

TURNING ADMINISTRATIVE SYSTEMS INTO INFORMATION SYSTEMS: THE STATISTICS OF INCOME PROGRAM OF THE IRS *

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Statistical work conducted within large administrative organizations can have a different character than that carried out in exclusively statistical settings. Our experience as the statistical component of a large tax collection organization, the U.S. Internal Revenue Service (IRS), certainly bears this out. Although interweaving statistical and administrative activities has its limitations, the Statistics of Income (SOI) program can (and does) act as a focal point for a broader and better use of administrative systems for statistical purposes.

This paper highlights the statistical programs that we conduct in SOI to meet the many needs of our customers [1]. The intent of our paper was to serve as a framework for the three other SOI papers presented at the 1992 National Tax Association Conference. As a result, we have attempted to give a broad perspective on our statistical programs and customers. In the first section we provide a brief introduction as to who we are. Our programs and customers are described in the second section. In the third section, we describe our statistical operations and procedures; then, we conclude with some remarks on how we are shaping our future. At various points in this article, we touch on the research activities that are part of our work. Full citations are available; the research articles themselves can be found in our regular series on the statistical uses of administrative records [2].

*This paper was originally presented at the annual meeting of the National Tax Association, October 12, 1992, in Salt Lake City, Utah and will appear in the conference *Proceedings*. Portions of the paper have appeared or will appear in three other articles: two were published in the April and July 1992 issues of the National Association of Business Economists (NABE) quarterly, *Business Economics* (an edited version of the latter also appears elsewhere in this volume); the third article will appear in *Statistics Sweden's Journal of Official Statistics* this spring.

INTRODUCTION

Under the U.S. self-assessment taxation system, taxpayers, whether individuals or businesses, report their financial affairs and calculate their tax liabilities on tax returns and related informational documents. While this source of information is quite different from that of survey-oriented statistical agencies, the SOI program still has the same general mission -- to collect and process data so that they become meaningful information and to disseminate this information to its customers and users.

Statistical operations at IRS began about 80 years ago with the passage of the sixteenth amendment to the U.S. Constitution (in 1913) and, also that year, the establishment of the first modern U. S. income tax law. Subsequently, the Revenue Act of 1916 required the annual publication of statistics. Despite many revisions to the tax law, the original sense of that Act continues today. Specifically, the current Internal Revenue Code (which is based on the Tax Reform Act of 1986) states that we will --

"...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."

For reasons now obscure, the words underlined above were joined together to give the IRS statistical operation its name -- the "Statistics of Income (SOI) program."

Despite this mandate, producing statistics is only a tiny part of the Internal Revenue Service's role. The costs of administering the Federal income tax system are substantial; the annual budget of the IRS for the current (1993) fiscal year is approximately \$7 billion. The SOI program presently requires an annual budget of about \$28 million (about 0.4 percent of the IRS total)

to accomplish its statutory responsibilities. Thus, despite its key role in converting administrative data into statistical information, the SOI program represents a very small portion of IRS resources -- often resulting in a relatively low priority in the overall IRS mission.

PROGRAMS AND CUSTOMERS

Although the major product of SOI's information mission has historically been the Statistics of Income series of publications, the mission has shifted from one where the principal output was a "product" (e.g., statistical tables) to one where the output is increasingly information "services." These services involve providing our principal customers, the U.S. Treasury's Office of Tax Analysis (OTA) and the Congressional Joint Committee on Taxation (JCT), with files of tax return data and helping them use these files as inputs to tax policy models. SOI data are also a basic source of information for the national economic accounts of the Commerce Department's Bureau of Economic Analysis (BEA). Services offered to BEA and other users of SOI data -- including a broad range of researchers, tax practitioners, and average citizens -- are to offer assistance on how to correctly interpret the information.

An organizational strength of SOI is its close relationships with the Office of Tax Analysis and the Joint Committee on Taxation, key decisionmakers within the Federal executive and legislative branches, respectively. This closeness assures a high degree of relevance in our work. Both use SOI data as their primary source of information for revenue estimation and analysis of the functioning of the tax system. Microsimulation modeling "experiments" have become the modus operandi in the U. S. and many other countries for tax policy analysis (Wolfson et al., 1990). Recently, the National Academy of Sciences recommended a number of important improvements to microsimulation modeling (Citro and Hanushek, 1991), and we have begun to rethink our work as a result. Prior to the National Academy report, a major re-design effort for our microdata products had already begun, and further efforts are now planned, especially on improving metadata (David, 1992).

