STATISTICS OF INCOME PARTNERSHIP STUDIES: SAMPLING PLAN REDESIGN II

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INTRODUCTION

This paper is the second in a series on efforts to improve the Internal Revenue Service's Statistics of Income Partnership studies. The first report, presented at the 1990 Joint Statistical Meetings, dealt with an assessment of the current sample design and gave an outline of the updated design (McMahon, Collins and O'Conor, 1990). Our present effort is divided into four parts, beginning with some background and a summary of that first report. We will then discuss sample allocation for the updated design. Next we evaluate a set of asset class predictors, and close by outlining the future research we have planned.

BACKGROUND

Partnerships are businesses, not all of which are tax shelters, and constitute a significant sector of the national economy. They are a form of business organization somewhere between a sole proprietorship and a corporation. The income, costs, deductions, tax credits and so forth are divided amongst the partners, with each individually responsible (as in a sole owner operation) for the tax consequences of their own share of the firm's business. Like a corporation, a partnership can have many diverse owners, such as individuals, corporations or even other partnerships.

There are many variations on the partnership theme, from simple family farms, to common trust funds, to Master Limited Partnerships (in sports, for example) and other styles of limited partnerships. In this context, "limited" refers to the limiting of an owner's responsibility for a partnership's debts to the amount that has been invested, much as a stockholder's liability for a corporation's actions is limited to the cost of the stock. The difference is that a partnership must have at least one owner (the general partner) who is liable for all debts.

This structure has made the limited partnership a very attractive vehicle for tax shelters, because deductions, tax credits and losses, as well as various profits, are passed through to the separate partners while retaining downside liability protections. Given the high marginal tax rates of the seventies, these shelters became very popular and now comprise a major proportion of the partnership population (Petska and Nelson, 1990, and Petska, 1991).

These businesses report their activity to the Internal Revenue Service (IRS) on an annual basis with the Form 1065, Partnership Return on Income. While the main purpose of the Partnership return is tax law enforcement, it also serves well as an economic questionnaire. The Statistics of Income Partnership studies use that aspect of the tax form in measuring this sector of the economy. The main customer for the data is the Bureau of Economic Analysis, which uses it in developing Gross National Product estimates. Of late, the samples on which these reports are based have become a source of business microdata, used by the Treasury and Congress for calculating the effects of various tax law proposals. The major focus of the Statistics of Income studies, though, has been on industry-level aggregate estimates of income sources, asset holdings, costs and other business data (see, for example, Middough, 1990 or Moglen, 1990).

Under the current design, the partnership sample of about 30,000 records is selected each year from a population of about 1,700,000 returns filed. The design is a complex multi-stage highly stratified sample, based on the size of assets, net income, receipts and (to a lesser degree) industry, with some strata selected with certainty. (See Figure A.)

Since these economic data are most meaningful when compared to other years, why change the design and confound the comparisons? Part of the answer lies in the effect inflation has had on the current design, which has been in place for over a decade. Several strata are no longer as effective as they had been and the certainty class boundaries are outdated. Originally, the design had envisioned expending only about one - sixth of the sample resources in the certainty strata. This has grown over the course of a decade to well over half of those resources, at the expense of the strata with the largest populations but smallest monetary boundaries. Last year, as an interim measure, an additional stratum was introduced in a secondary sampling operation to reduce the number of certainty records by a third, so as to avoid cutting the least-frequently sampled strata further.

Another factor which led to the redesign effort is the Tax Reform Act of 1986. One of the targets of

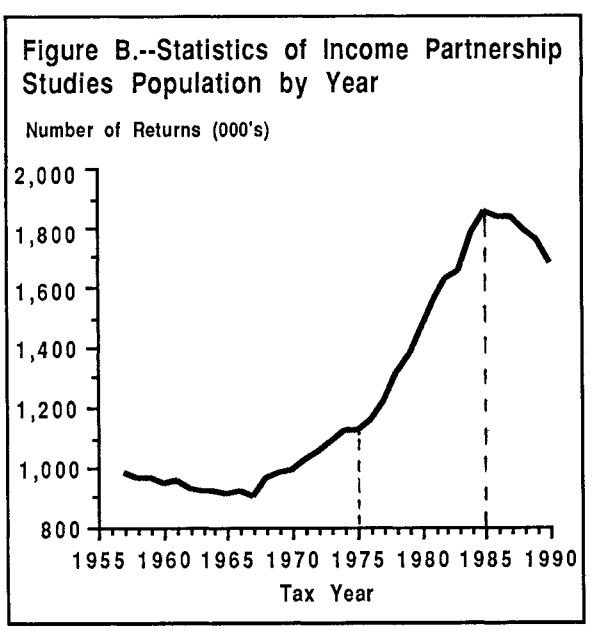
Figure A. Statistics of Income 1989 Partnerships Design and Population Counts

