TOWARD AN ECONOMIC MODEL OF

TAXPAYER-IRS INTERACTION

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PREFACE

This study is an analytical approach to the issue of taxpayer-Internal Revenue Service conflict. Specifically, it addresses, from a game theory perspective, the area of property valuation disputes in estate taxation. The primary objective is to formalize conditions under which such disputes will be settled out of court and determine the quantitative nature of these settlements.

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CHAPTER I

INTRODUCTION

The Valuation Problem in Estate and Gift Taxation

This study applies concepts from the fields of conflict resolution and economics to the development of a theory of taxpayer-Internal Revenue Service (IRS) interaction in estate and gift tax property valuation disputes. Heretofore, much has been written about the elusive and troublesome valuation issue from an experiential and traditional case research perspective but little has been written from the standpoint of economic analysis.

Valuation is inherently a difficult problem. Chambers (1965, p. 43) says, "There is no such thing as an inherent or intrinsic value; goods have values to persons in specific states at specific times." The Internal Revenue Code is imprecise in defining value; Treasury Regulations Section 20.2031-1(b) establishes fair market value as the standard, defining this concept as "the price at which the property would change hands between a willing buyer and a willing seller, neither being under any compulsion to buy or to sell and both having reasonable knowledge of relevant facts." Although in the majority of instances the hypothetical and conditional character of this definition necessarily prevents conclusive determination of value, some sort of determination is crucial to the computation of tax liability. Despite some guidelines in the Regulations and previous court cases with respect to specific types of property, the valuation problem remains difficult, precipitating innumerable disputes involving expenditure of substantial resources on both sides. For this reason, both empirical and theoretical research are needed to gain a better understanding of the varied aspects of the valuation process.

Valuation strategies are a popular topic at tax practitioner seminars and receive thorough coverage in the professional literature. Bishop and Rosenbloom (1982), for example, have produced a voluminous "digest" of federal tax valuation problems. One commentator (Hartwig, 1955, p. 1143) notes, "It is only a slight exaggeration to suggest that the only real problems in estate and gift tax cases which come across the average practitioner's desk are valuation problems." He further observes:

> Even a superficial consideration . . . of valuation problems leads one readily to the conclusion that value is essentially a difficult question of fact, prophesy (sic), opinion, common sense and informed judgment. A candid and experienced practitioner might well characterize these impressive terms as pure window-dressing and humbug intended to camouflage the irritation and impatience of practitioners with a problem which experience has taught them boils down to a simple question of 'horse-trading' (p. 1144).

Court decisions in the valuation area have been reported in a vague manner (Englebrecht and Davison, 1977) contributing to the aura of uncertainty surrounding this issue.[1] Descriptions of IRS settlement authority (for example, Norwood, Chisholm, Burke, and Vaughan, 1979) and anecdotal evidence from attorneys and certified public accountants add credence to the notion that an atmosphere of "give and take" characterizes many valuation audits.

Toward Increased Understanding

In light of the above discussion, developments in conflict resolution research hold promise of providing additional insight into taxpayer-IRS interaction; conversely, taxpayer-IRS interaction offers a rich environment for studying and testing propositions of conflict resolution theory. The present study explores such interaction; it does not attempt to develop new methods for assessing value.

Modern statistical and computing techniques have enabled researchers to move beyond traditional tax research to a systematic identification and isolation of important factors underlying outcomes of litigated tax cases. Madeo (1979) achieved some success in statistically discriminating cases won from cases lost by taxpayers in the area of accumulated earnings. Similarly, Whittington and Whittenburg (1980) were able to form rather accurate predictions of the outcomes of debt-versus-equity cases by using factor and multiple discriminant analysis. These efforts continue to inspire researchers to evaluate the usefulness of quantitative as opposed to, or as supplementary to, conventional qualitative techniques.

Englebrecht and Davison (1977) conducted a statistical summary of Tax Court decisions in an area where the concept of "winner" and "loser" is less clear--that of estate and gift tax valuation of closely-held stock. They concluded that, apparently as a product of the inherent ambiguity of the valuation issue, the Tax Court exhibits a tendency to compromise between the value asserted by the taxpayer and that claimed by the Internal Revenue Service. The impression one receives from their research is that the taxpayer and the Revenue Service weight the application of existing valuation guidelines in order to place themselves in the most favorable positions possible for minimizing and maximizing taxes, respectively, while the Tax Court seems to act as a compromiser. This suggests a balancing of interests by the Court, which is not new to jurisprudence (Rehnquist, 1977; Luizzi, 1980), but which is viewed with concern by Englebrecht and Davison in the tax setting. They voice a need for "studies examining the human factors' influence on valuation--both with respect to the litigants and the judges" (Englebrecht and Davison, 1977, p. 400).

