USING DATA ENVELOPMENT ANALYSIS TO EVALUATE TAX PREPARATION SOFTWARE

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This study uses Data Envelopment Analysis (DEA) to analyze and compare the performance of 18 professional tax preparation software packages. The DEA model connects price and setup cost (inputs) with operating capabilities (outputs) to evaluate the relative performance of individual software packages. DEA does not require a set of preassigned weights for inputs and outputs and, thus, overcomes the deficiency introduced by using arbitrary weights. The findings of this study provide professional accountants with nonsubjective assessments of professional tax preparation software packages.

Recent advances in information technology are having a profound impact on the preparation of income tax returns. Tax preparation software is replacing paper and pencil as the primary means for preparing individual and corporate tax returns. Tax software enables the professional accountant to input data quickly and accurately, with immediate returns, analyses, and electronic filing.

The evolution of tax preparation software has lead to a wide range of products. At the low-end is software with limited capabilities and capacity which allow for little customization.

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Such software may be adequate for the narrow needs of individuals and small firm users who have relatively few transactions and simple tax problems. However, many professional accountants require high-end tax software that possesses the capabilities, capacity, and flexibility necessary to meet complex tax problems of individuals and businesses (Courtney and Flippen, 1995).

An important task of the accountant in preparing for the tax season is to select the "best" tax preparation software. With more than 100 tax software packages on the market, selection is not an easy task. The professional accountant must match client needs with appropriate software. Frequently, the "best" software is not readily apparent. The tax preparer must gather relevant information from vendors and other sources and compare the relative merits of different software packages (Cohn, 1995).

Oftentimes, the software selection decision depends on the professional accountant's judgment. However, individual tax preparers have difficulty in properly processing numerous attributes of many competing software packages. Additionally, individual biases may affect the decision. Furthermore, the tax preparer is confronted with rapidly changing products, which means that the decision must be frequently reevaluated. Therefore, it is not surprising that many software decisions are subjective and influenced by the strength of the sales pitch (Stearman, 1992).

As a consequence, the professional accountant frequently seeks independent objective assessments of the relative merits of tax preparation software packages. One problem with these assessments is that they rely on arbitrary weightings of the relative costs and capabilities of the competing packages. This paper presents a DEA evaluation of 18 leading tax preparation software packages. DEA is advantageous in that it does not require preassigned weights for package costs and capabilities and, thus, overcomes the deficiency introduced by using arbitrary weights. The results should be useful to professional accountants in identifying the "best" package to meet their needs.

TAX PREPARATION SOFTWARE

Professional accountants have three alternatives available for preparing income tax returns: manual preparation, service bureaus, and in-house tax preparation software. A recent survey of professional accountants indicates that in-house tax preparation software has gained 80.6 percent share of the market, while manual preparation and service bureaus have the remaining share (Nelson and Langer, 1994). This is surprising since PC-based tax preparation software was not available to the professional accountant until the 1980's. The advent of personal computing has seen tax software evolve into complete systems for tax preparation, planning, and

analysis. Software is available for the preparation of Federal as well as state income tax returns. Furthermore, in recent years the cost of tax preparation software has dropped significantly, making it feasible even for the smallest accounting firms (Langer, 1995).

Tax preparation software must be developed within the framework of the Internal Revenue Code and various state income tax regulations. All software packages possess generalized capabilities for preparing basic individual and business tax returns. However, this does not mean that all software packages are alike. Packages differ in the extent of their detailed operating capabilities, in providing complete sets of returns, and in tax planning and analysis (Stearman, 1993).

More specifically, operating capabilities that distinguish tax software packages include electronic filing, installation and setup, analysis, processing, on-line help, and printing. Other relevant software capabilities are the number of individual, estates, and business forms included and the number of states available. These distinguishing capabilities are the subject of analysis in this study (Stearman, 1995).

Tax software must be updated annually due to changing income tax regulations and technological advances. As a consequence, the professional accountant must review his tax software selection every year. The professional accountant must continually keep abreast of new products and the latest developments in the tax software field.

DATA ENVELOPMENT ANALYSIS

In general, surveys of tax preparation software packages use arbitrary weights for individual criteria to arrive at a weighted score to measure the overall performance for each package (Giorgis, 1993; Marshall, 1993). Furthermore, the selection of criteria used to evaluate tax software packages is subjective. Potential deficiencies in an existing set of weights include bias and inconsistency with organization or user objectives.

