To the Graduate Council:

I am submitting herewith a dissertation written by Gary Lynn Waters entitled "Criteria for Determining the Appropriate Tax Treatment of Expenditures as Repairs Versus Improvements: An Empirical Investigation of Judicial Decisions." I have examined the final copy of this dissertation for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Doctor of Business Administration.

James Scheiner, Major Professor

We have read this dissertation
and recommend its acceptance:

Accepted for the Council:

Vice Chancellor
Graduate Studies and Research

CRITERIA FOR DETERMINING THE APPROPRIATE TAX TREATMENT OF EXPENDITURES AS REPAIRS VERSUS IMPROVEMENTS: AN EMPIRICAL INVESTIGATION OF JUDICIAL DECISIONS

A Dissertation

Presented for the

Doctor of Business Administration

Degree

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Gary Lynn Waters

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DEDICATION

This dissertation is dedicated to my parents, Mr. and Mrs. D. R. Waters.

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ABSTRACT

This research effort centered on three objectives: (1) to contribute to an operational refinement of the definitions of repairs and capital improvements, (2) to present an alternative methodology for quantitative analysis of tax cases, and (3) to compare the repair/capital improvement classification process of the United States District Court and the United States Tax Court. These objectives were accomplished through the use of quantitative models which were built from a random sample of sixty United States Tax Court Cases.

Objective one was accomplished through the relevant variables identified in a discriminant model and a logistic regression model. The variables identified by the models which indicate a capital improvement are: (1) Expenditure increases the value of the property; (2) Expenditure prolongs the life of the property; (3) Adequate accounting records are not present; and (4) Expenditure is in the form of a replacement, addition, or renovation. The variables which indicate a repair are: (1) There is a base or vestige of a usable asset present; (2) Expenditure is expected to be made repetitively; (3) Expenditure is an ordinary and necessary expense for the continued use of the asset; and (4) Expenditure keeps the property in an ordinarily efficient operating condition. Both models were

capable of discriminating between repairs and capital improvements, as seen by their prediction rates in excess of 80% for a hold-out sample of sixty United States Tax Court Cases.

The alternative methodology was logistic regression. The higher prediction rate (90%) of the logistic regression model in comparison to the prediction rate (83.33%) of the discriminant analysis model makes logistic regression a viable alternative for the quantitative analysis of tax cases. This higher prediction rate was accomplished with fewer variables.

The final objective was accomplished by evaluating the logistic regression model against a sample of sixty United States District Court Cases. The model correctly predicted 88.33% of these cases. This high prediction rate helps refute some assumptions regarding the United States District Court which have caused the exclusion of these decisions from some prior studies.

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CHAPTER I

INTRODUCTION

The question of capitalizing versus expensing costs incurred by a taxable entity is an area of controversy in Federal Income Taxes. Capitalizing results in a spreading of the tax deduction over several years, while expensing results in a full tax deduction in the year of incurrence. The controversy has developed over the years because of vague guidelines for distinguishing between expenses and capital expenditures and because of management's desire to minimize the present value of tax payments. The Internal Revenue Code[1] (IRC) and Income Tax Regulations[2] state that an expenditure which is expected to benefit the taxable entity for more than one year should be capitalized, while an expenditure which is expected to benefit only the current year should be expensed (IRC, pp. 25173-25176). Hence, the controversy developed largely due to the difficulty in determining the estimated time of benefit from an expenditure.

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[1]References to the Internal Revenue Code in this paper are to the Internal Revenue Code of 1954, as amended.

[2]Income Tax Regulations are issued by the Treasury Department of the United States and are intended to interpret and explain the Internal Revenue Code. Income Tax Regulations are authoritative pronouncements and do have the effect of being law unless they contradict the statute.

The purpose of this study is to investigate a specific example of the capitalize/expense problem: "Repair Versus Capital Improvement." Repairs are discussed in Section 162 of the IRC and Section 1.162-4 of the Income Tax Regulations, while capital improvements are discussed in Section 263 of the IRC and Section 1.263(A)-1 of the Income Tax Regulations. These rules and regulations state the costs of repairs to property used in a trade, business, or profession and the costs of repairs to property held for the production of income are deductible as ordinary and necessary expenses (Income Tax Regulations, p. 23,245). Likewise, the costs of improvements to these two types of properties are capital improvements and should be capitalized and depreciated or amortized over the remaining useful lives of the property (Income Tax Regulations, p. 23,376.2A). Repairs are defined as expenditures which neither add to the value of the property nor appreciably prolong its life. These expenditures merely keep the property in an ordinarily efficient operating condition (Income Tax Regulations, p. 23,245). Conversely, improvements are characterized by replacements or substitutions and usually increase the value and/or lengthen the remaining useful life of the property (Income Tax Regulations, p. 23,376.2A). The abstract nature of these definitions makes categorization of the expenditures a difficult task.

The objectives of this study are threefold. The first objective is to contribute to an operational refinement of the definitions of repairs and capital improvements. The need for this refinement has been expressed by two United States Supreme Court Justices. Justice Frankfurter describes the cases dealing with this section of the code as a "quagmire of particularities."[3] Alternatively, Justice Cardoza's comments centered on the "ordinary and necessary" controversy. He comments,

> The distinctions are one of degree and not of kind. One struggles in vain for any verbal formula that will supply a ready touchstone. The standard set up by stature is not a rule of law; it is rather a way of life. Life in all its fullness must supply an answer to the riddle.[4]

This operational refinement of the definitions of repairs and capital improvements will be through the development of a "predictive ability" model. That is, these definitions will be refined only if the model employed in this research effort has an above average prediction rate of the tax treatment of expenditures by the court system. If the model does not have an above average "predictive ability," no further refinement of the definitions of repairs and capital improvements will be made by this research effort.

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[3]McDonald versus Commissioner, 323 U.S. 57, 65 (1944). (United States Supreme Court Tax Case.)

[4]Welch versus Helvering, 290 U.S. 111, 115 (1933). (United States Supreme Court Tax Case.)

The second objective is to present an alternative methodology for quantitative analysis of tax cases. In most of the previous tax research employing quantitative methods, discriminant analysis has been used. An alternative, logistic regression, will be presented as will a comparison of the results of the two methodologies. This comparison of the results will point out the better of the two methodologies for this research effort.

The final objective of this study is to compare the classification decision of the United States District Court and the United States Tax Court. United States District Court Cases have often-times been excluded from empirical tax research because of perceived inconsistencies that exist among these courts. Hence, this study will examine a sample of United States District Court Decisions to provide evidence to help support or refute the existence of these inconsistencies.

This research study includes four additional chapters. Chapter II contains a review of the literature which deals with the repair/capital improvement controversy. Chapter III follows with a discussion of the methodology employed to achieve the objectives of the research study. This chapter includes a justification for the use of a quantitative methodology and a discussion of the selection of the sample of tax cases to be analyzed. Chatper IV presents the collected data and the analysis of the data.

Finally, Chapter V is an explanation of the contributions and limitations of the research study.

CHAPTER II

REVIEW OF LITERATURE

This chapter presents a review of the literature on the repair/capital improvement controversy. The literature discussed in this chapter can be divided into three segments:

1. A Determination of the Preferred Treatment of an Expenditure by a Taxable Entity,

2. An Outline of the Categorization Decision of a Taxable Entity, and

3. A Description of the Case History of the Repair/Capital Improvement Controversy.

Each of these divisions are discussed in detail.

Preferred Treatment

The literature which attempts to determine the preferred treatment of an expenditure by a taxable entity includes support for both the repair (immediate expensing) and capital improvement (allocation of the cost over its useful life) treatments. The literature which supports the repair treatment as being preferred by a taxable entity is discussed first.

Preference of the repair treatment is found in works by Seidman (1964), Schiff (1976), and Bierman (1977). Seidman, Schiff, and Bierman advocate expensing all

expenditures in order to simplify the tax laws and encourage capital investment by business entities. Each use present value analysis to determine which treatment maximizes the present value of the tax deduction of an expenditure. Each concluded that the repair/expense treatment maximizes the present value of the tax deduction.

Each of the authors make additional unique contributions to the analysis. Schiff introduced different inflation rates into a net present value analysis. He found that the greater the inflation rate, the more attractive the expensing treatment. Bierman conducted a net present value analysis at several discount rates and determined that the tax benefits of expensing were greater than the tax benefits of capitalizing including investment tax credit and depreciation at all discount rates equal to or greater than 7% (see Figure 1).

Offutt and Peck (1976), Kreiser (1978), and Schnepper (1978) all support capitalization as the preferred treatment. These authors present net present value analysis that shows the capital improvement treatment maximizes the present value of the tax deduction from an expenditure. However, the findings of these works are only true for low discount rates. This is consistent with Bierman's conclusions (Bierman, pp. 88-89). The use of these low discount rates seems unrealistic in light of the high actual cost of capital for most firms. Each of these works also omitted any consideration of inflation.

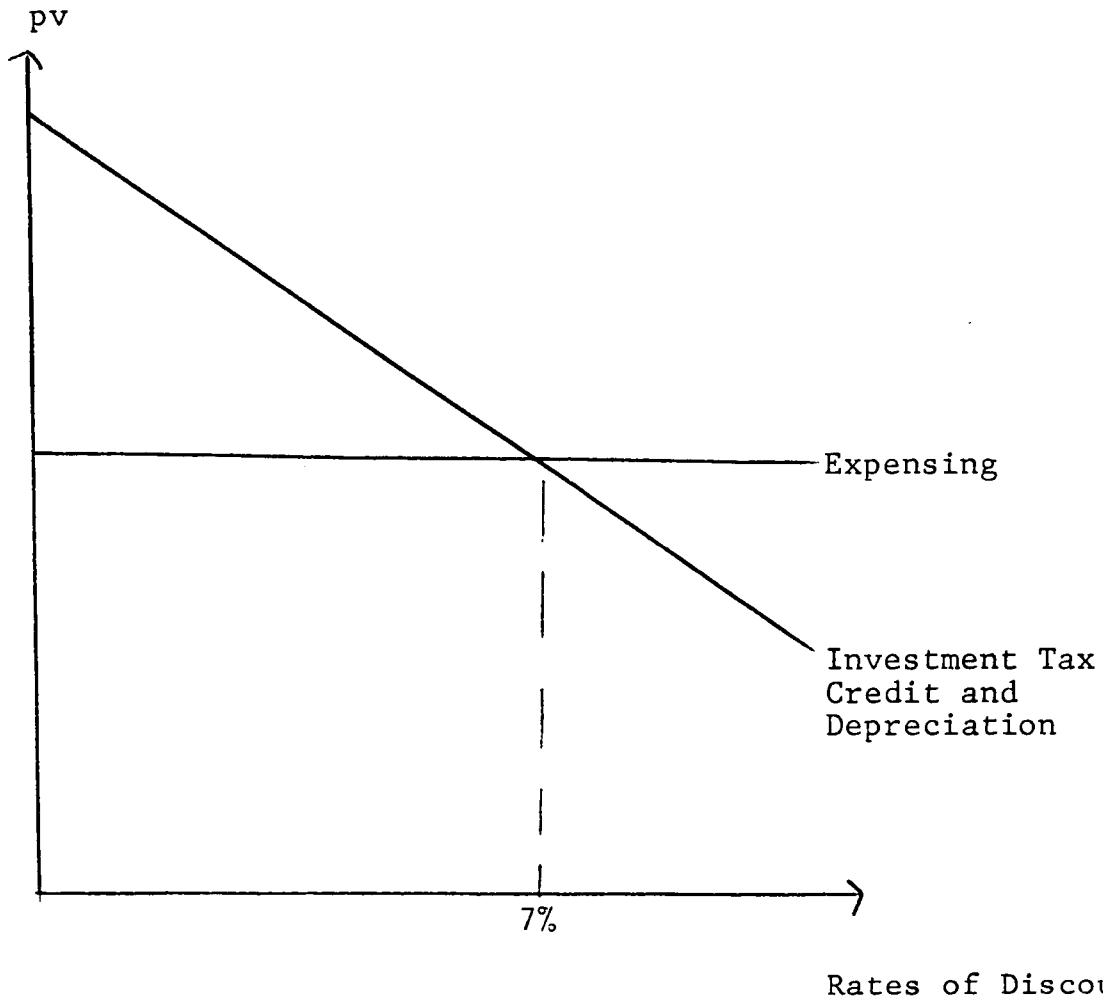

FIGURE 1. Present value of tax deductions.