For most of its nearly 80-year history, the main emphasis of the SOI program has been individual and corporation income tax information. However, growth has occurred in the nature and number of studies undertaken so that, by 1980, the SOI program consisted of 26 projects. Since then, the number of studies has more than doubled to nearly 60. This two-fold growth in programs since 1980 was accompanied by a parallel four-fold increase in the amount of data extracted from the various tax and information returns -- all at virtually no increase in inflation-adjusted costs.

Below we provide a brief overview of the major SOI studies, including examples from our work on individual taxation, business taxation, and the international area, among others.

Individual SOI Program

Income and tax statistics from individual income tax returns have been published annually by the IRS beginning with tax year 1916 (Gross et al., 1992). The content of the program is largely determined by the Office of Tax Analysis, for use in tax policy research and in (future) tax revenue estimation. The needs of other researchers for individual income tax data are addressed on a cost-reimbursable basis.

While the individual program has historically been based on an annual cross-sectional sample of individual tax returns, a major redesign of the program is currently underway (Czajka and Walker, 1990). From detailed discussions with OTA, it became apparent that the individual program needed to be refocused in three respects:

- Since the annual cross-sectional samples were not conducive to multi-year economic modeling for such events as sales of capital assets, the redesigned sample includes a large panel of individuals embedded within the annual cross-sectional samples.
- Because family "economic units" (reflecting households rather than individuals) are a more desirable focus of tax analysis, social security numbers of dependents, now reported on indi-

vidual tax returns, are used to obtain dependents' returns, which are then combined with the parents' returns to form "tax families."

- Sampling stratifiers and selection rates have been restructured to enhance the samples of returns with greater policy interest, such as those with very high or low incomes or those of the aged.

Other studies closely related to individual taxation issues are the Sales of Capital Assets (SOCA) panel studies and Information Returns studies. The SOCA studies have been conducted periodically by creating a panel file of returns to track multi-year capital gains transactions.

The Tax Year 1989 sample of individual income tax returns has been linked, on a record-by-record basis, to information returns provided by employers and financial institutions (for example, W-2's for wages and 1099's for interest and dividends). As an offshoot of the "family economic units" study cited earlier, information documents of individuals claimed as dependents on returns in this sample will be added as well. Finally, a representative selection of information documents of individuals not covered by individual income tax returns (i.e., non-filers and non-dependents) will be added. The resulting database is expected to cover nearly 98 percent of the U.S. population (Sailer et al., 1992).

SOI Business Programs

Although businesses can be legally organized in a variety of ways, most business activity is conducted by corporations, partnerships, or proprietorships. These three annual SOI programs are, thus, often referred to as the SOI business studies.

- **Corporations.**--Like those for individuals, SOI corporate data have been published annually beginning with tax returns for 1916 (Rehula et al., 1992). These data are the only publicly-available source of financial information on all corporations, since other sources include only large or publicly-held corporations or those in certain industries. The corporation program provides the basic source of data used for estimating corporate profits for the national accounts.
- **Partnerships.**--The annual SOI partnership program is vital to the national accounts since it is the only source of data on these businesses. Partnerships are required to file annual information returns including an income statement, balance sheet, and schedules showing the shares of income or losses and other items distributed or allocated to partners. Partners are required to report the distributions or allocations from partnerships on their own income tax returns.
- **Sole Proprietorships.**--Information about non-farm proprietorship business activities is reported on Schedule C of the individual tax return. Profits from these activities are combined with income from other sources in order to compute individual "adjusted gross income." Data on proprietorships provide the other half of information on the unincorporated business sector for the national accounts. Here, again, the tax return is the only annual source of financial information about these

The corporation program is rich in item content; complete income statement, balance sheet, and tax computation information have been mainstays of the program almost since its inception. As with the individual income tax studies, this program is being restructured to better meet the needs of OTA and BEA. Increased longitudinality is being designed into future studies, and enhancements are underway to compile corporate "families" by linking parent and subsidiary entities of consolidated corporations. Through the financial support of the Bureau of Economic Analysis, the delivery of corporation statistics has been greatly accelerated, beginning in 1992.