DEA is a nonparametric methodology. It requires neither an explicit formulation of the underlying functional relationships nor preassigned weights for outputs and inputs in evaluating a production operation in a multiple-output, multiple-input setting (Banker et al., 1994; Schefczyk, 1993; Sun et al., 1993). Therefore, DEA can avoid certain theoretical and computational problems.

In DEA convention, a production operation using m inputs to produce s outputs is called a DMU (decision making unit). A DMU has discretion in using an input-mix to produce an

output-mix. From a variety of DEA models, we chose the BCC (Banker, Charnes, and Cooper) model as formulated below (Banker et al., 1984) to evaluate tax preparation software packages.

$$\begin{aligned} \text{Maximize} \quad & V_P = \mu^T y_o \\ \text{Subject to} \quad & \mu^T y_j - \omega^T x_j < 0, \; j = 1, \ldots n \\ & \omega^T x_o = 1 \\ & \mu^T, \omega^T > 0 \end{aligned} \tag{1}$$

where n is the number of DMUs; x_j is the input vector; y_j is the output vector; DMU_o is the DMU currently being evaluated; μ and ω correspond to x_o and y_o respectively. In this study, outputs are operating capabilities and inputs are price and setup cost. The DEA model evaluates each tax package relative to the peer group one at time.

The dual of the above linear programming problem (2) takes the following form

$$\begin{aligned} \text{Minimize} \quad & V_D = \theta \\ \text{Subject to} \quad & \sum_{j=1}^{n} y_j \lambda_j - S^+ = y_o \\ & \sum_{j=1}^{n} x_j \lambda_j - \theta x_o - S^- = 0 \\ & \sum_{j=1}^{n} \lambda_j = 1, \qquad \lambda_j > 1 \\ & S^+, S^- \geq 0 \end{aligned} \tag{2}$$

where S^+ is the output slacks; S is the input slacks; λ is a coefficient vector for DMUs. Obviously there exist optimal solutions for (1) and (2), and $V_D < V_P < 1$.

Definition of Efficiency: Let (μ^*, ω^*) denote an optimal solution to (1). DMU_o is said to be efficient if $\mu^T y_o = 1$ where $\mu^* > 0$ and $\omega^* > 0$. Alternatively, the efficiency of DMU_o can be measured in terms of the dual problem (2). DMU_o is efficient if $\theta^* = 1$, $S^{+*} = 0$, and $S^{-*} = 0$ where $(\lambda^*, \theta^*, S^{+*}, S^{-*})$ is an optimal solution to problem (2). For an efficient performance, DMU_o's optimal inputs and outputs should be (x_o^*, y_o^*) where $x_o^* = \theta^* x_o - S^{-*}$ and $y_o^* = y_o + S^{+*}$. Therefore, the input wastes are $(1 - \theta^*) x_o - S^{-*}$ and corresponding output shortfalls are S^{+*}.

From the Definition of Efficiency, when $\theta^* = 1$, $S^{+*} = S^{-*} = 0$, then $x_o^* = x_o$, and $y_o^* = y_o$, i.e., optimal values equal observed values. Otherwise, DMU_o can improve its productivity by eliminating the input wastes and/or increasing the outputs. DEA provides the direction for improvement by pinpointing the specific components of deficient production.

Table 1

Tax Preparation Software Packages Evaluated

Program	Vendor	Phone	
A-Plus-Tax	Arthur Andersen	(800)	872-1040
CPASoftware	CPA Software	(904)	434-2685
Digitax	Cold River Software	(800)	432-1065
LMS/Tax	SCS/Compute	(800)	488-0779
Lacerte	Lacerte Software	(800)	765-7777
Package EX	Exac Tax	(800)	352-3638
PencilPushers	Damirus	(800)	370-2500
Professional Tax System	TAASC	(918)	493-6500
ProSeries	Intuit	(800)	934-1040
ProSystem fx	CCH	(800)	457-7639
RAM	Ram Software	(800)	888-6217
Tax Machine	SCS/Compute	(800)	326-1040
Tax/Pack Professional	Alpine Data	(800)	525-1040
Tax Relief	Micro Vision	(800)	829-7354
TaxSimple	TaxSimple	(800)	323-2662
TaxWorks	Laser Systems	(800)	230-2322
Ultra Tax	Creative Solutions	(800)	968-8900
Veritax	Cold River Software	(800)	837-4829

DATA

Eighteen high-end professional tax preparation software packages were chosen for analysis. Although not a complete survey of all packages on the market, those included in this survey represent the leading software packages in terms of sales volume. The *Journal of Accountancy* is the primary source of information on the tax packages. Table 1 presents a listing of the packages included in this study (Stearman, 1995).