Source: Harold Bierman Jr., "A Case for Immediate Expensing for Tax Purposes." Journal of Accountancy (October 1977):89.

Based on the review of the articles which attempt to determine the preferred treatment of an expenditure by a taxable entity, the repair treatment appears to be preferred. This preference is due to the repair treatment maximizing the present value of the deduction from an expenditure. This is in contrast to the preference of the government which desires capitalization of the expenditure in order to maximize tax revenues.

Outline of the Categorization Decision

The professional literature includes two works which deal with the categorization decision to be made by a taxable entity. Doane (1969) and Dillion (1972) both suggest several factors to consider in making this decision.

Doane's work agrees with the works of Schiff, Bierman, and Seidman since it supports the repair treatment as being the most preferred. This conclusion is drawn using a net present value analysis similar to the one used by the above authors. In addition to determining the preferred treatment of an expenditure, Doane also emphasizes the importance of the intent of the taxable entity in distinguishing between a repair and a capital improvement. He recommends that the intent should be specified on work orders, and detailed accounting records should be kept for repairs and capital improvements. Doane proposes setting a minimum dollar value for the capitalization of

an expenditure, with any value below this minimum being expensed.

Dillion presents an outline of the repair/capital improvement decision, and in this outline, he identifies factors that can be used in distinguishing between a repair and a capital improvement. These factors are:

1. A capital improvement is an expenditure to put property into operating condition, while a repair is an expenditure to keep property in operating condition.

2. Improvements, additions, and renovations represent capital improvements.

3. The following factors should be considered in concluding that an expenditure is a capital improvement:

a. The expenditure represents an additional and completely separate new unit of property.

b. The expenditure increases the value of the property.

c. The expenditure substantially (over 25%) increases the productivity or capacity of the property.

d. The expenditure prolongs the life of the property.

e. The expenditure adapts the property to a different use.

f. Expenditures after the asset is fully depreciated should always be considered capital improvements (Dillion, pp. 132-135).

Based on his research, Dillion also reaches two conclusions regarding the repair/capital improvement controversy:

1. No minimum dollar amount has been determined by the Internal Revenue Service or the courts to differentiate a repair from a capital improvement.

2. Separate accounting records should be kept for repairs and renovation plans (Dillion, pp. 132-135).

Case History Description

The literature includes two works which each analyzed over one-hundred (100) cases on the subject. Shugerman (1950) analyzed United States Tax Court Cases, United States District Court Cases, United States Court of Claims Cases, United States Court of Appeals Cases, and United States Supreme Court Cases. Simon (1967) reviewed cases heard before all of the above courts except the United States Tax Court.

Shugerman identified three criteria that courts have used in determining whether a new capital asset has been created by an expenditure. Satisfaction of these criteria will result in the expenditure being treated as a capital improvement. These three criteria are:

1. Replacement of an interchangeable mechanism in an asset that definitely increases the asset's value.

2. Replacement of a major asset segment which creates a new different asset or adds to its value.

3. Replacement of a portion of the asset which is substantial reconstruction of the asset (Shugerman, p. 215).

Shugerman also determined three criteria which, if satisfied, will deem an expenditure being treated as a repair:

1. The asset was in serviceable condition before the expenditure was incurred.

2. A base, or some vestige of a usable asset was present before the expenditure was incurred.

3. The effect of the expenditure is the production of an asset which is substantially like its original construction before the expenditure was incurred (Shugerman, p. 219).

Shugerman examined some of the factors used in the courts' decisions and had some conclusions about this classification process. These factors are:

1. Where a new unit has been created, a court will be very strongly inclined to adjudicate the expenditure as a capital improvement.

2. Renovation of a serviceable asset to its original condition usually constitutes a repair.

3. An expenditure which makes an inserviceable asset useful is usually treated as a capital improvement.

4. Separate accounting records are a very important factor in the classification process, especially when a repair is incurred concurrently with an renovation plan.

5. Apportionment of an expenditure between a repair and a capital improvement is usually not allowed if the taxable entity does not have adequate accounting records.

6. If the expenditure or the benefits from an expenditure are consumed by a taxable entity during a one year period, the expenditure is treated as a repair. However, in numerous cases, economic utility will be enjoyed in subsequent years, and the expenditure may or may not be treated as a repair.

7. The size of the outlay is not particularly indicative of the outlay's classification.

8. The fact that an expenditure is made repetitively or recurrently influences its being classified as a repair.

His conclusions about the process are:

1. The courts have not been completely consistent in their rulings on expenditures which have taken place a short period of time after the asset's purchase.

2. Few individual items are always treated either as a repair or as a capital improvement. New roofs are the exception in that they are usually treated as capital improvements.

3. Courts seem to have attached no importance to the expenditure being caused by government compulsion (Shugerman, pp. 215-223).

Simon's findings were similar to those of Shugerman. However, he had some additional findings. For example, in some of the early cases, the source of funds for the expenditure was an important variable. If the expenditure was paid out of earnings and profits, it was treated as a repair, while if the expenditure was paid out of funds generated from the sale of stock, it was treated as a capital improvement. This practice was generally ignored by 1907.

Simon listed as questions in the determination process some of the specifics mentioned in the Internal Revenue Code and Income Tax Regulations. His questions include:

1. Was the expenditure an ordinary and necessary one for the continued use of the property?

2. Did the expenditure appreciably increase the life of the property?

3. Did the expenditure materially increase the value of the property?

4. Was the expenditure made to restore the property to a sound state or to mend the property?

5. Was the expenditure made to keep the property in an ordinarily efficient operating condition?

6. Did the expenditure arrest normal deterioration (Simon, pp. 50-62)?

Summary

The review of the literature reveals that in most cases the repair/expense treatment is the preferred treatment of a taxable entity. The government on the other hand desires capitalization of the expenditure in order to maximize tax revenues. These fundamental differences are oftentimes uncompromisable, resulting in litigation. A court settles the controversy by studying the facts in each case and reaching a classification decision. The identification of common factors in these decisions is a major objective of this study.

CHAPTER III

METHODOLOGY

This chapter discusses the methodology employed to achieve the research objectives stated in Chapter I:

1. To contribute to an operational refinement of the definitions of repairs and capital improvements.

2. To present an alternative methodology for quantitative analysis of tax cases.

3. To compare the classification decision (repair versus capital improvement) of the United States District Court and the United States Tax Court.

After a discussion of general types of tax research, the specific methodology employed to achieve each objective is discussed. Following the discussion of specific methodologies, a section describing the selection of sample cases is presented. Finally, the chapter will conclude with a summary of the methodology used in this research effort.

Tax Research--Legal Versus Quantitative Approach

Tax research can take the form of the more subjective legal approach or a more objective quantitative approach. The legal approach focuses on the three operations a judge performs in reaching a conclusion. Jensen and Crumbley (1979) identify these three operations:

1. The judge must make factual determinations of relevant events in the adjudication of the case.

2. The judge must select appropriate rules to apply to the chosen events.

3. The judge must semantically and syntactically interpret the chosen rules within the context of the court. decision (Jensen and Crumbley, p. 5).

Using the legal approach, a person analyzes tax cases from these three perspectives and subjectively identifies common factors used in the decision processes of the judges. Jensen and Crumbley identify three deficiencies of the legal approach, which have been documented in prior research. These deficiencies are:

1. Subjective observations usually cannot be replicated among different researchers.

2. Observations by individual researchers may be biased toward finding precedent for their own point of view.

3. The degree of generalization of subjective case analysis is limited (Jensen and Crumbley, p. 6).

Quantitative analysis of tax cases is based on the belief that the judicial process is one which takes a series of related events and transforms them into a legal judgment. Mathematical equations are developed by establishing common factors of tax cases and relating these factors to each other and to the court's decision. Weeks (1975) describes

the quantitative approach to case analysis as a systematic generalization of the "seat-of-the-pants" brand of case analysis commonly employed when a legal analyst uses some undefined qualitative or subjective procedure to weigh all the variables in a particular series of cases (Weeks, p. 91).

Jensen and Crumbley identify several advantages of using a quantitative analysis of tax cases. These advantages are:

1. More useful information can be drawn from essentially the same set of facts as those used intuitively.

2. More and better data is required than is used for intuitive purposes so conclusions should be sounder and of greater generalizability.

3. Definition of the relevant variables in a complex legal issue is necessary for its rational resolution, and proper quantification of those variables is sufficient to ensure consistency in their treatment.

4. The resolving power of a mathematical approach is high in bringing inchoate purposes into focus.

5. The interrelationships between judicial decisions and facts are clearly identified so that interpretive conclusions may be adduced from the presence or absence of a particular relationship.

6. Quantitative models of decision processes focus on describing past decisions or on predicting future ones rather than on advocating some preferred decision as is done

in legal briefs. These models thereby specify the limits of past jurisprudence and indicate when a break in precedent is required for a favorable decision.

7. Building a mathematical model is an extremely rigorous means of learning the structure of the problems underlying a legal issue (Jensen and Crumbley, pp. 7-8).

Jensen and Crumbley conclude that quantitative analysis reduces the deficiencies associated with the legal approach--nonreplicable conclusions, biased observations, and limited generalizability. They do, however, enumerate some weaknesses associated with the quantitative analysis of tax cases:

1. Quantitative techniques give little consideration to the interplay between justices in conferences.

2. Quantitative techniques overlook developing judicial trends towards over-ruling or change.

3. Quantitative techniques overlook new factors.

4. Quantitative techniques overlook reasons and principles that may have guided the court but are not fully expressed or explained in the written opinions (Jensen and Crumbley, p. 10).

Search for Precedents

Tax research, using either the legal approach (Watkins, 1973; Misiewicz, 1977) or the quantitative approach (Madeo, 1977; Taylor, 1978) is dependent upon precedents found in tax cases. Precedents are found by

reading tax cases to note similarities or differences and absence or presence of similar factors. Horvitz and Finley (1979) have emphasized the importance of precedents in tax research:

> Only by applying established precedent can normative generalizations be determined in finding a solution to a particular controversy. The application of precedent in conjunction with statute interpretation is the only methodology that preludes arbitrariness in legal decision making (Horvitz and Finley, p. 638).

