current design practices and technology.

c. Focus initially on those things that are under the control of the content provider. Consider questions such as:

   - Are products being provided in formats that meet customer needs?
   - Are products and pages accessible to all users?
   - Is content organized and adequately described so that users outside the provider's culture can clearly understand what is being provided?

d. Take as much control over content management as possible. Involve employees who are familiar with the mission and products of the organization in redesign efforts. Keep management informed of team progress and ideas to ensure executive-level support. This is especially important if redesign plans require any site-level policy changes.

e. Develop a thorough understanding of design guidelines and restrictions, and, if possible, meet with Web site managers to better understand them.

f. Present research results to Web site managers along with a clear plan for improvement that respects current Web site guidelines. When necessary, propose modifications that will meet the needs of specific customer groups, focusing on a few essential changes.

g. Become involved in the Web site's user group, or urge the formation of such a group if none exists. These are excellent forums for educating Web site managers about customer needs.

h. Prototype and test pages prior to implementing any changes.

i. Continuously monitor user experiences on the Web site. Web pages are not static, but must continue to change as technology and Web practices evolve.

▶ Endnotes

[1] While an online survey of TaxStats users would have been preferred, at the time of the redesign, irs.gov did not have the technical capacity to implement Web surveys.

[2] Prior to the redesign, documents were available in PDF, Lotus, and Microsoft EXCEL. In addition, larger files were compressed and provided as executable files.

[3] Maurer, Donna and Warfel, Todd, "Card Sorting: a definitive guide," http://www.boxesandarrows.com/view/card_sorting_a_definitive_guide, 2004.

[4] The minimum recommended number of card sort participants is 15. While conducting this exercise face-to-face allows observers to record respondent reactions, it is acceptable to mail packages to participants when cost is an important consideration or when conducting the exercise via mail improves participation rates. Nielsen, Jakob, "Card Sorting: How Many

Users To Test," http://www.useit.com/alertbox/20040719.html, 2004.

[5] See, for example, "Best Practices in Designing Web Sites for Dissemination of Statistics," United Nations Statistical Commission and Economic Commission for Europe, 2001.

[6] See, for example, Levi, Michael D., "Usability Testing Web Sites at the Bureau of Labor Statistics," National Institute of Standards and Technology Symposium, Transcript, 1997.

[7] While five is considered the minimum number of test subjects required to discover the majority of usability problems, SOI determined that its users fell into two broad groups, experienced statistical data users and individuals with a general interest in the U.S. tax system, so that it was necessary to try to get representatives of both groups. Nielsen, Jakob, "Why You Only Need To Test with 5 Users," http://www.useit.com/alertbox/20000319.html, 2000.

[8] See Section 508 of the Rehabilitation Act (29 U.S.C. 794d), as amended by the Workforce Investment Act of 1998 (P.L. 105-220), August 7, 1998 (herein referred to as Section 508).

Index of IRS Methodology Reports on Statistical Uses of Administrative Records

Special Studies in Federal Tax Statistics, 2005
Selected papers given primarily at the 2005 Joint Statistical Meetings of the American Statistical Association in Minneapolis, Minnesota, and at the National Tax Association's Annual Conference on Taxation in Miami, Florida. The volume is divided into seven major sections. It begins with three papers: one on analyzing business organizational structure from tax data; one on current research in the nonprofit sector; and one on geographic variation in filing rates for Schedule H, the IRS form used to report Social Security and Medicare wages paid to household employees. Section 2 presents a paper on Schedule M corporate book-tax difference data, 1990-2003. Section 3 presents a paper on the effects of taxation on corporate financial policy. Section 4 contains three papers on measuring nonsampling error in the SOI Individual Tax Return Study; how imputed returns on the Corporate File compare to actual returns; and the impact of followup on Tax Year 2002 Foreign Tax Credit Data. Section 5 contains four papers on cluster analysis in describing tax return data; comparing income concepts at IRS, Census, and BLS; the 1999-2003 Statistics of Income Tax Return Edited Panel; and trends in 401(k) and IRA contribution activity, 1999-2002. Section 6 presents a paper on the Estate and Personal Wealth sample design. Finally, Section 7 presents a paper on IRS area-to-area migration data.