The general areas of operating capabilities and characteristics captured from each of the eighteen tax software packages include general features, electronic filing, analysis, processing, printing, states available, individual forms available, business forms available, and installation and setup. These operating capabilities are supported by 478 detailed operating functions which are the primary focus of analysis. The individual detailed operating functions are too numerous to list in this article. Therefore, examples are presented for just two capabilities. The general features capability is concerned with whether or not a package has operating functions for preparing estimated payment vouchers, amended returns, and net operating loss schedules for Federal as well state returns. Electronic filing capability concerns whether or not a package has operating functions for providing direct filing using a third party, refund anticipation loans, state electronic filing, and electronic filing for business packages.

Furthermore, a complete package enables the preparation of all Federal and state tax forms. However, many packages lack operating functions for providing full sets of Federal tax forms and for preparing returns for all states that levy an income tax. Some packages permit the preparation of returns only for states with relatively high populations and significant economic activity. For example, California and New York are covered by all the packages, while North Dakota and Montana are provided for in relatively few packages. Hence, tax software packages are frequently aimed only at the high sales volume markets.

For each package, detailed operating functions were evaluated through a series of "yes-no" response-type questions to determine whether or not individual packages possess certain operating features and capabilities. For example, with respect to Electronic Filing, one question is "Direct filing capabilities?" For the Analysis capability, one question is "Tax planning supported?" These and similar questions provide the basis for differentiating among the software packages.

A tally of the "yes" responses was made for each of the capabilities for the individual software packages. This tally is the basis for evaluating the relative performance capabilities of the packages. The greater the number of "yes" responses, the greater the performance capability of the software package.

PERFORMANCE EVALUATIONS

For evaluation of software performance, price and setup cost are designated as inputs while operating capabilities represent outputs. Since tax software can be purchased in individual modules, separate analyses are made for (1) individual tax returns-1040, (2) business returns, (3) business and estate returns, (4) individual and business returns, and (5) a bundled package of individual, business, and estate returns. Outputs are reflected in the operating capabilities of electronic filing, analysis, processing, on-line help, printing, number of states available-1040, number of states available-business, number of states available-estates, forms-1040, forms supported, and forms-business.

Individual modules of a package are evaluated relative to their peer group. The price of a module is associated with a differing combination of outputs. For example, a complete tax preparation package includes all operating capabilities, while a business returns module excludes capabilities related to individual and estate returns. Thus, the analyses provide for an evaluation of the relative performance capabilities of the individual modules as well as the package as a whole.

To compute DEA efficiency scores, the DEA model (1) presented in the section on Data Envelopment Analysis is used. Based on the input-output mix used in the computation, the model generates the optimal multiplier vector (or the vector of shadow prices) for DMU_o to reach an optimal level of performance. The optimal multiplier vector is actually a set of individual weights assigned by DMU_o to the inputs and outputs it is using. Comparing this set of weights with the optimal multipliers of other DMUs shows the relative strengths and weaknesses of DMU_o in terms of possible input/output slacks.

The DEA efficiency scores for individual and combined sets of modules are presented in Table 2. The results for "1040 module" indicate that ProSeries, Tax/Pack Professional, TAXSIMPLE, and Veritax have efficiency scores of 1. These packages provide professional accountants with the greatest value per dollar in preparing individual tax returns. Other 1040 tax software modules are deficient in one or more operating capabilities relative to these efficient modules. Similarly, the most efficient "business returns" modules are Professional Tax Systems, RAM, Tax/Pack Professional, Tax Relief, and TaxWorks. The results for the combined "1040 and business returns," indicate that the packages with efficiency scores of 1 are Professional Tax System, Tax/Pack Professional, Tax Relief, TaxWorks, and Ultra Tax. Furthermore, the most efficient packages for the combined "business and estates modules" include Lacerte, Package EX, Professional Tax System, ProSeries, Tax Relief, TAXSIMPLE, and TaxWorks.