The underlying reason for examining precedents in tax cases is the principle of stare decisis. This concept implies consistent application of the law, and in its traditional form states that a court is bound by the prior decisions from courts of equal or higher levels (Jensen and Crumbley, p. 3).

The search for precedents entails the reading of tax cases concerning a particular issue. These cases include (1) a presentation of the facts, (2) the decision, and (3) a written opinion of the judge detailing the basis of his decision. This written opinion is the portion of the tax case where the judge identifies factors in his decision. Lawlor (1970) points out that although several behavioral scientists believe that background, attitudinal, and physical facets of the judge are the basis for his decisions, these decisions still must be linked with the facts of the case (Lawlor, p. 78). There is some speculation of a bias on the part of the judge to selectively report only

the facts which support his conclusion. The possibility of this bias being introduced is lessened by the possibility of reversal or appeal for failure to consider all relevant factors.

Schubert (1974) emphasized the concept of consistency in the written opinions of judges. He comments:

> There is a high degree of rationality in judicial decision making, but it consists primarily of the psychological rationality of consistency in the structuring of attitudes in the minds of individual judges rather than of the logical rationality of consistency in the structuring of the rationalizations for outcomes found in their written opinions (Schubert, p. 23).

Ulmer (1963) noted several theories originating in different disciplines which state humans tend to act consistently with their beliefs. These theories include Osgood and Tanenbaum's congruity theory, Festinger's cognitive dissonance theory, Heider's interpersonal balance theory, Lacky's consistency of phenomenal self theory, Lewin's conflict avoidance theories, and Freud's psychological adjustments to intense ambiualence theory. He concluded that the concept of stare decisis is the counterpart of these theories in our legal court system (Ulmer, p. 172).

Jensen and Crumbley considered the concept of stare decisis within the context of the two approaches to tax research. They concluded that the legal approach does not fully utilize the concept of stare decisis, while the equations used in the quantitative approach can fully capture the degree of adherence to the concept of stare decisis

present in a series of court cases (Jensen and Crumbley, pp. 6-11).

Prior Research Using Quantitative Analysis

In the last quarter century, quantitative analysis of court cases has been completed by several researchers. Kort (1957) studies Supreme Court Decisions in right to counsel cases using correlation analysis to find a minimum score necessary for an affirmative Supreme Court vote. Other researchers using correlation analysis include Tanenhaus, Schick, Muraskin, and Rosen (1963) in their study of Supreme Court certiorari decisions, Nagel (1964) in his study of reapportionment cases in the federal and state courts, Neef and Nagel (1974) in their study of appellate court pornography cases, Ulmer and Stooky (1975) in their study of law and order Supreme Court Justices, and Champagne and Danube (1975) in their study of Social Security disability decisions of administrative law judges. In all of these non-tax legal research studies, the use of correlation analysis allowed the researchers to identify a set of factors which were correlated with the examined decisions.

Three researchers have used correlation analysis in recent tax research. Moore (1973) used correlation analysis in his empirical tax research study of capital versus an income producing factor under Section 1348. Misiewicz (1977) used correlation analysis in his study of educational expense

deductions, and Englebrecht and Jamison (1979) used correlation analysis to show that the United States Tax Court does not act as a compromiser in settling valuation issues involving charitable contributions under Section 170. Again, correlation analysis was a valuable tool in helping these researchers reach their conclusions.

Regression analysis was used by Kort (1963) to study Supreme Court involuntary confession cases and right to counsel cases. Other users of regression analysis include Grunbaum and Newhouse (1965) in their study of labor union regulation, Landes (1971) in his study of demands for trials, Nagel, Reinbolt, and Eimerman (1975) in their study concerning free press versus fair trial, and Ebbesen and Konecni (1975) in their study of bail setting. Recent empirical tax research studies using regression analysis include two studies by Englebrecht (1976, 1977). He used regression analysis to determine if the United States Tax Court was using legislative and administrative guidelines when valuing closely-held stock for estate and gift tax purposes. Regression analysis allowed him to validate these guidelines for the valuation of closely-held stock and was also helpful in the determination or validation of factors in the other research efforts.

Discriminant analysis was successfully used in several non-tax research studies in the 60's and has been used recently in four empirical tax research studies.

Madeo (1977) determined that accumulated earnings cases could be better classified by using variables in the Internal Revenue Service Audit Guidelines than by using variables listed in the Income Tax Regulations. Bond (1977) used discriminant analysis to determine the factors considered by the United States Tax Court in distinguishing between debt and equity. Taylor (1978) conducted a study to determine factors used in distinguishing between capital gain treatment and ordinary income treatment in real property transactions. Kramer (1979) used a combination of discriminant analysis and regression analysis in a study of large holdings of publicly traded stock. In all of these research efforts, discriminant analysis allowed the researchers to identify relevant factors for a given decision or to evaluate alternative factors.

Operational Refinement of Definitions

The first objective of this research effort is to contribute to an operational refinement of the definitions of repairs and capital improvements. This refinement was accomplished by an analysis of the definitional elements used by the courts in distinguishing between a repair and a capital improvement.

The first step in the analysis is the compilation of a list of factors used to distinguish an expenditure as being a repair or a capital improvement. This list of factors will be compiled from three sources:

1. The professional literature which discusses the repair/capital improvement controversy.

2. A sample of United States Tax Court Cases which have dealt with this classification problem.

3. The Internal Revenue Service Audit Guide which instructs Internal Revenue Service Agents in distinguishing between a repair and a capital improvement.

Once a list of factors has been identified, a larger sample of United States Tax Court Cases will be analyzed. All of these tax cases involve the repair/capital improvement argument. The cases will be analyzed for the presence or absence of the identified factors. If a factor is found to be a part of the decision as described in the written opinion of United States Tax Court Judges, a value of +1 will be assigned. If a factor is not found to be a part of the decision as described in the written opinion of the United States Tax Court Judges, a value of 0 will be assigned. After the data is collected from the sample of United States Tax Court Cases, a model will be constructed using discriminant analysis.

Discriminant analysis.[1] Discriminant analysis is a technique for finding a linear combination of predictor variables that maximizes differences in group means. The underlying assumptions of discriminant analysis are:

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[1]This discussion is based upon Tatsuoka's Multivariate Analysis (pp. 157-193).

1. The dependent variables must be discrete.

2. Each group identified by the dependent variables can be defined in terms of p variables that are judged to be important in differentiating among the groups.

3. The distributions of the group populations must be multivariate normal.

4. The group covariances must be equal.

The data used in this research study satisfy these assumptions within particular limits. The dependent variables involved are discrete in that they are two classification groups, repairs and capital improvements. The second assumption is really the hypothesis that is being tested in this part of the research study. Satisfaction of this assumption will allow a refinement of the definitional elements of the two groups of repairs and capital improvements. The third assumption is violated by the introduction of discrete variables, but studies by Gilbert (1968) and Krzanowski (1975) have shown that linear discriminant analysis can perform well under this circumstance of discrete variables (Gilbert, p. 1411, Krzanowski, p. 789). The last assumption is hopefully satisfied but since the covariances of the two groups are unknown, the assumption will be made that the covariances of the two groups are equal. Other researchers (Taylor, 1978; Bond, 1977; Madeo, 1977) have made a similar assumption.

As stated earlier, the focus in discriminant analysis is to find a linear combination that maximizes differences

in group means. This linear combination model takes the form

$$Y_1 = V_{11} X_1 + V_{12} X_2 + \ldots + V_{1p} X_p$$

where

$$V_{11}, V_{12}, \ldots, V_{1p}$$

is an eigenvector which forms the weighting coefficients and,

$$X_1, X_2, \ldots, X_p$$

are the independent variables. The discriminant score, Y_1, will be used to assign an expenditure as either a repair or a capital improvement.[2]

The discriminant model will be constructed using a step-wise discriminant approach found in the Biomedical Statistical Package (BMDP). The constructed model will be applied to a hold-out sample of United States Tax Court Cases. If an above average prediction rate is found using the model on the hold-out sample, support will be gathered for the hypothesis that discrimination between repairs and capital improvements is possible based on the appearance of definitional elements in the written opinion of United States

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[2]The y-score is determined by evaluating the mathe-mathical formula for the present relevant factors. A total in excess of a cut-off point (to be determined) will result in a classification of the expenditure as a repair, while a total that is less than or equal to the cut-off point will result in a classification as a capital improvement.

Tax Court Judges. If a below average prediction rate is found, support will be gathered for the hypothesis that discrimination between repairs and capital improvements is not possible based on the appearance of definitional elements in the written opinion of United States Tax Court Judges.

Logistic Regression[3]

The second objective of this research study is to present an alternative methodology to discriminant analysis. This alternative methodology is logistic regression. Logistic regression has been shown to be a better methodology in specific situations. The statistical literature, Efron (1975), Press and Wilson (1978), and Halperin, Blackwelder and Verter (1971), has shown that logistic regression has given a model which has a higher prediction rate than the model derived from discriminant analysis. These researchers compared raw prediction rates and found the prediction rates of the logistic regression model to be 1 to 10% higher than the prediction rate of the discriminant model. They used logistic regression to identify the relevant factors for population growth and disease classification.

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[3]This discussion is based upon Cox's Analysis of Binary Data (pp. 14-41).

Logistic regression, sometimes referred to as binary regression, is a technique for finding a linear combination that maximizes a maximum likelihood function. The underlying assumptions of logistic regression are less strict than those of discriminant analysis. Logistic regression has been shown to be so robust that the assumptions of multivariate normality and equal covariances are not needed. Press and Wilson (1978) showed this to be the case and also concluded that logistic regression is usually preferable when many of the independent variables are qualitative. Day and Kerridge (1967) showed that logistic regression will always find the linear model if a model can be constructed.

The robustness of logistic regression is especially applicable in this research effort. The data used in this research study satisfy most of the assumptions of discriminant analysis. The assumptions of multivariate normality and equal covariances were satisfied only within particular limits.

As stated earlier, the focus of logistic regression is the determination of a linear combination. The form of the linear model derived using logistic regression is

$$Y_1 = a + b_1 x_1 + b_2 x_2 + \ldots b_n x_n$$

where

a = y intercept

$b_1, b_2, \ldots, b_n$ = weighting coefficients

$x_1, x_2, \ldots, x_n$ = independent variables

The parameters, b_i, are estimated as values that maximize the likelihood function:

$$E(y) = \frac{e^{bx}}{1 + e^{bx}}$$

Again, the Y_1 score will be used to classify an expenditure as a repair or capital improvement.[4]

A logistic regression model will be constructed using a step-wise regression approach found in the BMDP Statistical Package. This model will be built using the same data used to build the discriminant model and will be evaluated against the same hold-out sample of cases to determine the prediction rate of the logistic regression model. A higher prediction rate of the hold-out sample using the logistic regression model will support the hypothesis that the logistic regression model does result in a better model than the discriminant analysis model. An equal or lower prediction rate will support the hypothesis that the logistic regression model does not result in a better model than the discriminant analysis model.

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[4]The y-score is determined by evaluating the mathematical formula for the present relevant factors. A total in excess of a cut-off point (to be determined) will result in a classification of the expenditure as a repair, while a total that is less than or equal to the cut-off point will result in a classification as a capital improvement.