Size of Partnership	Pop-ulation
Total Assets $25,000,000 or more	9,465
Total Assets less than $25,000,000 and Income/Loss $5,000,000 or more	2,018
Total Assets less than $25,000,000, Income/Loss $2,500,000 under $5,000,000 and Receipts $5,000,000 or more	1,594
Total Assets $5,000,000 under $25,000,000, Income/Loss $2,500,000 under $5,000,000 and Receipts less than $5,000,000	1,348
Total Assets under $5,000,000, Income/Loss $2,500,000 under $5,000,000 and Receipts less than $5,000,000	1,134

Income/Loss under $2,500,000:

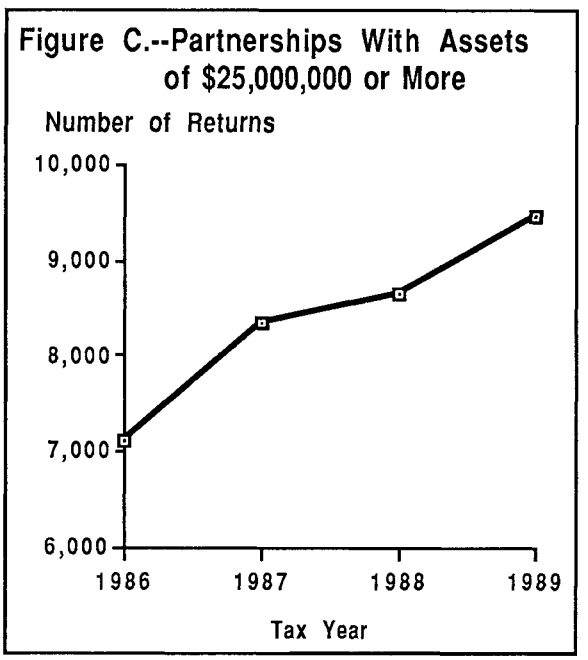
Absolute Value of Total Assets ($)	Absolute Value of Receipts ($)			
	Under 250,000	250,000 under 1,000,000	1,000,000 under 5,000,000	5,000,000 or more
Real Estate Companies				
0 or not reported	97,878	3,911	687	50
1 under 250,000	206,961	2,965	453	68
250,000 under 1,000,000	126,204	15,726	743	60
1,000,000 under 5,000,000	38,939	46,462	7,939	152
5,000,000 under 25,000,000	4,148	6,866	11,928	735
Non Real Estate Companies				
0 or not reported	427,488	19,376	2,882	275
1 under 100,000	365,915	50,969	6,103	200
100,000 under 1,000,000	159,519	44,693	17,999	995
1,000,000 under 5,000,000	31,668	13,166	9,795	2,532
5,000,000 under 25,000,000	6,004	3,626	4,746	2,306

that reform was tax shelters or, more accurately, the passive losses that were used to offset income from other sources (Nelson and Petska, 1989). Since partnerships were a source of passive losses, the Act caused a decline in the formation of new partnerships and, perhaps, speeded the liquidation of existing firms.



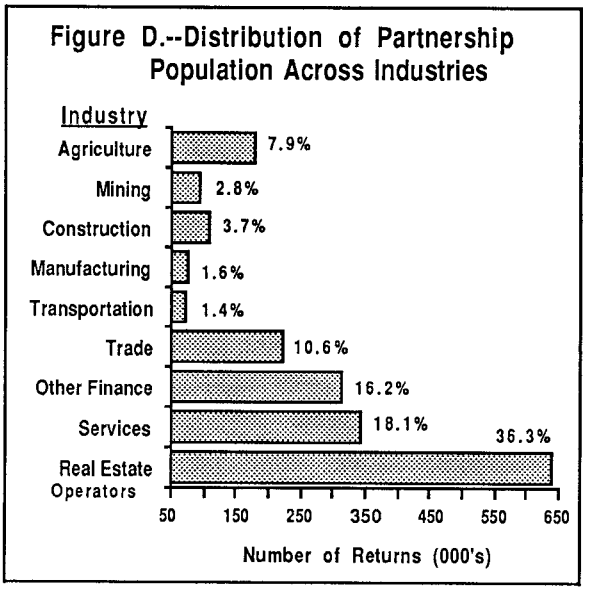
It was largely the tax shelter component of the population that fueled the rapid growth of the population from 1975 to 1985 (shown in Figure B between the dotted lines), raising the population from just over one million returns filed to about 1,850,000. During that period the annual growth rate for the population was about five percent per year (nearly double the growth rate for corporations).