Table 2

Ranking Based on DEA Efficiency Scores

Tax Software	1040		Business		1040 & Business		Business & Estates		Complete Package	
Package	Efficiency	Ranking	Efficiency	Ranking	Efficiency	Ranking	Efficiency	Ranking	Efficiency	Ranking
Anderson	0.3277	13	0.4628	12	0.4407	12	0.5757	7	0.5815	8
CPA Software	0.5356	8	0.8657	2	0.7946	5	n.a.	n.a.	n.a.	n.a.
Digitax	0.2299	15	0.7031	9	0.4731	11	0.9527	2	0.8202	5
LMS/Tax	0.5182	9	0.6288	11	0.6324	9	0.7235	6	0.7151	7
Lacerte	0.4889	11	0.861	3	0.7683	6	1.0000	1	1.0000	1
Package EX	0.5407	7	0.7598	7	0.6906	8	1.0000	1	0.9595	2
Pencil Pushers	0.6189	5	0.7537	8	0.7624	7	0.9163	3	0.8798	4
Professional	0.6233	4	1.0000	1	1.0000	1	1.0000	1	1.0000	1
ProSeries	1.0000	1	0.7708	6	0.8673	3	1.0000	1	1.0000	1
ProSystem	0.3058	14	0.4425	13	0.4530	15	0.5097	8	0.5503	9
RAM	0.5465	6	1.0000	1	0.8402	4	n.a.	n.a.	n.a.	n.a.
Tax Machine	0.3703	12	0.6408	10	0.5804	10	0.8304	5	0.7395	6
Tax/Pack Prof.	1.0000	1	1.0000	1	1.0000	1	n.a.	n.a.	n.a.	n.a.
Tax Relief	0.9284	2	1.0000	1	1.0000	1	1.0000	1	1.0000	1
TAXSIMPLE	1.0000	1	0.8547	4	0.9905	2	1.0000	1	1.0000	1
TaxWorks	0.7002	3	1.0000	1	1.0000	1	1.0000	1	1.0000	1
Ultra Tax	0.4977	10	0.8332	5	1.0000	1	0.9146	4	0.9472	3
Veritax	1.0000	1	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.

It is interesting to note that the Ultra Tax-1040 module and the Ultra Tax-business module individually are deficient relative to the cheaper modules. However, Ultra Tax's combined module for 1040 and business returns is able to achieve a perfect efficiency score because the price of the combined module is competitive. This information is valuable to software vendors. The implication is that to be competitive, Ultra tax should lower its price for the 1040 module and the business module but not for the combined 1040 and business module.

The results show that for the "complete packages," Lacerte, Professional Tax System, ProSeries, Tax Relief, TAXSIMPLE, and TaxWorks have efficiency scores of 1. These software packages provide the professional accountant with greatest value per dollar. This evaluation is particularly significant since most professional accountants prepare a combination of individual, business, and estate returns and, therefore, are normally in the market for a complete tax software package. Further analysis of the efficient complete packages indicates that oftentimes their individual modules are deficient relative to other modules. For example, Lacerte's complete package achieved a 1.00 efficiency score while its 1040 and business returns modules are deficient. Another example is ProSeries which has perfect efficiency score for the complete package and for its 1040 module but does not attain efficiency for its business module. The implication for professional accountants is that the synergistic effects of the complete packages overcome the deficiencies in the individual modules.

Furthermore, the DEA results for the complete packages are generally in agreement with a survey of tax preparers attending recent American Institute of Certified Public Accountants tax conferences. The survey asked the participants to rate their overall satisfaction with their tax software packages. The findings indicate agreement that ProSystem, Tax Relief, Tax Machine, Lacerte, ProSeries, TaxWorks, and Professional Tax System are the leading packages currently on the market (Steed, 1995).

In addition to an overall efficiency score for each module of a package, DEA generates slacks, S^+ and S^- in the dual problem (2). The slack for an operating capability is the difference between the value measured and the value which is considered efficient. Slacks identify input wastes and output shortfalls and provide estimated quantities of improvement in individual operating capabilities for a package necessary to attain an efficient performance. For instance, as indicated in Table 2 all evaluated Tax Relief modules attain efficient performance except for the 1040 module which has an efficiency score of 0.9284. Detailed results for Tax Relief's 1040 module are presented in Table 3A. These results indicate that Tax Relief's 1040 module is deficient in the areas of general features, electronic filing, processing, states available, individual forms, and installation & setup.

Another example is TaxWorks with an efficiency score of 1 for all its evaluated modules except the 1040 module. The TaxWorks 1040 module has an efficiency score of 0.7002. The

slacks for the TaxWorks 1040 module are presented in Table 3B. This module is deficient relative to other 1040 modules in terms of its general features, analysis, printing, individual forms, maximum forms and installation and setup. However, Tax/Pack Professional achieves efficiency scores of 1 for all of it modules on an individual basis and on a combined basis. As a consequence, it has no slack for any operating capabilities. This information is valuable to the professional accountants in choosing a product, while the software company can use the same information to improve its product.