Application to United States District Court Decisions

The third objective of this research effort is to compare the classification decision of the United States District Court and the United States Tax Court. In most prior quantitative analysis of tax cases, United States District Court Cases have been excluded form the research studies (Madeo, 1977; Bond, 1977; Taylor, 1978). The reasons for this exclusion are based on two assumptions:

1. Since the United States Tax Court hears tax cases only, the Tax Court is assumed to have a higher level of expertise in tax areas.

2. Some inconsistencies appear in United States District Court decisions.

The purpose of this section of the study is to provide evidence to support or refute these assumptions.

The prediction rate of the better model using discriminant analysis or logistic regression is determined against a sample of United States District Court Cases. A below average prediction rate results in support of the hypothesis that the aforementioned assumptions are true. Likewise, an above average prediction rate results in evidence to help refute these assumptions.

Sample Selection

The samples of United States Tax Court Cases and United States District Court Cases will be randomly

selected from a list of cases provided by the Lexis System.[5] The three samples are:

1. United States Tax Court cases used to build the model.

2. United States Tax Court cases used to evaluate the model.

3. United States District Court cases used to evaluate the model.

The sample size of each group is sixty. This size has been used in prior tax research (Madeo (1977)). No restriction on the time frame of the cases is made. However, cases are analyzed to determine if the classification process has changed over time. This analysis can be through an examination to see if particular variables are present or absent during a given time frame or by comparing models constructed from cases of different time frames.

Summary

In summary, the methodology employed in this research effort is a quantitative analysis of tax cases. A quantitative analysis is chosen for several reasons:

1. A quantitative analysis is more objective than the traditional legal analysis.

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[5]Lexis is a computer based research tool relying on the use of key terms.

2. A quantitative analysis is a more formal approach to tax research.

3. The results from a quantitative analysis are usually more replicable then those from the legal analysis.

4. Quantitative analysis usually more fully captures the degree of adherence to the principle of stare decisis present in the court cases.

In evaluating the prediction rate of the models constructed during this research project, it must be remembered that these tax cases usually involve situations which are in the "grey area" of the decision process. Expenditures which are clearly repairs or clearly capital improvements are usually not found in court cases. Only those expenditures that could be justified for either treatment are usually found in these cases.

CHAPTER IV

DATA ANALYSIS

This chapter reports on the data collection and analysis. The chapter is divided into five parts. The first part discusses data collection for the study. The next three parts each analyze separately the following major research questions:

1. Whether discrimination between repairs and capital improvements is possible based on the appearance of definitional elements in the written opinions of United States Tax Court Judges.

2. Whether a logistic regression model, using the definitional elements in the written opinions of United States Tax Court Judges, results in a better model than a discriminant analysis model, using the same elements.

3. Whether assumptions regarding United States District Court Decisions, which have caused the exclusion of these decisions from some prior tax studies, are true.

Finally, the chapter concludes with a summary of the results of this research study.

Data Collection

The collection of data for this study began with the development of a list of potential factors which might have an impact on decisions in tax cases. An

analysis of twenty United States Tax Court Cases resulted in the identification of ten factors (see Appendix A). These factors are:

1. Expenditure increases the value of the property.
2. Expenditure prolongs the life of the property.
3. Adequate accounting records are not present.
4. Expenditure is in the form of a replacement, addition or renovation.
5. Expenditure is part of an overall renovation plan.
6. Expenditure is expected to be made repetitively.
7. Expenditure is an ordinary and necessary expense for the continued use of the asset.
8. Expenditure mends or restores the asset.
9. Expenditure arrests normal deterioration.
10. Expenditure keeps the property in an ordinarily efficient operating condition.

Nine more factors were identified from the professional literature. These nine additional factors were taken from articles written by Dillion (1972), Shugerman (1950) and Simon (1967). These factors are:

1. Dollar amount of the expenditure.
2. Expenditure increases the productivity of the asset.
3. Asset is fully depreciated.
4. Expenditure adapts property to a different use.

5. There is a base or a vestige of a usable asset present.

6. Asset is in a serviceable condition.

7. Treatment of individual items, i.e., new roofs.

8. Expenditure caused by governmental compulsion.

9. Type of property.

The Internal Revenue Service Audit Guide was also examined for other possible factors, but no additional factors were identified.

The second phase of the data collection involved the analysis of the tax cases. From the list of four hundred and eighty United States Tax Court Cases provided by using the Lexis System, two random samples of sixty cases were selected. From the list of two hundred and ten United States District Court Cases provided from by the Lexis System, a random sample of sixty cases was selected.[1]

The first sample of United States Tax Court Cases was used to build the model. The second sample of United States Tax Court Cases and the sample of United States

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[1]The random selection of United States Tax Court Cases to build the model began with the selection of case number five and continued with every eighth case until sixty cases had been selected. The random selection of United States Tax Court Cases to evaluate the model began with the selection of case number eight and continued with every eighth case until sixty cases had been selected. The random selection of United States District Court cases to evaluate the model began with the selection of case number three and continued with every third case until sixty cases had been selected.

District Court Cases were used to evaluate the model. A list of the cases appears in Appendix B.

The three samples were read and analyzed for the presence or absence of the nineteen identified factors. If a factor was present in the case, a +1 was assigned for that factor in the particular case. If a factor was absent from the case, a 0 was assigned for that factor in the particular case. The collected data consisted of classification decision for each case (repair or capital improvement) and +1's or 0's for each of the nineteen factors.

Operational Refinement of Definitions

The first objective of this research study is to contribute to an operational refinement of the definitions of repairs and capital improvements. This refinement process involved building a model through discriminant analysis. The data collected from the first sample of United States Tax Court Cases, which contained thirty-two repair decision cases and twenty-eight capital improvement decision cases, was used to build a model using the Biomedical Statistical Package for Step-Wise Discriminant Analysis. Discriminant analysis resulted in the model shown in Table 1.

The first three factors are positive factors for the expenditure being treated as a capital improvement. The importance of the first two factors, increasing the

TABLE 1

DISCRIMINANT ANALYSIS MODEL

Variables	Capital Improvement[1]	Repair[2]
1. Expenditure increases the value of the property.	+22.52176	- 1.46907
2. Expenditure prolongs the life of the property.	+32.37233	- 3.61689
3. Adequate accounting records are not present.	+25.98643	- 0.19901
4. There is a base or a vestige of a usable asset present.	-13.71725	+ 4.72181
5. Expenditure is expected to be made repetitively.	- 4.45382	+ 5.91307
6. Expenditure is an ordinary and necessary expense for the continued use of the asset.	- 0.56352	+11.05704
7. Expenditure keeps the property in an ordinarily efficient operating condition.	- 3.39030	+12.72663

[1]Constant = -27.19504.

[2]Constant = -11.81306.

value of the property and prolonging the life of the property, is logical. A capital improvement could definitely be expected to increase the value of the property or prolong the life of the property, while a repair of the property should not result in either of these two. The third factor, regarding inadequate accounting records, involved the taxpayer not being able to fully prove the detailed evidence of the expenditure. In all cases involving this factor, the United States Tax Court Judge classified the expenditure as a capital improvement, which is not usually the taxpayer's preferred treatment.

The last four factors are positive factors for the expenditure being treated as a repair. These four factors reveal that a repair is an expenditure expected to be made repetitively on an asset which currently has a base or vestige of usability. A capital improvement would not be expected to be made repetitively and would probably take an unusable asset and make it usable again. Likewise, a repair is an ordinary and necessary expense for the continued use of the asset. A repair merely keeps the property in an ordinarily efficient operating condition. On the other hand, a capital improvement would be expected to increase the value or prolong the life of the asset.

Evaluation of model. The evaluation of this discriminant analysis model involved using the model to predict

the outcome of the second sample of United States Tax Court Cases, which contained thirty-one repair decision cases and twenty-nine capital improvement decision cases. The discriminant analysis model correctly predicted twenty-six of the repair decison cases (84%) and correctly predicted twenty-four of the capital improvement decision cases (83%). The overall prediction rate of the discriminant analysis model was 83.33% (see Table 2).[2] This prediction rate is certainly above average and would allow the researcher to provide evidence to support the hypothesis that discrimination between repairs and capital improvements is possible based on the appearance of definitional elements in the written opinion of United States Tax Court Judges. This prediction rate is consistent with prediction rates of earlier researchers. Madeo (1977) had prediction rates of 78% and 95% for the models in her research study and concluded that both models discriminated winning accumulated earnings cases from losing cases. Taylor (1978) reached the same conclusion for a discriminant model that had a prediction rate in excess of 90%. His model discriminanted ordinary income treatment from capital gain treatment for real estate transactions. Both of these researchers used

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[2]The evaluation of the model involved computing y-scores for each of the cases. The y-score would determine the prediction of the case. This prediction was compared with the judge's opinion to determine correct classification or misclassification by the model (see Appendix C).

TABLE 2

DISCRIMINANT ANALYSIS MODEL EVALUATION

Judge's Opinion	Model Treatment	
	Repair	Capital Improvement
Repair	26- 84%	5- 17%
Capital Improvement	5- 16%	24- 83%
Total	31-100%	29-100%

Note: Overall Prediction Rate = 50/60 = 83.33%.

the same cases to build and evaluate the model. In this research study, a hold-out sample of cases was used to evaluate the model, and a very high prediction rate was still accomplished. The discriminatory power of this model will allow for further operational refinement of the definitions of repairs and capital improvements.[3] A detailed analysis of the evaluation of the model for the second sample of United States Tax Court Cases can be found in Appendix C.

Logistic Regression

The second objective of this research study is to present an alternative methodology, logistic regression, for quantitative analysis of tax cases. In presenting this alternative methodology, a model using logistic regression was built and evaluated in the same manner as the discriminant analysis model.

The data collected from the first sample of United States Tax Court Cases was used to build a model through the Biomedical Statistical Package for Step-Wise Logistic Regression. Logistic Regression resulted in the model shown in Table 3.

The presence of the first two factors are supportive factors for the expenditure being treated as a capital

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[3]The operational refinement of the definitions of repairs and capital improvements is in the form of the relevant factors of the model.

TABLE 3

LOGISTIC REGRESSION MODEL

Variables	Capital Improvement and Repair
1. Expenditure prolongs the life of the property.	-25.681
2. Expenditure is in the form of a replacement, addition, or renovation.	-17.174
3. Expenditure is an ordinary and necessary expense for the continued use of the asset.	+17.159
4. Expenditure keeps the property in an ordinarily efficient operating condition.	+17.394

Note: Constant = 0.0.

improvement. The presence of the first factor has been discussed previously, but the second factor regarding a replacement, addition, or renovation was not a relevant factor in the discriminant analysis model. This factor implies that a new asset is being created and would be more associated with those expenditures identified as capital improvements.

An interesting aspect of this second factor is in regards to a repair and renovation of an asset being done concurrently. The United States Tax Court has decided that separate accountings records must be kept for these transactions in order for them to be treated differently for tax purposes. In the absence of adequate accounting records, both transactions will be treated as a capital improvement. In all cases where adequate accounting records was a factor, the replacement, addition, or renovation factor was also relevant to the decision. Therefore, the presence of this factor is easily seen in comparison with the presence of the adequate accounting records factor of the discriminant analysis model.