For many years, partnerships commanded only modest interest because they were not taxed directly and, thus, had no direct effect on Federal revenue; however, the proliferation of partnerships in tax shelters has substantially increased interest. For example, curbing deductions of partnership losses by individual partners, the passive loss limitations, was a key provision in the 1986 Tax Reform (Petska, 1992). Unlike the data for individuals and corporations, which are published in separate SOI reports, partnership data are annually published in the *SOI Bulletin* (Shekhter, 1992).

businesses. Proprietorship information is also published annually in the *SOI Bulletin* (Ammon, 1992).

SOI International Studies

International studies are conducted biennially or periodically in two broadly-defined areas: foreign investment and activity abroad by U.S. "persons" and investment and activity in the U.S. by foreign "persons."

Foreign investment and activity abroad by U.S. persons includes the following studies: corporation foreign tax credit, controlled foreign corporations of U.S. corporations, interest charge domestic international sales corporations, foreign sales corporations, U.S. possessions corporations, international boycott participation, individual foreign tax credit, individual income earned abroad, and foreign trusts. Treasury uses many of these studies for mandated reports to Congress.

Investment and activity in the United States by foreign persons includes the following studies: foreign-owned U.S. corporations, foreign corporations with income derived from U.S. sources, nonresident alien income and tax withheld, nonresident alien estates, U. S. partnership income of foreign partners, and sales of U.S. real property interests by foreign "persons."

Much of the recent analyses of these data have been compiled in a compendium of studies of international income and taxes, available upon request (Long et al., 1991).

Other SOI Studies

Annual, biennial, or periodic statistical programs are also conducted in SOI on tax-exempt (i.e., non-profit) organizations, certain tax-exempt obligations, estates and personal wealth, and excise taxation:

- **Tax-Exempt Organizations.**--Annual studies are conducted of information returns filed by private foundations, nonprofit charitable and other organizations exempt under Internal Revenue Code section 501(c), exempt organizations with potentially taxable "unrelated business income," and tax-ex-

empt private activity bonds. Studies of tax-exempt organizations have also recently been released in an historical compendium (Meckstroth, 1992).

- **Estate Tax and Personal Wealth.**--Estate tax studies are conducted annually based on a specific year of death. Periodically, studies are undertaken to estimate the wealth of top (living) wealthholders by combining mortality rates with the estate data. A long-term research project is also underway based on estate tax filings from 1916 to the present examining intergenerational transfers of wealth through inheritance (McCubbin, 1990).

SOI has also had a partnership role with the Federal Reserve Board in periodically mounting the Survey of Consumer Finances -- an exceedingly complex series of household interviews designed to estimate personal wealth (Kennickell and Woodburn, 1992).

- **Excise Tax.**--These studies include (or have included) returns of the quarterly crude oil windfall profit tax and the environmental excise tax on certain hazardous substances, i.e., the so-called "Superfund Tax" (Mahler, 1992). Additional studies are being planned in this area to provide a more comprehensive and timely picture of tax receipts.

Statistics of Income information is published both on paper and in an electronic media; examples of the former include the quarterly *SOI Bulletins*; annual SOI reports based on corporation and individual tax returns; and the annual *Corporation Source Book*. Examples of the electronic media products include the Individual Public-use file as well as the *Corporation Source Book*. We have also recently instituted an electronic bulletin board which can be accessed by calling (202) 874-9574.

FROM DATA TO INFORMATION

SOI core statistical systems have much in common with those of other government statistical organizations (Fellegi, 1987). Statistical sampling is a major tool in study designs, and computers are a ubiquitous element in our environment. Data collection is a highly structured and disciplined process. Sample

estimates are usually obtained by randomization-based weighting of selected cases; public-use micro-data files are made available after being "sanitized" to satisfy disclosure concerns. Aggregate tables are compiled and frequently published, and research on methods, often driven by operating concerns, is conducted in ongoing attempts at improvement. This section describes, in some detail, how these statistical activities are applied in SOI programs.