CONCLUSION

Tax preparation software has become a critical factor as professional accountants take advantage of rapidly changing information technology. A professional accountant's tax preparation software strategy is a significant decision about information technology, productivity, and client satisfaction. The selection is a multiple criteria decision-making process that matches the client's requirements with the appropriate software package.

The DEA model has been used to connect price and setup cost operating capabilities of tax preparation software packages for the purpose of evaluating the performance of individual packages relative to their peer group. DEA does not require a set of preassigned weights for inputs and outputs, thereby overcoming the deficiency introduced by using arbitrary or subjective assessments. By using nonsubjective assessments of tax software packages, DEA provides tax preparers with unbiased evaluations for selection. Even though the DEA evaluations identify several packages that are efficient, the professional accountant's judgment is still critical in the final selection. With numerous packages available, the findings of this study should help professional accountants reduce time and cost and improve their selection process.

Table 3A

Slacks for Tax Relief, 1040 Module

Input or Output	Value Measured	Value if Efficient	Slack
General Features	60.00	62.00	2.00
Electronic Filing	30.00	38.00	8.00
Analysis	90.00	90.00	0.00
Processing	30.00	36.00	6.00
Printing	110.00	110.00	0.00
States Available	38.00	53.20	15.20
Individual Forms	61.00	83.00	22.00
Max Forms	40.00	72.00	32.00
Installation & Setup	20.00	36.00	16.00
Price	775.00	775.00	0.00

Table 3B

Slacks for Taxworks , 1040 Module

Input or Output	Value Measured	Value if Efficient	Slack
General Features	60.00	76.90	16.90
Electronic Filing	50.00	50.00	0.00
Analysis	70.00	94.20	24.20
Processing	30.00	30.00	0.00
Printing	90.00	130.50	40.80
States Available	40.00	40.00	0.00
Individual Forms	59.00	87.50	28.50
Max Forms	60.00	80.80	20.80
Installation & Setup	20.00	40.40	20.40
Price	1097.00	1097.00	0.00

REFERENCES

Banker, R.D., Charnes A., & Cooper, W. W. (1984). " Models for Estimating Technical and Scale Efficiencies in Data Envelopment Analysis." ***Management Science***, 30(9), 35-44.

Caves, D.W., Christensen, L. R., & Diewert, L. E. (1982). "The Economic Theory of Index Numbers and the Measurement of Input, Output, and Productivity." ***Econometrica***, 50(6), 1393-1414.

Charnes, A., Cooper, W. W., Huang, Z., & Sun, D. B. (1990). "Polyhedral Cone-Ratio DEA Models with Illustrative Application to Large Commercial Banks." ***Journal of Econometrics***, 46, 73-91.

Charnes, A., Cooper, W. W., Wei, Q. L., & Huang, Z. M. (1991). "Cone Ratio Data Envelopment Analysis and Multi-Objective Programming." ***International Journal of System Sciences***, 20, 1099-1118.

Cohn, M. (1995). "1040 Tax Prep Update." ***Accounting Technology***, 11(2), 18-23.

Courtney, H. M. and Flippen, C. L.(1995). "A Shopper's Guide to Accounting Software." ***Journal of Accountancy***, 179(8), 37-59.

Fisher, D. M, and Sun, D. B. (1996). "Lan-Based E-mail: Software Evaluation." ***Journal of Computer Information Systems***, 34(2), 21-25.

Langer, J. (1995). "Practitioners Ask for (and Get) More Tax Applications." ***Taxation for Accountants***, 55(4), 212-232.

Mahmood, M. A., Pettingell, K. J., Shaskevich, A. I. (1996). "Measuring Productivity of Software Projects: A Data Envelopment Analysis Approach." ***Decision Sciences***, 27(7), 57-80.

Schefczyk, M. (1993). "Operational Performance of Airlines: An Extension of Traditional Measurement Paradigms." ***Strategic Management Journal***, 14, 301-317.

Sherman, H. D., Ladino, G. (1995). "Managing Bank Productivity Using Data Envelopment Analysis (DEA)." ***Interfaces***, 25(2), 60-73.

Stearman, S. W., "A Review of the Leading Tax Programs." ***Journal of Accountancy***, 176(4), 1992, 57-81.

----------, "What's New in Tax Software." ***Journal of Accountancy***, 177(4), 50-66.

----------, (1994). "Spotlight on Tax Software." ***Journal of Accountancy***, 178(4), 49-74.

----------, (1995). "Tax Software Buyers' Guide." ***Journal of Accountancy***, 180(4), 51-81.

Sun, D. B., and Gong, L. G. (1993). "Performance Evaluation of New Production Operations." ***Applications of Management Science***, 7, 99-113.