The last two factors are positive factors for the expenditure being treated as a repair. Both of these factors were present in the discriminant analysis model and have been discussed previously. For a comparison of the factors present in the two models, see Table 4.

TABLE 4

RELEVANT FACTORS

Variables	Discriminant Analysis Model	Logistic Regression Model
1. Expenditure increases the value of the property.	X	
2. Expenditure prolongs the life of the property.	X	X
3. Adequate accounting records are not present.	X	
4. Expenditure is in the form of a replacement, addition, or renovation.		X
5. There is a base or a vestige of a usable asset present.	X	
6. Expenditure is expected to be made repetitively.	X	
7. Expenditure is an ordinary and necessary expense for the continued use of the asset.	X	X
8. Expenditure keeps the property in an ordinarily efficient operating condition.	X	X

Note: X represents presence in the model.

Evaluation of model. The evaluation of this logistic regression model involved using the model to predict the outcome of the sixty cases in the second sample of United States Tax Court Cases. The logistic regression model correctly predicted twenty-seven of the thirty-one repair decision cases (87%) and correctly predicted twenty-seven of the twenty-nine capital improvement decision cases (93%). The overall prediction rate of the logistic regression model was 90% (see Table 5).[4] This prediction rate is 6 to 7% higher than the prediction rate of the discriminant analysis model. These results are consistent with the results from the statistical literature. The results provide evidence to support the hypothesis that the logistic regression model does result in a better model than the discriminant analysis model, with less variables (see Table 6). A detailed analysis of the evaluation of the model for the second sample of United States Tax Court Cases can be found in Appendix D.

Application to United States District Court Decisions

The third objective of this research study is to compare the classification decision of the United States

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[4]The evaluation of the model involved computing y-scores for each of the cases. The y-score would determine the prediction of the case. This prediction was compared with the judge's opinion to determine correct classification or misclassification by the model (see Appendix D).

TABLE 5

LOGISTIC REGRESSION MODEL EVALUATION

Judge's Opinion	Model Treatment	
	Repair	Capital Improvement
Repair	27- 87%	5- 7%
Capital Improvement	4- 13%	27- 93%
Total	31-100%	29-100%

Note: Overall Prediction Rate = 54/60 = 90%.

TABLE 6

COMPARISON OF MODELS

Type of Case	Discriminant Analysis Model	Logistic Regression Model
Repair Decision Cases		
Correct Predictions	26-84%	27-87%
Misclassifications	5-16%	4-13%
Capital Improvement Decision Cases		
Correct Predictions	24-83%	27-93%
Misclassifications	5-17%	2- 7%
Overall Prediction Rates	83.33%	90%

District Court and the United States Tax Court. The purpose of this comparison is to provide evidence to support or refute some previously discussed assumptions about the United States District Court.

This comparison involved evaluating the logistic regression model against a sample of United States District Court Cases. The sample included twenty-eight repair decision cases and thirty-two capital improvement decision cases. The logistic regression model, built using United States Tax Court Cases, correctly predicted twenty-five of the repair decision cases (89.3%) and twenty-eight of the capital improvement decision cases (87.5%). The overall prediction rate was 88.33% (see Table 7).[5] This high prediction rate provides evidence to help refute the assumptions regarding the United States District Court. Hopefully, this evidence will allow for the inclusion of United States District Court Decisions in future tax research studies.[6] A detailed analysis of the evaluation

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[5]The evaluation of the model involved computing y-scores for each of the cases. The y-scores would determine the prediction of the case. This prediction was compared with the judge's opinion to determine correct classification or misclassification by the model (see Appendix E).

[6]Due to the assumptions, most prior tax studies have excluded United States District Court Decisions. This evidence supports their inclusion and provides evidence to help refute the assumptions regarding the United States District Court.

TABLE 7

LOGISTIC REGRESSION MODEL--UNITED STATES DISTRICT COURT EVALUATION

Judge's Opinion	Model Treatment	
	Repair	Capital Improvement
Repair	25- 89.3%	4- 12.5%
Capital Improvement	3- 10.7%	28- 87.5%
Total	28-100.0%	32-100.0%

Note: Overall Prediction Rate = 53/60 = 88.33%.

of the model for the sample of United States District Court Cases can be found in Appendix E.

Summary

In summary, the results of the research study allow the researcher to provide evidence in support of the following statements:

1. Discrimination between repairs and capital improvements is possible based on the appearance of definitional elements in the written opinion of United States Tax Court Judges.

2. The logistic regression model does result in a better model than the discriminant analysis model.

3. The assumptions regarding the United States District Court are not valid in all cases.

Analysis of Model Over Time

To analyze the possibility of the classification process changing over time, the cases were divided into two time frames and examined for presence or absence of the particular factors. There is no evidence that the classification process has changed over time. This analysis can be found in Appendix F.

CHAPTER V

CONTRIBUTIONS AND LIMITATIONS

This research study centered on three objectives, refining the definitions of repairs and capital improvements, proposing an alternative methodology to quantitatively analyze tax cases, and comparing the classification decision of United States District Court and the United States Tax Court. In accomplishing these objectives, two classification models were built using discriminant analysis and logistic regression. The high prediction rates of both models against a hold-out sample of United States Tax Court Cases allow for the refinement of the definitions of repairs and capital improvements through the relevant factors identified by the models. These relevant factors and their origination are shown in Table 8.

An alternative methodology for the quantitative analysis of tax cases, logistic regression, was presented. The logistic regression model proved to be a better model than the discriminant analysis model since the logistic regression model had a higher prediction rate with fewer variables in the model.

Comparison of the classification decision of the United States District Court and the United States Tax Court entailed evaluating the logistic regression model

TABLE 8

RELEVANT FACTORS

Factors	Model[1]	Origination[2]
1. Expenditure increases the value of the property.	DA	Cases
2. Expenditure prolongs the life of the property.	DA, LR	Cases
3. Adequate accounting records are not present.	DA	Cases
4. Expenditure is in the form of a replacement, addition, or renovation.	LR	Cases
5. There is a base or a vestige of a usable asset present.	DA	Professional Literature
6. Expenditure is expected to be made repetitively.	DA	Cases
7. Expenditure is an ordinary and necessary expense for the continued use of the asset.	DA, LR	Cases
8. Expenditure keeps the property in an ordinarily efficient operating condition.	DA, LR	Cases

[1]DA refers to discriminant analysis model, and LR refers to logistic regression model.

[2]The list of potential factors was compiled from reading a sample of twenty United States Tax Court Cases and from reading articles from the professional literature.

against a hold-out sample of United States District Court Decisions. Again, the model had a high prediction rate which provides evidence to help refute the assumptions used to exclude United States District Court Cases from some prior tax research.

The remaining part of this chapter is divided into four sections. The first section discusses the taxable entity's decision making process regarding the classification of an expenditure as a repair or a capital improvement. This discussion considers the costs to the taxable entity when an expenditure is incorrectly classified. The next section considers the study's contributions. Following this discussion, the third section presents the study's limitations. The chapter concludes with a discussion of potential future research.

Taxable Entity Decision Making

In classifying an expenditure as a repair or capital improvement, a taxable entity must consider the factors surrounding a transaction. The entity must weigh these factors and classify the expenditure based upon the relative strengths of the factors. Hopefully, this classification process will correctly classify the expenditure in the majority of cases, but a possibility does exist for an incorrect classification, and certain costs are associated with this incorrect classification.

The costs incurred by a taxable entity when an expenditure is incorrectly classified are referred to as "misclassification costs." These costs can occur in one of two situations (see Table 9). In one case, the taxable entity incorrectly classifies a capital improvement as a repair. If this misclassification is never detected by the Internal Revenue Service, the taxable entity will not incur any costs. However, if the misclassification is detected by the Internal Revenue Service, the taxable entity will incur costs in the form of additional taxes and interest. Costs for penalties and legal representation may also be incurred.

In the second situation, the taxable entity incorrectly classifies a repair as a capital improvement. If the misclassification is not detected by the Internal Revenue Service, the taxable entity will incur opportunity costs. These costs are the difference in the present value of the deduction that would have been generated from a repair and the present value of the deduction generated from the capital improvement. In the rare situation in which the entity has incorrectly classified the expenditure as a capital improvement and the misclassification is detected by the Internal Revenue Service, the entity will be allowed to maximize the present value of the deduction but may incur costs for legal representation.

A taxable entity should consider all factors in classifying an expenditure as a repair or a capital

TABLE 9

MISCLASSIFICATION COSTS

	"True" State	
Taxable Entity Classification	Capital Improvement	Repair
Capital Improvement	No Misclassification Costs	Out-of-Pocket Costs
Repair	Opportunity Costs	No Misclassification Costs

improvement, including misclassification costs. In considering these misclassification costs, characteristics of the taxable entity must be identified. If the taxable entity is risk-adverse, the entity may not be willing to assume the risk associated with these misclassification costs. If the taxable entity is a risk-taker, the entity may be willing to assume the risk associated with these misclassification costs.

Contributions

The contributions of this research study are:

1. Refinement of the definitions of repairs and capital improvements is furthered by the relevant factors of the constructed models.

2. Logistic regression is introduced as a viable alternative methodology for the quantitative analysis of tax cases.

3. Inclusion of United States District Court Decisions in future tax research is justified by the results which question some assumptions regarding the United States District Court.

Limitations

The limitations of this research study are threefold. The limitations are:

1. The researcher is not an observer of the tax cases but must rely on the judges' written opinion. The

researcher must assume that judges are accurately recording their decision processes and mentioning all relevant factors of their decisions. This assumption is consistent with the assumption of prior tax researchers, Madeo (1977), Taylor (1978), and Kramer (1979).

2. The researcher is assuming that the United States Tax Court and United States District Court are correctly classifying the expenditures. This assumption must be made in order to correlate certain factors with corresponding decision processes. The possibility of reversal or appeal supports this assumption. No examination of possible appeals or reversals of the decisions was made.

3. The study was limited to court cases. Settlements by the taxable entity and the Internal Revenue Service outside the court system could not be considered due to the lack of published data. Hence, the analyzed data from the court cases usually involved transactions in the "grey area" of the classification process.

Future Research

Possible future research involves the use of logistic regression in tax research and the inclusion of United States District Court Decisions in tax research. This future research might involve replications of past studies and also current research efforts in the tax area.

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APPENDICES

APPENDIX A

SAMPLE OF UNITED STATES TAX COURT CASES--

FACTOR LIST DEVELOPMENT

The following cases were analyzed:

Illinois Merchants Trust Company, Executor (Estate of Manieere, William R.), 4 Board of Tax Appeals 103.

Coors Porcelain Company, 52 Tax Court Decisions 495.

Honigman, Jason L. and Edith, 55 Tax Court Decisions 692.

Campbell, Thomas O. and Mary F., 1973 Prentice-Hall Tax Court Memorandum Decisions 451.

Evans, Sam C. and Patricia L., 1974 Prentice-Hall Tax Court Memorandum Decisions 1133.

Coors, William K. and Phyllis E., 60 Tax Court Decisions 247.

Pacific Fruit Express Company, 60 Tax Court Decisions 393.

Gilles Frozen Custard, Incorporated, 1970 Prentice-Hall Tax Court Memorandum Decisions 358.