Special Studies in Federal Tax Statistics, 2004
Selected papers given primarily at the 2004 Annual Meetings of the American Statistical Association in Toronto, Ontario, Canada, and two other professional conferences--the Luxembourg Wealth Study Workshop in Perugia, Italy, and the Conference on Privacy in Statistical Databases in Barcelona, Spain. The volume is divided into five major sections. It begins with four papers on recent developments in Statistics of Income research. Section 2 includes five papers on quality assessment of administrative records data. Section 3 presents a paper on estimates of income and wealth from survey and tax data. Section 4 contains a paper on disclosure protection techniques. Finally, Section 5 presents a paper on some current theorietical research on multivariate analysis presented in a poster session at ASA.

Special Studies in Federal Tax Statistics, 2003
Selected papers given primarily at the 2003 Annual Meetings of the American Statistcal Association in San Francisco, CA. The volume is divided into four major sections. It begins with four papers presented in the same session under the topic, "Are the Rich Getting Richer and the Poor Getting Poorer?" Section 2 includes a paper on survey methods. Section 3 presents five papers on new developments in tax statistics and administrative records. Finally, Section 4 contains a paper on survey nonresponse and imputation.

Special Studies in Federal Tax Statistics, 2002
Selected papers given primarily at the 2002 Annual Meetings of the American Statistical Association in New York City and at the 2002 National Tax Association Conference in Orlando, FL. The volume is divided into seven major sections. It begins with two papers on recent IRS research. Section 2 includes a group of four papers on methodological and analytical advances in tax statistics. Section 3 presents two papers on statistical uses of administrative records. Section 4 contains a paper on disseminating IRS locality data. Section 5 includes a paper on confidentiality and data access issues. Section 6 presents a paper on measuring the quality of IRS responses to taxpayer inquiries. Finally, Section 7 includes two papers on distributional theory and computation.

Special Studies in Federal Tax Statistics, 2000-2001
Selected papers given primarily at the 2000 and 2001 Annual Meetings of the American Statistical Association in Indianapolis, Indiana and Atlanta, Georgia, plus one other paper presented at the International Conference on Establishment Surveys II in Buffalo, New York in 2000. The volume is divided into four major sections. The book begins with five papers on statistical applications. Section 2 presents two papers on confidentiality and data access issues. Section 3 presents two papers on changing industry codes. Finally, Section 4 includes five papers on analyses of Federal tax and information returns.

Turning Administrative Systems Into Information Systems, 1999
Selected papers given at the 1999 Annual Meetings of the American Statistical Association (ASA) in Baltimore, MD. In addition, the report includes one paper presented at the 1998 ASA conference in Dallas, TX. The volume is divided into six major sections. The book begins with a complete ASA session analyzing administrative records from the U.S. tax system. It contains four papers, as well as a set of comments on the presentations. Section 2 presents four papers on the statistical uses of administrative records. Section 3 includes two papers, which focus on employee satisfaction and customer satisfaction surveys at the IRS. Section 4 contains two papers, one of which was presented at the 1998 ASA conference, that provide an update on the Survey of Consumer Finances. Section 5 presents one paper that looks at the feasibility of preparing State corporate data by matching receipts and employment data by State and industry. Finally, the volume concludes with a paper on distributional theory and computation.

Turning Administrative Systems Into Information Systems, 1998-1999
Selected papers given at the 1998 Annual Meetings of the American Statistical Association in Dallas, Texas. In addition, the report includes a session of papers presented in 1999 at the Annual Meetings of the American Economic Association (AEA) plus one other paper. The volume is divided into five major sections. The book begins with the AEA session in memory of the late Dr. Daniel B. Radner, Social Security Administration economist. It contains four papers on new empirical findings in the distributions of personal income and wealth, as well as two sets of introductory remarks and two sets of comments on the presentations. Section 2 presents two papers on data measurement and data bases for economic research. Section 3 includes two papers, which focus on sample design, estimation, and imputation research. Section 4 explores issues dealing with public-use files, including the potential for disclosure. Finally, Section 5 concludes the volume with a paper verifying the classification of public charities in the 1994 Statistics of Income Study Sample. (It is the only paper not presented at the ASA or AEA meetings.)