Sample Design and Selection

U. S. tax returns are filed and administratively processed at one of ten IRS regional sites, called "service centers." Once processed, IRS compiles selected information from all returns into a computerized "master file" system, which is the informational backbone of the agency. SOI operations begin by sampling returns from the master file system; the master file offers a sampling frame that enables use of efficient and sophisticated sample designs.

Generally, statistics compiled for the SOI studies are based on stratified probability samples of returns. As the returns are processed into the master file system, they are assigned sampling strata, based on criteria such as income (or other measures of economic size), industry, and presence of supplemental forms or schedules.

Each taxpayer, whether an individual or business, has a unique number -- the social security number for individuals and the employer identification number for businesses. These unique taxpayer identification numbers (TIN's) are used as the seed for a pseudo-random number (a transform of the TIN) which, along with the sampling strata, determines whether a given return is to be selected into the sample (Harte, 1986).

The algorithm for generating the TIN transform stays the same from year to year. Consequently, a return is selected into the SOI sample if it falls into a stratum with the same or higher probability of selection (Westat, 1974). If it falls into a stratum with a lower selection probability, the likelihood of selection will correspond to the ratio of the second

year to the first year's selection probabilities (Sunter, 1987).

Of over 200 million tax returns processed each year for administrative purposes, only about half a million are sampled for statistical analysis. However, since sampling rates generally increase with increases in the size of financial amounts (for example, income or assets), the returns in the samples are, on average, disproportionately larger and more complex than those in the administrative (population) files. Thus, in comparison to IRS administrative processing, which captures 100 percent of the tax returns but limited item content, SOI programs collectively represent a small overall volume -- however, with a proportionately higher fraction of complex returns and much greater item content.

Data Capture Techniques

After sampling, the electronically available information from the master file system is substantially augmented with additional data items captured from the (still largely paper) tax returns themselves. Statistical abstraction can take as little as a few minutes for a simple return to as long as several days for a large corporate return.

Until a few years ago, SOI conducted basic informational processing in a "batch-mode," involving several operational units at all ten service centers. Within each center, different employees in different functional units manually abstracted from the returns, key-entered, and error corrected data from tax and information returns. This fragmented system denied "ownership" and accountability and was not conducive to maintaining high levels of quality.

To improve the quality and efficiency of SOI field processing, a network of minicomputers was built solely for statistical processing. This new system uses on-line transaction processing, so that all data capture operations are completed in one pass. In addition to reducing handling costs and removing overlapping responsibilities, accountability and ownership have been improved, because one person is now responsible for

assuring the validity of all data processing for any selected return.

Data Cleaning and Completion

Due to substantial penalties for misreporting, the detailed income and expenditure data on tax returns are generally regarded as more reliable than similar survey data. Even so, SOI employees go to great lengths to protect against nonsampling errors, such as those due to taxpayer or data processing errors. SOI economists and statisticians develop extensive on-line tests for consistency and reliability, based on the structure of the tax law and the improbability of various data combinations. Subsamples of work are independently reprocessed and compared as a further check.

Missing data problems arise, albeit infrequently (under 1 percent of the time). To handle these, missing items can sometimes be obtained through telephone or written followups. More often, though, the missing data are obtained through imputation. For example, an estimate can be made based on other data on the return (or accompanying schedule); prior-year data for the same taxpayer; or same year data from a "similar" return. Multiple imputation techniques have proven highly successful, and their use is increasingly applied to our work (Rubin, 1987).

Weighting and Estimation

On the whole, the SOI approach to making population estimates is quite straightforward. The probability with which a return is selected for an SOI sample depends on the sampling rate prescribed for the stratum in which it is classified. Weights are computed by dividing the (population) count of returns filed for a given stratum by the count of sample returns for that same stratum.

In some studies, the estimates are improved by employing post-strata, based on supplemental criteria or refinements of those used in the original stratification. Weights are then computed for these post-strata using refined population counts -- oftentimes with fairly computer-intensive methods.

Published Tables and User Analyses

Extensive aggregate tables have always been produced as part of the SOI program. SOI information is published in both a paper and a magnetic media, including the quarterly *SOI Bulletins*; annual SOI reports based on corporation (Rehula et al., 1992) and individual (Gross et al., 1992) tax returns; the annual *Corporation Source Book*, which provides industry and asset size data in more detail than the annual reports and is also available on magnetic tapes; and special compendiums of research and analysis (Meckstroth, 1992; Long et al., 1991). As noted above, public-use microdata files of individuals, for which taxpayer identifiers and other means of re-identification have been removed, and certain tax-exempt organizations, whose returns are open to public inspection, are also available [3, 4].