Churchill Farms, Incorporated, 1969 Prentice-Hall Tax Court Memorandum Decisions 1088.

Bane, Charles A. and Eileen B., 1971 Prentice-Hall Tax Court Memorandum Decisions 140.

Sturgill, Charlie Motor Company, 1973 Prentice-Hall Tax Court Memorandum Decisions 1292.

Plainfield--Union Water Company, 39 Tax Court Decisions 333.

Oberman Manufacturing Company, 47 Tax Court Decisions 471.

Midland Empire Packing Company, 14 Tax Court Decisions 635.

Potter, E. L., 20 Board of Tax Appeals 252.

Scoville Manuafacturing Company, 25 Board of Tax Appeals 265.

Cohen, Charles H., 1948 Prentice-Hall Tax Court Memorandum Decisions 186.

Munroe Land Company, 1966 Prentice-Hall Tax Court Memorandum Decisions 2.

Thurner, George E., 1952 Prentice-Hall Tax Court Memorandum Decisions 9.

Alabama-Georgia Syrup Company, 58 Tax Court Decisions 61.

APPENDIX B

SAMPLES OF TAX CASES--MODEL CONSTRUCTION AND EVALUATION

SAMPLE OF UNITED STATES TAX COURT CASES--

MODEL CONSTRUCTION

1. Amfac, Incorporated, 70 Tax Court Decisions 305.
2. Estate of Elizabeth L. Audenried, 56 Tax Court Decisions 420.
3. Oliver L. Bardes and Olive M. Bardes, 37 Tax Court Decisions 1134.
4. Kenneth S. Battelle, 47 Board of Tax Appeals 117.
5. Belz Investment Company, 72 Tax Court Decisions 101.
6. C. O. Bibby and Marie Bibby, 44 Tax Court Decisions 638.
7. Richard E. Boesel, Jr. and Virginia N. Boesel, 65 Tax Court Decisions 378.
8. Boonton Molding Company, 24 Tax Court Decisions 1065.
9. Louis M. Brooks, 6 Tax Court Decisions 504.
10. Burford Oil Company, 4 Tax Court Decisions 613.
11. Adoph B. Canelo III and Sally M. Canelo, 53 Tax Court Decisions 352.
12. The Chesapeake and Ohio Railway Company, 64 Tax Court Decisions 352.
13. The Dixie, Incorporated, 31 Tax Court Decisions 415.
14. Estate of Puilip Dorsey, 52 Tax Court Decisions 1222.
15. James D. Dunn and Jo Ann Dunn, 42 Tax Court Decisions 490.
16. Elk Lick Coal Company, 23 Tax Court Decisions 585.
17. Euergreen-Washelli Memorial. Park Company, 51 Tax Court Decisions 189.

18. F. H. E. Oil Company, 41 Board of Tax Appeals 130.

19. Geneva Drive-In Theatre, Incorporated, 67 Tax Court Decisions 764.

20. Gilken Corporation, 10 Tax Court Decisions 445.

21. Nathan D. Goldberg, 22 Tax Court Decisions 533.

22. H. C. Cockrell Warehouse Corporation, 71 Tax Court Decisions 1036.

23. Jason L. Honigman and Edith Honigman, 55 Tax Court Decisions 1067.

24. Journal-Tribune Publishing Company, 24 Tax Court Decisions 1048.

25. Kansas City, Kansas Chamber of Commerce, 35 Tax Court Decisions 562.

26. Howard M. Kay, 11 Tax Court Decisions 471.

27. Keokuk and Hamilton Bridge, Incorporated, 12 Tax Court Decisions 249.

28. Estate of Ethel R. Kerdolff, 72 Tax Court Decisions 222.

29. Kerrigan Iron Works, Incorporated, 17 Tax Court Decisions 566.

30. B. H. Klein, 14 Tax Court Decisions 687.

31. Aaron Kraut and Iris Kraut, 62 Tax Court Decisions 420.

32. John Federick Lewis, Jr., 1 Tax Court Decisions 449.

33. Estate of Harry Stoll Leyman, 66 Tax Court Decisions 65.

34. Arthur V. McDermott, 13 Tax Court Decisions 468.

35. Edna Morris, 59 Tax Court Decisions 21.

36. The Municipal Bond Corporation, 41 Tax Court Decisions 20.

37. Frank A. and Helen A. Newcombe, 54 Tax Court Decisions 1298.

38. Nulex, Incorporated, 30 Tax Court Decisions 769.

39. Pacific Fruit Express Company, 60 Tax Court Decisions 640.

40. John Hamilton Perkins and Virginia M. Perkins, 36 Tax Court Decisions 313.

41. F. H. Philbrick and Florence Philbrick, 27 Tax Court Decisions 346.

42. The Phillips and Easton Supply Company, 20 Tax Court Decisions 455.

43. Plainfield-Union Water Company, 39 Tax Court Decisions 333.

44. Robert W. and Maybelle Pointer, 48 Tax Court Decisions 906.

45. Punch Press Repair Corporation, 21 Tax Court Decisions 223.

46. Rochester Button Company, 7 Tax Court Decisions 529.

47. Edwin F. Sandberg, 8 Tax Court Decisions 423.

48. Rosalie M. Schubert, 33 Tax Court Decisions 1048.

49. Scott Paper Company, 74 Tax Court Decisions 741.

50. Sommerfeld Machine Company, 15 Tax Court Decisions 453.

51. South Texas Properties Company, 16 Tax Court Decisions 1003.

52. Southern Ford Tractor Corporation, 29 Tax Court Decisions 833.

53. Southland Industries, Incorporated, 17 Tax Court Decisions 1551.

54. C. D. Spangler and Veva C. Spangler, 32 Tax Court Decisions 782.

55. James J. Standing and Marie S. Standing, 28 Tax Court Decisions 789.

56. Studio Theatre, Incorporated, 18 Tax Court Decisions 548.

57. Joe B. Thornton and Ruth B. Thornton, 47 Tax Court Decisions 1.

58. Melvin E. Tunningley, 22 Tax Court Decisions 1108.

59. United Mercantile Agencies, 34 Tax Court Decisions 808.

60. Universal Castings Corporation, 37 Tax Court Decisions 107.

SAMPLE OF UNITED STATES TAX COURT CASES--

MODEL EVALUATION

1. Morris and Annette G. Alexander, 61 Tax Court Decisions 278.

2. American Terrazzo Strip Company, Incorporated, 56 Tax Court Decisions 961.

3. W. Linton Atkinson and Rosalea Atkinson, 31 Tax Court Decisions 1241.

4. The Austin Company, 22 Tax Court Decisions 703.

5. Avey Drilling Machine Company, 16 Tax Court Decisions 1281.

6. Aviation Country Club, Incorporated, 21 Tax Court Decisions 807.

7. Beech Creek Railroad Company, 5 Tax Court Decisions 135.

8. Laurene Walker Berger, 7 Tax Court Decisions 1339.

9. Blackstone Theatre Company, 12 Tax Court Decisions 801.

10. Bloomfield Steamship Company, 33 Tax Court Decisions 75.

11. Boeing Company, 62 Tax Court Decisions 134.

12. David F. Bolger and Barbara A. Bolger, 59 Tax Court Decisions 760.

13. Borston Fish Market Corporation, 57 Tax Court Decisions 884.

14. Brandtjen and Kluge, Incorporated 34 Tax Court Decisions 416.

15. Breece Veneer and Panel Company, 22 Tax Court Decisions 1386.

16. Brewer-Fay Investment Company, 39 Tax Court Decisions 894.

17. Raymond G. Burge and Kathleen E. Burge, 28 Tax Court Decisions 246.

18. Calvert Iron Works, Incorporated, 26 Tax Court Decisions 770.

19. Cleveland Adoph Mayer Realty Corporation, 8 Tax Court Decisions 1163.

20. Catherine F. Dinkins, 45 Tax Court Decisions 593.

21. The Fanner Manufacturing Company, 29 Tax Court Decisions 587.

22. Fidelity-Philadelphia Trust Company, 18 Board of Tax Appeals 43.

23. Louis C. Fieland and Ruth F. Fieland, 73 Tax Court Decisions 59.

24. Frederick H. Prince Trust, 35 Tax Court Decisions 974.

25. 124 Front Street, Incorporated, 65 Tax Court Decisions 6.