Since the passage of the Tax Reform Act, the number of partnership returns filed (and, thus, the number of companies) has decreased 10 percent, down about 4 percent in the past year alone.



This decline, however, is not uniform across all the population. As you see in Figure C, the largest partnerships, as measured by asset size in this case, continue to increase in numbers. Other measures of size, such as receipts, show similar patterns. We have also noted that the average number of partners for the largest firms seems to be decreasing, which implies that the partners are less likely to be individuals, but corporations or other entities instead.

The population is not uniform in another way. Not all industries are equally present in the population. As we noted above, our focus is on industry division level estimates, but one industry in particular, with one third of all partnerships, stands out -- Real Estate Operators. Figure D clearly demonstrates how much this industry dominates the



partnership scene, with over twice the population of the next largest division -- Services. Unfortunately, records selected for the sample from that industry are used in only a small number of the estimates (less than one percent), so a proportional allocation of the sample across industries would obscure activities in the smaller industry divisions. It is for that reason that 20 strata are reserved for Real Estate Operators in the current sampling plan -- to decrease the sample for that industry from a proportional one-third to about one fifth of the total sample -- as depicted in Figure A, above. This feature is retained in the new design.

FEATURES OF THE NEW DESIGN

With these basic considerations in mind, we developed a new design for the Partnership studies' sample. The current design has served reasonably well -- most industry division estimates have coefficients of variation under ten percent for critical variables such as total assets, receipts or depreciation, with a considerable number below five percent. Agriculture data are not of great importance to our users (they prefer other sources for that information), so we have not included farm receipts in the stratification. This reduced the share of the sample spent on that industry to 2.4 percent (compared to its 8 percent share of the population). Since the impetus for the new design is updating time-eroded boundaries and accomodating the micro-simulations for tax policy evaluations, the strengths of the current design form target variance and coverage conditions for the revisions (Hinkins, Jones and Scheuren, 1988).

In the new version, we are also keeping the basic matrix design of the strata shown in Figure A; i.e., rows are for asset classes and columns are for receipts categories. This matrix structure was devised to insulate the sample against the effects of outliers, but it is of use in projecting population sizes as well. Both the current and new designs reserve five strata for the very largest companies. The definition of largest will change with the new design, but this feature, along with the matrix structure and the real estate strata, is retained for the new design.

One special characteristic of the current design that we will not keep is the eight strata reserved for returns with no assets or unreported assets. Part of operating in an administrative environment is living with the consequences of regulatory decisions. In this case, the regulations permit certain small or family companies not to report their asset size or holdings to IRS. The eight strata were a quick fix when this rule was first proposed and only sparse, incomplete data were available about the affected population.

As the number of returns in these "assets zero or not reported" strata grew, we explored several approaches to reduce their impact on the sample. One method we tried was regression with an intercept. Unfortunately, the value for the intercept alone would have resulted in inactive firms (which are not included in the studies) being selected with certainty. Clearly, the use of an intercept model would increase the operational cost without improving the final estimates.

We have a better solution now: using regression through the origin, we developed a set of seven Asset Predictors. It should be emphasized that the predicted assets values are used in stratification only, and only for those returns that meet criteria for exemption, whereas the eight strata in the current design also contained a lot of inactive and deceased companies. The seven predictors are based on industry groupings: two each for Trade, Finance and Services, with a catch-all for the few others.

Furthermore, in the new design the strata boundaries are updated: assets move from 25 to 100 million, for example, and the Receipts and Net Income classifiers are merged. These last two amounts are computed from various data on the tax return records, as a consequence of operating in an administrative system.