CONCLUSION

Electronic media products are increasingly available on magnetic tape, floppy disk, CD ROM, and in a computer bulletin board format.

In addition to producing data from its statistical files, SOI has an ongoing interest in analyzing tax data and in developing improved methodologies. An example of the former is the analysis of the corporate alternative minimum tax which was presented at this Conference (Gill and Treubert, 1992). On the latter, papers are written each year, often for the annual meetings of the American Statistical Association. These and other technical papers, are published in the series statistical uses of administrative records [2].

In comparison to most other major U.S. government statistical agencies, SOI is small. Because our mission is highly focused, most of what we do is not widely known. We have strong traditions that give us a sense of continuity and confidence -- unfortunately, sometimes at the price of being overly conservative in the face of a changing environment.

Despite recent strides, SOI information systems have deficiencies, including the needs for improvements in program timeliness, data access, intertem-

poral consistency, and preservation of historical information. Some of our attempts to address these were covered in other papers presented at this Conference. While a number of successful efforts are underway to make information from the tax system more useful for policymakers, tax administrators, business planners, and the public at large, we are fully cognizant of the fact that many more improvements are needed.

As part of efforts to meet future goals, SOI has participated in and contributed, in a modest way, toward many of the worldwide paradigm shifts now sweeping statistics and statistical organizations. We have benefited especially from the revolution in computing, albeit belatedly; the quality revolution is also one where we started late but where we have made some important strides. Applying newly invented or improved concepts and tools to old problems has been energizing; indeed, the excitement has not only led us to tackle new problems, it has given us the impetus to "reinvent ourselves." Towards this goal, comments and suggestions are sought. We invite those who have similar challenges to join in a common effort.

For more information about Statistics of Income data, contact our Statistical Information Service at (202) 874-0410 or write to the Director, Statistics of Income Division, Internal Revenue Service, PO Box 2608, Washington, DC 20013-2608. Most SOI reports and tape files can be purchased directly from SOI. Special tabulations are available on a reimbursable basis, subject to the availability of resources. All data released are subject to disclosure constraints and are processed to ensure the confidentiality of individual taxpayers.

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ENDNOTES

- [1] Additional discussions of these topics can be found in: Petska, Tom, Scheuren, Fritz and Wilson, Bob, (1992) "The Statistics of Income

Program of the Internal Revenue Service, Parts 1 and 2," *Business Economics*, April and July; and Statistics of Income Division, (1988) "75th Anniversary, 1913-1988," *SOI Bulletin*, Volume 8, Number 2, Statistics of Income Division, Internal Revenue Service.

- [2] These technical papers are published in the SOI methodology reports series which includes: Alvey, Wendy; Kilss, Beth; and Jamerson, Betty (eds.) (1981-1992), *Statistics of Income and Related Administrative Record Research*, Internal Revenue Service; Kilss, Beth and Alvey, Wendy (eds.) (1984), *Statistical Uses of Administrative Records: Recent Research and Present Prospects*, Internal Revenue Service, Vols. I and II; and Kilss, Beth and Alvey, Wendy (eds.) (1985), *Record Linkage Techniques -- 1985*, Internal Revenue Service.
- [3] Various measures are employed to make public-use files available while protecting taxpayer confidentiality, including purging unique identifiers, rounding data items, and averaging the data of "similar" returns. For a discussion of these techniques, see Spruill, Nancy, (1982) "Measures of Confidentiality," 1982 *Proceedings of the American Statistical Association, Section on Survey Research Methods*. For a description of an application of these techniques on the individual SOI public-use file, see Strudler, Michael, Oh, H. Lock, and Scheuren, Fritz, (1986) "Protection of Taxpayer Confidentiality With Respect to the Tax Model," 1986 *Proceedings of the American Statistical Association, Section on Survey Research Methods*.
- [4] Public-use files on proprietorships were released for certain years in the early 1980's. See, for example, Statistics of Income Division, Internal Revenue Service, (1983) "General Description of the 1980 Sole Proprietorship (Schedule C) Public-use File."

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