26. Charles Gutwirth, 40 Tax Court Decisions 666.

27. Mary B. Heyward, 36 Tax Court Decisions, 739.

28. E. R. Fenimore Johnson, 19 Tax Court Decisions 93.

29. Grace H. Kelham, 13 Tax Court Decisions 984.

30. Ken-Cochran, Incorporated, 30 Tax Court Decisions 69.

31. Carl E. Koch and Paula Koch, Frederick W. Koch and Robin E. Koch, 67 Tax Court Decisions 71.

32. Latchis Theatres of Keene, Incorporated, 19 Tax Court Decisions 1054.

33. James F. Latimer, 55 Tax Court Decisions 515.

34. Leonard Refineries, Incorporated, 11 Tax Court Decisions 1000.

35. George W. Longfellow and Ruth Longfellow, 31 Tax Court Decisions 11.

36. Louisville and Nashville Railroad Company, 66 Tax Court Decisions 962.

37. John McShain and Mary McShain, 65 Tax Court Decisions 686.

38. Madison Gas and Electric Company, 72 Tax Court Decisions 50.

39. Midwest Liquor Dealers, Incorporated, 20 Tax Court Decisions 950.

40. Mary Young Moore, 15 Tax Court Decisions 906.

41. Walter G. Morley, 8 Tax Court Decisions 904.

42. Andrew Morris and Betty Morris, 38 Tax Court Decisions 279.

43. Oberman Manufacturing Company, 47 Tax Court Decisions 471.

44. Palm Beach Aero Corporation, 17 Tax Court Decisions 1169.

45. Penn Athletic Club Building, 10 Tax Court Decisions 919.

46. D. L. Phillips, 24 Tax Court Decisions 435.

47. Red Star Yeast and Products Company, 25 Tax Court Decisions 321.

48. William E. Reisner and Carol E. Reisner, 34 Tax Court Decisions 1122.

49. Nathaniel Richter, 4 Tax Court Decisions 271.

50. Ernest L. Rink and Ruth E. Rink, 51 Tax Court Decisions 746.

51. Sandy Estate Company, 43 Tax Court Decisions 361.

52. Schuyler Grain Company, Incorporated, 50 Tax Court Decisions 265.

53. Southern Dredging Corporation, 54 Tax Court Decisions 705.

54. Spicer Theatre, Incorporated, 44 Tax Court Decisions 198.

55. Peter Theodore, 38 Tax Court Decisions 1011.

56. Thomas Flexible Coupling Company, 14 Tax Court Decisions 802.

57. Murray Thompson, 21 Tax Court Decisions 448.

58. Tourea Land and Cattle Company, 10 Tax Court Decisions 90.

59. Carroll H. West and Mary G. West, 63 Tax Court Decisions 253.

60. John W. Willmott, 2 Tax Court Decisions 321.

SAMPLE OF UNITED STATES DISTRICT COURT CASES--

MODEL EVALUATION

1. George G. Abraham and Herbert Abraham, 67-2 United States Tax Cases 9643.

2. Lorenzo Alvary, 61-2 United States Tax Cases 9501.

3. American Trading and Production Corporation, 72-1 United States Tax Cases 9432.

4. Amherst Coal Company, 69-1 United States Tax Cases 9215.

5. Arkansas Bank and Trust Company, 64-1 United States Tax Cases 9113.

6. The Atlanta Athletic Club, 67-2 United States Tax Cases 15769.

7. William J. Atkins and Ruth K. Atkins, 77-2 United States Tax Cases 9644.

8. Bahan Textile Machinery Company, Incorporated, 72-1 United States Tax Cases 9321.

9. Bradford, Incorporated, 72-2 United States Tax Cases 9671.

10. William S. Brandom and Elizabeth Ann Brandom, 78-2 United States Tax Cases 9687.

11. Briar Homes Corporation 65-2 United States Tax Cases 9744.

12. John M. Briley and Dorothy D. Briley, 60-2 United States Tax Cases 9778.

13. Joseph W. Drown, 62-1 United States Tax Cases 9285.

14. Emile F. DuPont and Margaret D. DuPont, 67-1 United States Tax Cases 9237.

15. E-Z Sew Enterprises, Incorporated, 66-2 United States Tax Cases 9599.

16. Endres Floral Company, 78-2 United States Tax Cases 9614.

17. Federal Employees' Distributing Company, 62-2 United States Tax Cases 9591.

18. Dr. Thomas P. Foltz and Eleanor Foltz, 71-1 United States Tax Cases 9207.

19. Frankford-Quaker Grocery Company, 73-1 United States Tax Cases 9297.

20. Frito-Lay, Incorporated, 62-2 United States Tax Cases 9809.

21. Ray V. Frost and Doris S. Frost, 69-2 United States Tax Cases 9468.

22. The G. W. Van Keppel Company, 71-2 United States Tax Cases 9434.

23. Gem, Incorporated, 61-1 United States Tax Cases 9361.

24. Rodney A. Goodliny, 67-1 United States Tax Cases 9175.

25. Heart of Atlanta Motel, Incorporated, 63-1 United States Tax Cases 9402.

26. James Steven Hogg, 67-2 United States Tax Cases 9698.

27. Hulman Foundation, Incorporated, 62-2 United States Tax Cases 9656.

28. Jack I. Jalla and Ellen C. Jaffa, 61-2 United States Tax Cases 9682.

29. Jaybee Manufacturing Corporation, 70-2 United States Tax Cases 9618.

30. James F. Johnson and Mabel I. Johnson, 67-2 United States Tax Cases 9752.

31. James W. Kindelan and Mary Kindelan, 64-2 United States Tax Cases 15581.

32. Jerry F. Lambert and Betty B. Lambert, 76-1 United States Tax Cases 9223.

33. Liberty National Bank and Trust Company, 67-1 United States Tax Cases 9361.

34. Liberty National Life Insurance Company, 77-1 United States Tax Cases 9107.

35. William C. Lieb, Jr., 77-1 United States Tax Cases 9356.

36. Julian J. Loeb, 62-1 United States Tax Cases 9268.

37. The Maryland Jockey Club of Baltimore City, 64-1 United States Tax Cases 9289.

38. Mohawk Paper Mills, Incorporated, 67-1 United States Tax Cases 9108.

39. Mount Mansfield Television, Incorporated, 64-2 United States Tax Cases 9714.

40. Mountain Fuel Supply Company, 70-2 United States Tax Cases 9532.

41. Mountain Lake Corporation, 71-1 United States Tax Cases 9308.

42. Myron's Ballroom, 74-2 United States Tax Cases 9679.

43. Newark Morning Ledger Company, 75-2 United States Tax Cases 9749.

44. Olga Pando, 72-2 United States Tax Cases 9500.

45. Panhandle Eastern Pipe Line Company, 56-1 United States Tax Cases 9513.

46. Portland General Electric Company, 60-2 United States Tax Cases 9732.

47. Ranchers Exploration and Development Corporation, 78-2 United States Tax Cases 9556.

48. Rialto Realty Company, 73-2 United States Tax Cases 9791.

49. Robert C. Rice and Bonnie Rice, 75-1 United States Tax Cases 9207.

50. Joe L. Rose and Bernedee V. Rose, 64-1 United States Tax Cases 9449.

51. Safway Steel Scaffolds Company of Georgia, 72-2 United States Tax Cases 9800.

52. Sandersville Railroad Company, 74-2 United States Tax Cases 9584.

53. Suburban Realty Company, 77-2 United States Tax Cases 9547.

54. Tanforan Company, Incorporated, 70-1 United States Tax Cases 9452.

55. Transamerica Corporation, 66-2 United States Tax Cases 9541.

56. Tube Processing Corporation, 65-1 United States Tax Cases 9216.

57. United States Gypsum Company, 62-1 United States Tax Cases 9367.

58. W. J. Wehrli and Helen B. Wehrli, 67-2 United States Tax Cases 9639.

59. Western Maryland Railway Company, 68-2 United States Tax Cases 9639.

60. Wood Preserving Corporation of Baltimore, Incorporated, 64-2 United States Tax Cases 9835.

APPENDIX C

DISCRIMINANT ANALYSIS MODEL--UNITED STATES TAX COURT EVALUATION

TABLE C.1

DISCRIMINANT ANALYSIS MODEL--UNITED STATES
TAX COURT EVALUATION

Case Number (See Appendix B)	Relevant Factors Present (See Table 1)	y-score	Prediction	Decision	Correct Prediction	Incorrect Prediction
1	1,2	27.69905	Capital Improvement	Capital Improvement	X	
2	1,2	27.69905	Capital Improvement	Capital Improvement	X	
3	6,7	11.97061	Repair	Repair	X	
4	6,7	11.97061	Repair	Repair	X	
5	1,2	27.69905	Capital Improvement	Capital Improvement	X	
6	6,7	11.97061	Repair	Repair	X	
7	1,2	27.69905	Capital Improvement	Capital Improvement	X	
8	1,2	27.69905	Capital Improvement	Capital Improvement	X	
9	None	--	--	Repair		X
10	1,2	27.69905	Capital Improvement	Capital Improvement	X	

TABLE C.1 (Continued)

Case Number (See Appendix B)	Relevant Factors Present (See Table 1)	y-score	Prediction	Decision	Correct Prediction	Incorrect Prediction
11	1,5,6,7	-13.08092	Repair	Capital Improvement		X
12	2	-15.42995	Capital Improvement	Repair		X
13	5,6,7	17.88368	Repair	Repair	X	
14	5,6,7	17.88368	Repair	Repair	X	
15	2	5.17729	Capital Improvement	Capital Improvement	X	
16	1,2	27.69905	Capital Improvement	Capital Improvement	X	
17	5,6,7	17.88368	Repair	Repair	X	
18	1	- 4.67328	Repair	Capital Improvement		X
19	2,5,7	- 2.66683	Repair	Capital Improvement		X
20	4,7	5.63538	Repair	Repair	X	

TABLE C.1 (Continued)

Case Number (See Appendix B)	Relevant Factors Present (See Table 1)	y-score	Prediction	Decision	Correct Prediction	Incorrect Prediction
21	2,3	31.16372	Capital Improvement	Capital Improvement	X	
22	6,7	11.97061	Repair	Repair	X	
23	4,7	5.63538	Repair	Repair	X	
24	1,2	27.69905	Capital Improvement	Capital Improvement	X	
25	6,7	11.97061	Repair	Repair	X	
26	2,3	31.16372	Capital Improvement	Capital Improvement	X	
27	6,7	11.97061	Repair	Repair	X	
28	2	5.17729	Capital Improvement	Capital Improvement	X	
29	5,6,7	17.88368	Repair	Repair	X	
30	1	- 4.67328	Repair	Capital Improvement		X
31	1,2	27.69905	Capital Improvement	Capital Improvement	X	

TABLE C.1 (Continued)

Case Number (See Appendix B)	Relevant Factors Present (See Table 1)	y-score	Prediction	Decision	Correct Prediction	Incorrect Prediction
32	6,7	11.97061	Repair	Repair	X	
33	2,3	31.16372	Capital Improvement	Capital Improvement	X	
34	1	- 4.67328	Repair	Capital Improvement		X
35	1,2	-16.89902	Capital Improvement	Repair		X
36	5,6,7	17.88368	Repair	Repair	X	
37	2	5.17729	Capital Improvement	Capital Improvement	X	
38	7	.91357	Repair	Repair	X	
39	1,2	27.69905	Capital Improvement	Capital Improvement	X	
40	6,7	11.97061	Repair	Repair	X	
41	6	- .75602	Capital Improvement	Repair		X
42	6,7	11.97061	Repair	Repair	X	

TABLE C.1 (Continued)

Case Number (See Appendix B)	Relevant Factors Present (See Table 1)	y-score	Prediction	Decision	Correct Prediction	Incorrect Prediction
43	2	5.17729	Capital Improvement	Capital Improvement	X	
44	1,2	27.69905	Capital Improvement	Capital Improvement	X	
45	5,6,7	17.88368	Repair	Repair	X	
46	5,6,7	17.88368	Repair	Repair	X	
47	6,7	11.97061	Repair	Repair	X	
48	1,2	27.69905	Capital Improvement	Capital Improvement	X	
49	2,6	- 4.37291	Capital Improvement	Repair		X
50	1,2	27.69905	Capital Improvement	Capital Improvement	X	

TABLE C.1 (Continued)

Case Number (See Appendix B)	Relevant Factors Present (See Table 1)	y-score	Prediction	Decision	Correct Prediction	Incorrect Prediction
51	5,6,7	17.88368	Repair	Repair	X	
52	6,7	11.97061	Repair	Repair	X	
53	1,3	21.31315	Capital Improvement	Capital Improvement	X	
54	1,2	27.69905	Capital Improvement	Capital Improvement	X	
55	5,6,7	17.88368	Repair	Repair	X	
56	2	5.17729	Capital Improvement	Capital Improvement	X	
57	5,6,7	17.88368	Repair	Repair	X	
58	5,6,7	17.88368	Repair	Repair	X	
59	5,6,7	17.88368	Repair	Repair	X	
60	2,3	31.16372	Capital Improvement	Capital Improvement	X	

APPENDIX D

LOGISTIC REGRESSION MODEL--UNITED STATES TAX COURT EVALUATION

TABLE D.1

LOGISTIC REGRESSION MODEL--UNITED STATES
TAX COURT EVALUATION

Case Number (See Appendix B)	Relevant Factors Present (See Table 3)	y-score	Prediction	Decision	Correct Prediction	Incorrect Prediction
1	1,2	-42.855	Capital Improvement	Capital Improvement	X	
2	1,2	-42.855	Capital Improvement	Capital Improvement	X	
3	3,4	34.553	Repair	Repair	X	
4	3,4	34.553	Repair	Repair	X	
5	1,2	-42.855	Capital Improvement	Capital Improvement	X	
6	3,4	34.553	Repair	Repair	X	
7	1,2	-42.885	Capital Improvement	Capital Improvement	X	
8	1,2	-42.855	Capital Improvement	Capital Improvement	X	
9	2	-17.174	Capital Improvement	Repair		X
10	1,2	-42.855	Capital Improvement	Capital Improvement	X	

TABLE D.1 (Continued)