There are two major consequences of the Partnership sample's dependence on this environment: the samples must be selected on a flow basis and the selection programs must be integrated into the computer operations and conform to administrative rules. The "flow basis" selection results from the

competition within IRS for the returns by the various branches -- Audit or Statistics of Income, for example. The competition is keenest, as one would expect, for returns from companies with the largest assets or income.

The need for integration provides that the sampling plan must use only those data already available in the system and essentially complete at least eight months before selection begins. Thus, the population does not even exist before the design must be presented for implementation. Further, the time frame must be for an entire year, as regulations permit companies up to six months delay for filing returns, simply by requesting the additional time. Thus, when we allow for data edit and file preparation, two full years will pass between completion of the design and availability of the sample for evaluation.

The sample design for the 1992 operations was an outline when the presentation was prepared for the 1990 Joint Statistical Meetings. The sample allocation and an evaluation of the longitudinal reliability of the asset predictor plan were still needed.

SAMPLE ALLOCATION

In deciding how much sample is needed for each stratum, we need to predict the populations for the various strata and find reasonable measures of the variances of key variables.

Projecting the Population

Projecting the total population is fairly straightforward. We have only four years' data, due to the Tax Reform Act's effects (as illustrated in Figure B). Allowing for the phase-in provisions' effects on the 1986 and 1987 reports, we expect a filing population of about 1,620,000. The data for 1990 are still incomplete, with one quarter of the filing time remaining, but the trend suggests that this is a reasonably conservative estimate, overstating the population size by only a slight margin.

We need more than a grand total, however; we need stratum by stratum projections. The tax years 1986 and 1987 data are confounded in this case by the transitional effects of the laws, so we are left with only the tax years 1988 and 1989 data sets (this latter set only became available in April 1991). With only the two years' data, the projection model choices were limited:

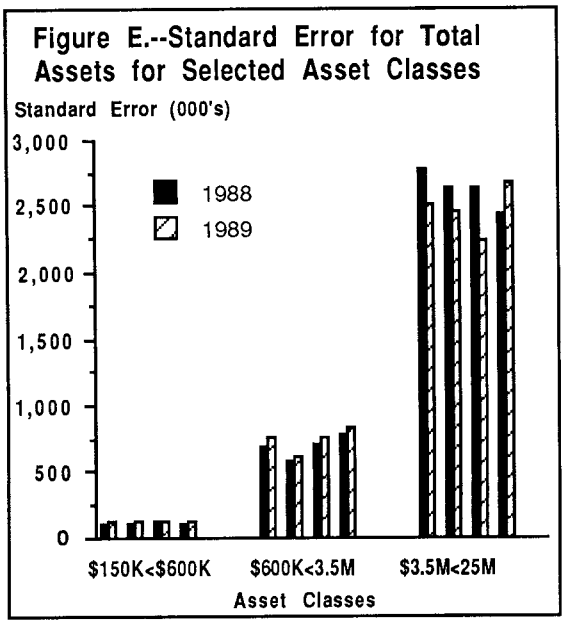
- **Linear Model**, assuming that the change in a stratum's population from one year to the next was constant, gave negative populations to several strata, which is an unlikely result in practice.
- **Pro-Rata Model**, using the distribution for the most recent year and prorating the overall population of 1,620,000 to the strata, would have no negative stratum sizes. The assumption of constant decline across all strata is, however, in conflict with the observed growth in the largest classes. Hence, this model understates the size of the upper strata, which would result in overshooting the target sample size.
- **Relative Growth Model**, assuming that the rate of growth or decline is constant, avoids the pitfall of negative populations, and certainly does not understate the larger classes. Unfortunately, the cumulative effect of this model was a prediction of almost 1.9 million companies. The fifteen percent growth rate this suggests is at odds with the anticipated five percent decline. Clearly something was being overstated.
- **Mixed Models**, using the matrix structure of the design, we explored another approach -- we collapsed the strata into the asset classes (relying on the relative stability of this size measure over time), estimated populations for these classes, then prorated the asset class projections over the income/receipts classes to reconstruct the strata. This resulted in two sets of estimates, as both the linear and relative growth models were used to project the asset group sizes. In both cases we felt that, given the recession, the upper strata were mildly overstated.

Our actual choice of projections was the average of the two asset class models and the prorata model, which acts as a correction for the overstatement of the certainty classes.