Turning Administrative Systems Into Information Systems, 1996-1997
Selected papers given primarily at the 1996 and 1997 Annual Meetings of the American Statistical Association in Chicago, Illinois and Anaheim, California, plus one non-ASA article. The volume is divided into nine major sections. The book begins with a paper originally printed as a textbook article on inheritance and wealth in America. Section 2 presents papers on using administrative records for generating national statistics. Section 3 contains two sets of panel reports on the statistical uses of administrative records. Section 4 focuses on methodological research. Section 5 explores issues dealing with quality improvement in government. Section 6 presents a panel discussion on Customer Satisfaction Surveys. Section 7 focuses on the effect of downsizing on Federal statistics. Section 8 explores the privacy area. Finally, Section 9 concludes with seven papers on statistical disclosure limitation.

Turning Administrative Systems Into Information Systems, 1995
Selected papers given primarily at the 1995 Annual Meetings of the American Statistical Association in Orlando, Florida and another conference. The volume is divided into five major sections. The book begins with a paper on SOI migration data, giving an example of how this unique dataset can be used by demographers and policy research-

ers. Section 2 presents papers on sample designs and redesigns, as well as on SOI efforts in the corporation and partnership areas. Section 3 contains papers on weighting and estimation research. Section 4 focuses on analytical approaches to quality improvement, from graphical techniques to cognitive research. Finally, Section 5 concludes with papers from an invited session on record linkage applications for health care policy, a session organized by SOI in view of its long-term interest in improving matching techniques for administrative and survey data.

Turning Administrative Systems Into Information Systems, 1994

Selected papers given primarily at the 1994 Annual Meetings of the American Statistical Association in Toronto, Ontario, Canada. The volume is divided into nine major sections. The book begins with an overview of the Statistics of Income Programs, describing the origins and customers of various SOI data and highlighting our products and services. Section 2 presents the descriptive results from two recent studies--one on sales of capital assets and one on self-employed nonfilers. Section 3 contains papers and discussion from a session on privacy issues involved in using administrative record data. The next two sections are much more methodical in nature: Section 4 focuses on sample design and estimation work in SOI, beginning with a reprint of a 1963 paper by W. Edwards Deming, which presents an evaluation of the SOI sample. Section 5 presents data on record linkage. Section 6 draws together the papers from a session on nonresponse in Federal surveys. Section 7 is a more statistical section, which contains a collection of papers on imputation methodology in a number of different arenas. Section 8 focuses on another long-time theme of these volumes--quality improvement efforts. Finally, Section 9 presents two unrelated papers on data preparation techniques.

Turning Administrative Systems Into Information Systems, 1993

Selected papers given at the 1993 Annual Meetings of the American Statistical Association in San Francisco, California and other related conferences. The volume contains seven major sections, each focusing on a somewhat different area of research. The first section begins with a paper that presents a view for the future of the Federal statistical system. This effort is part of a dialogue with other agency leaders to redefine a cohesive plan for Federal data producers and users. Section 2 contains several descriptive papers based on tax data about individuals, and Section 3 looks at similar uses of tax data for businesses. Section 4 focuses on sample design issues for several SOI projects, while Section 5 presents information on improvements to analytical techniques. Finally, Sections 6 and 7 describe a number of different studies SOI is involved in to improve the quality and productivity of other areas of IRS.

Turning Administrative Systems Into Information Systems, 1991-1992

Selected papers given mostly at the 1991 and 1992 Annual meetings of the American Statistical Association, held, respectively, in Atlanta, Georgia and Boston, Massachusetts. Papers chosen for this volume exemplify some of the basic changes that are occurring in the Statistics of Income program during the 1990's, including discussions of methodological improvements and applications currently under way in the U.S. Federal statistical community. The volume contains seven general areas of interest: information from tax return data; the 1989 Survey of Consumer Finances; estimation and methodological research in the SOI business program; sample design and weighting issues in the SOI individual program; some quality improvement applications; some technological innovations for SOI research; and a look to the future data needs for the Federal sector. Previous volumes in the series were called Statistics of Income and Related Administrative Record Research (see below). The title was changed to more clearly reflect how the Internal Revenue Service's Statistics of Income function is adapting to better meet the informational needs of its many customers.