Case Number (See Appendix B)	Relevant Factors Present (See Table 3)	y-score	Prediction	Decision	Correct Prediction	Incorrect Prediction
11	3,4	34.553	Repair	Capital Improvement		X
12	1	-25.681	Capital Improvement	Repair		X
13	3,4	34.553	Repair	Repair	X	
14	3,4	34.553	Repair	Repair	X	
15	1	-25.681	Capital Improvement	Capital Improvement	X	
16	1,2	-42.855	Capital Improvement	Capital Improvement	X	
17	3,4	34.553	Repair	Repair	X	
18	2	-17.174	Capital Improvement	Capital Improvement	X	
19	1,4	- 8.287	Capital Improvement	Capital Improvement	X	
20	4	17.394	Repair	Repair	X	

TABLE D.1 (Continued)

Case Number (See Appendix B)	Relevant Factors Present (See Table 3)	y-score	Prediction	Decision	Correct Prediction	Incorrect Prediction
21	1	-25.681	Capital Improvement	Capital Improvement	X	
22	3,4	34.553	Repair	Repair	X	
23	4	17.394	Repair	Repair	X	
24	1,2	-42.855	Capital Improvement	Capital Improvement	X	
25	3,4	34.553	Repair	Repair	X	
26	1,2	-42.855	Capital Improvement	Capital Improvement	X	
27	3,4	34.553	Repair	Repair	X	
28	1,2	-42.855	Capital Improvement	Capital Improvement	X	
29	3,4	34.553	Repair	Repair	X	
30	2	-17.174	Capital Improvement	Capital Improvement	X	
31	1,2	-42.885	Capital Improvement	Capital Improvement	X	

TABLE D.1 (Continued)

Case Number (See Appendix B)	Relevant Factors Present (See Table 3)	y-score	Prediction	Decision	Correct Prediction	Incorrect Prediction
32	3,4	-42.855	Repair	Repair	X	
33	1	34.553	Capital Improvement	Capital Improvement	X	
34	2	-17.174	Capital Improvement	Capital Improvement	X	
35	1	-25.681	Capital Improvement	Repair		X
36	3,4	34.553	Repair	Repair	X	
37	1	-25.681	Capital Improvement	Capital Improvement	X	
38	2,4	.22	Repair	Repair	X	
39	1,2	-42.855	Capital Improvement	Capital Improvement	X	
40	3,4	34.553	Repair	Repair	X	
41	3	17.159	Repair	Repair	X	
42	3,4	34.553	Repair	Repair	X	

TABLE D.1 (Continued)

Case Number (See Appendix B)	Relevant Factors Present (See Table 3)	y-score	Prediction	Decision	Correct Prediction	Incorrect Prediction
43	1,2	-42.855	Capital Improvement	Capital Improvement	X	
44	1,2	-42.855	Capital Improvement	Capital Improvement	X	
45	3,4	34.553	Repair	Repair	X	
46	3,4	34.553	Repair	Repair	X	
47	3,4	34.553	Repair	Repair	X	
48	1,2	-42.855	Capital Improvement	Capital Improvement	X	
49	1,3	- 8.522	Capital Improvement	Repair		X
50	1,2	-42.855	Capital Improvement	Capital Improvement	X	
51	3,4	34.553	Repair	Repair	X	
52	3,4	34.553	Repair	Repair	X	

TABLE D.1 (Continued)

Case Number (See Appendix B)	Relevant Factors Present (See Table 3)	y-score	Prediction	Decision	Correct Prediction	Incorrect Prediction
53	None	--	--	Capital Improvement		X
54	1,2	-42.855	Capital Improvement	Capital Improvement	X	
55	3,4	34.553	Repair	Repair	X	
56	1,2	-42.855	Capital Improvement	Capital Improvement	X	
57	3,4	34.553	Repair	Repair	X	
58	3,4	34.553	Repair	Repair	X	
59	3,4	34.553	Repair	Repair	X	
60	1,2	-42.855	Capital Improvement	Capital Improvement	X	

APPENDIX E

LOGISTIC REGRESSION MODEL--UNITED STATES DISTRICT COURT EVALUATION

TABLE E.1

LOGISTIC REGRESSION MODEL--UNITED STATES
DISTRICT COURT EVALUATION

Case Number (See Appendix B)	Relevant Factors Present (See Table 3)	y-score	Prediction	Decision	Correct Prediction	Incorrect Prediction
1	3,4	34.553	Repair	Repair	X	
2	3,4	34.553	Repair	Repair	X	
3	3,4	34.553	Repair	Repair	X	
4	2	-17.174	Capital Improvement	Capital Improvement	X	
5	3,4	34.553	Repair	Repair	X	
6	1,2	-42.855	Capital Improvement	Capital Improvement	X	
7	1,2	-42.855	Capital Improvement	Capital Improvement	X	
8	None	--	--	Capital Improvement		X
9	3,4	34.553	Repair	Repair	X	
10	1	-25.681	Capital Improvement	Capital Improvement	X	

TABLE E.1 (Continued)

Case Number (See Appendix B)	Relevant Factors Present (See Table 3)	y-score	Prediction	Decision	Correct Prediction	Incorrect Prediction
11	1,2	-42.855	Capital Improvement	Capital Improvement	X	
12	2	-17.174	Capital Improvement	Capital Improvement	X	
13	3,4	34.553	Repair	Repair	X	
14	None	--	--	Repair		X
15	3,4	34.553	Repair	Repair	X	
16	2	-17.174	Capital Improvement	Capital Improvement	X	
17	1,2	-42.855	Capital Improvement	Capital Improvement	X	
18	1,2	-42.855	Capital Improvement	Capital Improvement	X	
19	1,2	-42.855	Capital Improvement	Capital Improvement	X	
20	3	17.159	Repair	Repair	X	

TABLE E.1 (Continued)

Case Number (See Appendix B)	Relevant Factors Present (See Table 3)	y-score	Prediction	Decision	Correct Prediction	Incorrect Prediction
21	1,2	-42.855	Capital Improvement	Capital Improvement	X	
22	3,4	34.553	Repair	Repair	X	
23	1,2	-42.855	Capital Improvement	Capital Improvement	X	
24	1,2	-42.855	Capital Improvement	Capital Improvement	X	
25	3,4	34.553	Repair	Capital Improvement		X
26	None	--	--	Capital Improvement		X
27	3,4	34.553	Repair	Repair	X	
28	4	17.394	Repair	Repair	X	
29	1,2	-42.855	Capital Improvement	Capital Improvement	X	
30	3,4	34.553	Repair	Repair	X	

TABLE E.1 (Continued)

Case Number (See Appendix B)	Relevant Factors Present (See Table 3)	y-score	Prediction	Decision	Correct Prediction	Incorrect Prediction
31	1,2	-42.855	Capital Improvement	Capital Improvement	X	
32	2	-17.174	Capital Improvement	Capital Improvement	X	
33	3	17.159	Repair	Repair	X	
34	3	17.159	Repair	Repair	X	
35	None	--	--	Repair		X
36	1,2	-42.855	Capital Improvement	Capital Improvement	X	
37	1,2	-42.855	Capital Improvement	Capital Improvement	X	
38	1,2	-42.855	Capital Improvement	Repair		X
39	1,2	-42.855	Capital Improvement	Capital Improvement	X	
40	3,4	34.553	Repair	Repair	X	

TABLE E.1 (Continued)

Case Number (See Appendix B)	Relevant Factors Present (See Table 3)	y-score	Prediction	Decision	Correct Prediction	Incorrect Prediction
41	None	--	--	Capital Improvement		X
42	3,4	34.553	Repair	Repair	X	
43	1,2	-42.855	Capital Improvement	Capital Improvement	X	
44	3,4	34.553	Repair	Repair	X	
45	1,2	-42.855	Capital Improvement	Capital Improvement	X	
46	1,2	-42.855	Capital Improvement	Capital Improvement	X	
47	3,4	34.553	Repair	Repair	X	
48	3,4	34.553	Repair	Repair	X	
49	3,4	34.553	Repair	Repair	X	
50	3,4	34.553	Repair	Repair	X	

TABLE E.1 (Continued)

Case Number (See Appendix B)	Relevant Factors Present (See Table 3)	y-score	Prediction	Decision	Correct Prediction	Incorrect Prediction
51	3,4	34.553	Repair	Repair	X	
52	1,4	- 8.287	Capital Improvement	Capital Improvement	X	
53	1,2	-42.855	Capital Improvement	Capital Improvement	X	
54	1,2	-42.855	Capital Improvement	Capital Improvement	X	
55	4	17.394	Repair	Repair	X	
56	1,2	-42.855	Capital Improvement	Capital Improvement	X	
57	3,4	34.553	Repair	Repair	X	
58	1,2	-42.855	Capital Improvement	Capital Improvement	X	
59	3,4	34.553	Repair	Repair	X	
60	1,2	-42.855	Capital Improvement	Capital Improvement	X	

APPENDIX F

ANALYSIS OF VARIABLES OVER TIME

TABLE F.1

ANALYSIS OF VARIABLES OVER TIME

	Variables																		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Pre-1960, 65 U.S. Tax Court Cases																			
Factor Present	2	24	2	23	0	0	7	26	8	1	4	3	14	0	29	23	5	30	1
Percentage of Cases--Factor Present	3.1	36.9	3.1	35.4	0	0	10.8	40.0	12.3	1.5	6.2	4.6	21.5	0	44.6	35.4	7.7	46.2	1.5
Post-1960, 55 U.S. Tax Court Cases																			
Factor Present	1	20	0	21	0	0	4	24	8	1	2	3	11	1	25	22	3	27	1
Percentage of Cases--Factor Present	1.8	36.4	0	38.2	0	0	7.3	43.6	14.5	1.8	3.6	5.5	20.0	1.8	45.5	40.0	5.5	49.1	1.8
Pre-1970, 35 U.S. District Court Cases																			
Factor Present	1	15	1	13	0	0	4	15	14	2	2	1	5	0	13	11	2	13	0
Percentage of Cases--Factor Present	2.9	42.9	2.9	37.1	0	0	11.4	42.9	40.0	5.7	5.7	2.9	14.3	0	37.1	31.4	5.7	37.1	0
Post-1970, 25 U.S. District Court Cases																			
Factor Present	1	13	1	12	0	0	2	12	11	0	1	2	3	0	11	10	1	11	0
Percentage of Cases--Factor Present	4.0	52.0	4.0	48.0	0	0	8.0	48.0	44.0	0	4.0	8.0	12.0	0	44.0	40.0	4.0	44.0	0

VITA

Gary Lynn Waters was born in Cullman, Alabama on February 4, 1955. He attended Jones Chapel Junior High School and West Point High School, graduating from West Point High School in May of 1973.

In June of 1973, Gary entered Auburn University. He graduated with honors from Auburn University in June of 1976, with a major in Accounting.

In June of 1976, Gary accepted a teaching assistantship at the University of Alabama in Tuscaloosa and began study toward a Master's degree in Accounting. The degree was awarded in August of 1977.

In September of 1977, Gary entered The University of Tennessee, Knoxville and began study toward a Doctor of Business Administration degree with a major in Accounting. The degree was awarded in August of 1981.

Gary is a member of Beta Alpha Psi, Delta Sigma Pi, National Association of Accountants, and American Accounting Association. He is presently an Assistant Professor of Accounting at Auburn University.