Variances and Allocation

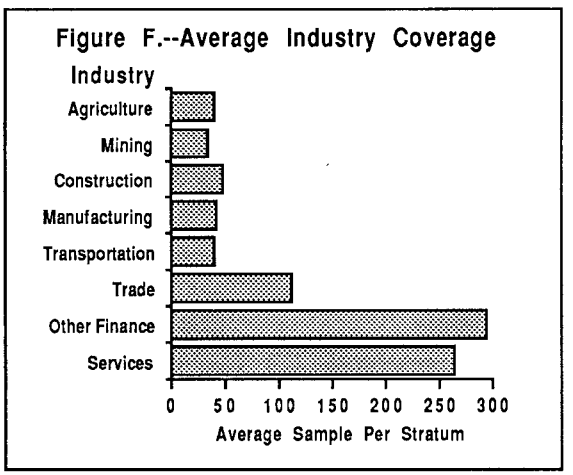
With the population projections nailed down, we now needed to acquire population variances for the optimum allocation scheme. Aside from the stratification variables, we also chose a number of variables that were frequently present, such as depreciation, portfolio income and number of partners.

Since the variance data are estimated from samples of 1988 and 1989 returns, we were concerned that there might be some trend or excessive variation in the estimates. Figure E shows the standard errors for total assets for about one-third of the strata. The pattern of similarity between the years you see here recurs for the other variables (and the other strata), but the groupings of the strata into asset classes makes



this case easiest to present. As you see, the pattern is virtually identical for both years, with the difference always below ten percent, although increasing somewhat with the size of the firms.

Thus assured, we were able to proceed with the allocation scheme. As with the strata population projections, discussed above, we took an average of the standard errors in making the allocations. We allocated the sample separately for each key variable, then took a weighted average of the resulting sample sizes for each stratum. Once we completed the allocation, we noted that five strata had designed sample sizes below 20 selections. They were all in the Real Estate Operators industry and were easily



adjusted, but this raised the question of industry coverage.

As you can see in Figure F, the average number of returns selected in each stratum for the various industry divisions is not unreasonable, especially given the relatively small number of companies in divisions such as Transportation (with an estimated population of only 22,000, about 1.4 percent of the population). These averages depend on the population projections prorated onto sample estimates from the tax years 1988 and 1989, so any specific stratum size is only an educated guess. Still, the average for even the smallest division is about 40.

The result of these computations, balancings and concerns is the design outlined in Figure G.

Figure G. Statistics of Income 1992 Partnership Sample Design Population Projections and Sampling Rates

Size of Partnership	Population (Rate)
Assets $100,000,000 or more	1,940 (100%)
Assets less than $100,000,000 and Income/Receipts $10,000,000 or more	6,800 (100%)
Assets $25,000,000 under $100,000,000 and Income/Receipts $3,500,000 under $10,000,000	3,000 (50%)
Assets $25,000,000 under $100,000,000 and Income/Receipts less than $3,500,000	3,000 (30%)
Assets less than $25,000,000 and Income/Receipts $3,500,000 under$10,000,000	15,500 (30%)

Absolute Value of Assets ($)	Absolute Value of Income/Receipts ($)			
	Under 40,000	40,000 under 150,000	150,000 under 350,000	350,000 under 3,500,000
Real Estate Operators				
Under 100,000	153,000 (0.12%)	32,000 (0.12%)	3,600 (0.8%)	4,600 (2.5%)
100,000 under 350,000	53,500 (0.12%)	71,000 (0.15%)	13,700 (0.5%)	1,000 (3.0%)
350,000 under 1,000,000	14,500 (0.2%)	58,600 (0.2%)	31,500 (0.3%)	9,200 (1.7%)
1,000,000 under 5,000,000	4,700 (0.55%)	11,400 (0.65%)	30,000 (0.85%)	45,600 (2.0%)
5,000,000 under 25,000,000	1,100 (3.0%)	530 (3.5%)	1,300 (2.0%)	19,600 (5.5%)
All Other Industries				
Under 35,000	346,000 (0.13%)	151,000 (0.34%)	65,300 (0.57%)	35,200 (2.5%)
35,000 under150,000	90,000 (0.25%)	54,000 (0.55%)	30,000 (0.75%)	37,100 (1.85%)
150,000 under 600,000	47,500 (0.55%)	34,800 (0.8%)	17,300 (1.5%)	30,400 (3.0%)
600,000 under 3,500,000	15,200 (0.15%)	16,300 (2.0%)	13,100 (3.0%)	23,100 (7.0%)
3,500,000 under 25,000,000	2,700 (10%)	2,100 (20%)	2,800 (10%)	13,300 (17%)