Statistics of Income and Related Administrative Record Research, 1990

Selected papers given primarily at the 1990 Annual meeting of the American Statistical Association in Anaheim, California. Papers selected for this volume contain discussions of methodological improvements and applications

currently under way in the U.S. Federal statistical community. In particular, the focus is on work being done by the Statistics of Income Division of the Internal Revenue Service (IRS). The volume covers five general areas: longitudinal panel data and estimation issues; analytical research using survey and administrative data; design issues for Federal surveys; information on the conclusions of the Establishment Reporting Unit Match Study; and a look at future data needs for the Federal sector.

Statistics of Income and Related Administrative Record Research, 1988-1989
Selected papers given mostly at the 1988 and 1989 Annual Meetings of the American Statistical Association in New Orleans, Louisiana and Washington, D.C., respectively. Papers for the volume focus on perspectives on statistics in government--in celebration of ASA's 150th anniversary; improvements in income and wealth estimation; methodological enhancements to administrative record data; some looks at the effects of tax reform; and technological innovations for statistical use.

Statistics of Income and Related Administrative Record Research, 1986-1987
Selected papers given, for the most part, at the 1986 and 1987 Annual Meetings of American Statistical Association in Chicago and San Francisco, respectively. Papers focus on ongoing wealth estimation research and U.S. and Canadian efforts regarding methodological enhancements to corporate and individual tax data and recent refinements to disclosure avoidance techniques.

Record Linkage Techniques, 1985*
The Proceedings of the Workshop on Exact Matching Methodologies held in Arlington, Virginia, May 9-10, 1985. Includes landmark background papers on record linkage use and papers describing methodological enhancements, applications, and technological developments, as well as extensive bibliographic material on exact matching.

Statistical Uses of Administrative Records: Recent Research and Present Prospects*
A two-volume reference handbook on research results involving the use of administrative records for statistical purposes from 1979 through 1982:

- Volume I (March 1984) focuses on general considerations in administrative record research, applications of income tax data, uses based on data from other major administrative record systems, and enhancements to statistical systems using administrative data.

- Volume II (July 1984) focuses on comparability and quality issues, access to administrative records for statistical purposes, selected examples of end uses of linked administrative statistical systems, and a status report that sets goals for the future.

Statistics of Income and Related Administrative Record Research, 1984*
Selected papers given at the 1984 Annual Meeting of American Statistical Association in Philadelphia. Papers focus on future policy issues, applications, exact matching techniques, quality control, missing data, and sample design issues.

Statistics of Income and Related Administrative Record Research, 1983*
Selected papers given at the 1983 Annual Meeting of American Statistical Association in Toronto. Papers focus on use of administrative records in censuses and surveys, applications for epidemiologic research and other statistical purposes, and statistical techniques involving imputation and disclosure and confidentiality

Statistics of Income and Related Administrative Record Research, 1982*
Selected papers given at the 1982 Annual Meeting of American Statistical Association in Cincinnati. Papers focus on statistical uses of administrative records, resulting methodologic advances, and estimates and projections for intercensal updates.

Statistics of Income and Related Administrative Record Research*
Selected papers given at the 1981 Annual Meeting of American Statistical Association in Detroit. Papers focus on applications and methodologies with an emphasis on IRS's Statistics of Income Program, the Small Business Data Base, nonprofit and pension data, and on Canada's Generalized Iterative Record Linkage System.

Economic and Demographic Statistics*
Selected papers given at the 1980 Annual Meeting of American Statistical Association in Houston. Papers focus on evaluation of the 1977 Economic Census, CPS hot deck techniques, and efforts to upgrade Social Security's Continuous Work History Sample.

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*Out of print—Copies of selected papers can be obtained upon request.

NOTE: The IRS Methodology Reports on statistical uses of administrative records are now being offered free of charge. To obtain copies, write to:

Statistical Information Services (SIS)
Statistics of Income Division (RAS:S:SS:SD)
Internal Revenue Service
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