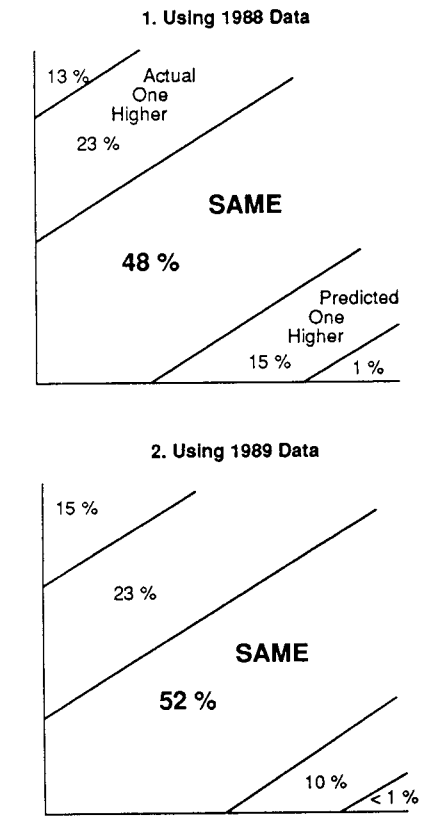
STABILITY OF ASSET PREDICTOR EQUATIONS

There remains the concern about the longitudinal stability of the asset predictor formulae for

partnerships exempt from reporting this information. These equations are used to classify returns into strata when the asset data are missing. Will they be reasonably reliable two years after they were developed? There were two ways to look at the stability: rerun the regressions using the newer 1989 data file and compare the coefficients; and compare error patterns for both years. The new formulae were virtually the same for five of the seven equations; one was close enough; but one -- for Finance -- was well off the mark. Since a major proportion of the records to receive predicted asset classification were in this industry, what effect would this have on the error pattern?

Last year we presented the error profile shown in Figure H.1 for the regressions. When this is contrasted to the error pattern for the more recent data, in Figure H.2, the differences are minimal. Since we are only interested in predicting which class a return

Figure H. -- Stability of Asset Predictor Error File



belongs in, not an actual amount, this strategy is, apparently, strong enough to hold across a year. Of course, the years in question were ones of mild economic growth, so perhaps this result is not surprising. Clearly further study is needed.

FUTURE DIRECTIONS

That leads us to what we will be doing while awaiting the results of this new design's operation -- with the increasing importance of microsimulations, what used to be minor non-sampling errors attain greater prominence. Therefore, three areas will be given particular attention: the quality of data capture, accuracy of the imputation procedures and the effect of unlocated records. These are areas that we can directly affect (as opposed to the accuracy of taxpayer responses). While the quality assurance plan already in place has a wealth of data, an assessment of the estimated errors impact is only in the planning stages.

By the time these studies are complete, we should have results from the first year's operations with the new design. We hope to be able to report the effects of the asset prediction, the accuracy of our strata population predictions, and the evaluation of the coverage properties of this new design in 1993.

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REFERENCES

Hinkins, S., Jones, H. and Scheuren, F. (1988), Design Modification for the SOI Corporate Sample:Balancing for Multiple Objectives, Proc. of the Sect. of Survey Res. Meth., Amer. Stat. Assn., 216-221.

McMahon, P., Collins, R. and O'Conor, K. (1990), Revising the Statistics of Income Partnership Sampling Plan, Proc. of the Sect. on Survey Res. Meth., Amer. Stat. Assn.

Middough, J. (1990), Partnership Returns, 1987, Statistics of Income Bulletin, IRS, 9, 3, 5-30.

Moglen, G. (1990), Partnership Returns, 1988, Statistics of Income Bulletin, IRS, 10, 1, 5-37.

Nelson, S. and Petska, T. (1989), Partnerships, Passive Losses and Tax Reform, Proc. of the Sect. on Bus. and Econ. Stat., Amer. Stat. Assn.

Petska, T. and Nelson, S. (1990), Partnerships and Tax Shelters: An Analysis of the Impact of the 1986 Tax Reform, Proc. of the Sect. on Survey Res. Meth., Amer. Stat. Assn.

Petska, T. (1991), Further Examination of Tax Shelters in the Post-Reform World, Proc. of the Sect. on Survey Res. Meth., Amer. Stat. Assn.