That the game-theoretic approach adopted in the present study might provide insight is hinted by Eustice (1977, p. 31), "While not exactly the 'sport of kings,' tax litigation is more often conducted with a level of 'gamesmanship' seldom encountered on the playing fields by even the most energetic sportsmen." The present study offers an economic analysis of the incentives and normative behavior of rational disputants in estate and gift tax valuation and thereby addresses one important aspect of the "human factors" cited by Englebrecht and Davison. The central question is a normative one: given the ambiguity of the valuation issue, what are the optimal strategies of taxpayer and Revenue Service for assigning value in an environment which includes a court as a conflict resolution mechanism? Answers to this normative question may prove useful in their own right and may lead to some positive insights as to why the parties behave as they do. In any event, the analysis employed reduces the level of detail and focuses on basic economic incentives. Thus the analysis formalizes and adds rigor to the study of the vague and confusing valuation issue which consumes so much time and energy on the part of taxpayers, practitioners and government representatives.

Some questions which the analysis helps to illuminate include the following:

1. If taxpayers and IRS representatives seek to maximize expected utility, then how should they deal with the valuation issue?

2. Is it feasible to predict theoretically the negotiated outcome or range of outcomes of a taxpayer-IRS valuation dispute?

3. Why do negotiations break down in some valuation cases and not in others? In other words, what conditions contribute to explaining why some valuation cases are settled through the appellate process within the Revenue Service while some are not? Can "common sense" explanations of this phenomenon be reduced to a few key concepts?

4. Is the tendency toward compromise valuation on the part of the Tax Court, as observed by Englebrecht and Davison (1977), a reasonable surrogate for a negotiated outcome?

5. Are there attributes of court settlements that tend to aggravate conditions of docket congestion? That is, does the observed behavior of the court tend to increase its attractiveness to disputants as a conflict resolution mechanism?[2] Identification of factors which tend to encourage litigation rather than negotiation can suggest policies to reduce the impact of those factors.

Preview of Remaining Chapters

The next chapter introduces the conflict resolution model used in the study. It also specifies the assumptions which will be maintained in each of 28 scenarios or settings involving a taxpayer and the Revenue Service. Chapters III through VI contain the analyses of the 28 scenarios, and Chapter VII summarizes the study.

ENDNOTES

[1]Two notable exceptions are the Bader case (59-1 USTC par. 9431; 172 F. Supp. 833 (DC Ill.)) and the Central Trust case (62-2 USTC par. 12.092; 304 F. 2d 923). These cases state specific formulas involving earning power, dividend capacity and book value for valuing closely held stock. Such formulas are suitable for rapid calculation by computer (e.g., Arthur Anderson & Co. (1982)). Although it is not clear that the Bader and Central Trust cases have served as effective precedents (Englebrecht and Leeson, 1978), they at least attempt to reduce uncertainty.

[2]According to a report in the May 30, 1984 Wall Street Journal (p. 1), the Tax Court's backlog amounts to well over 50,000 cases.

CHAPTER II

METHODOLOGICAL FRAMEWORK

Chapter Overview

This chapter sets the stage for Chapters III through VI, which form the core of the study. Assumptions regarding the game situation which exists in the taxpayer-IRS setting are stated, along with a summary of the basic models being investigated. Additionally, the rationality postulates underlying subsequent analysis are listed.

The Basic Model

The study uses a theory of conflict resolution to develop optimal strategies for the parties to a valuation dispute. Aided by concepts from game theory (Luce and Raiffa, 1957), a basic model is formulated in which certain primitive assumptions are maintained so as to focus on essential economic features of the conflict. Two active participants or _players_ are studied--one taxpayer and one Revenue Service representative or agent. Consistent with other work (for example, Rubin (1977) and Schotter (1978)), a third entity, the court, is viewed as a _chance player_, whose valuation decisions represent an exogenous event or _state of the world_ which may influence the course of the conflict.[1] Only _fixed threats_ exist; that is, the payoffs the players receive in the absence of an agreement are dictated by the bargaining situation itself, not by any alternative actions the players may take (Harsanyi and Selten, 1972).

The taxpayer and Revenue Service agent are modeled as informed persons, aware of the tax law, and both are treated as amoral, resourceful, evaluative maximizers of expected utility. A simple, single-period world is constructed in which the only operative tax issue is valuation. The estate tax (and gift tax) setting, in which the taxpayer favors lower values while the Revenue Service agent prefers higher values, is the relevant environment, and any estate-tax-income-tax tradeoff arising from the basis of property on an estate tax return is ignored.[2] These abstractions are consistent with the single-issue assumption and at least for litigated cases are an appropriate simplification (Englebrecht and Davison, 1977). In fact, the Treasury has been criticized as being overly concerned with fiscal matters, always fearful of losing revenue (Eustice, 1977).

A feature of the basic model is the assumption that audit examinations and tax litigation can be conducted without cost. All players are assumed to be risk neutral. That is, the players are assumed to be interested only in expected values, regardless of risk, in the relevant range of outcomes. The assumption that the taxpayer wishes to minimize taxes by minimizing value while the agent takes the opposite position leads to an expression for the optimal strategy of each (for example, the value the taxpayer should place on the tax return, whether the agent should audit, the value the agent should claim, and whether either party should force litigation).

Finally, an environment of complete information is assumed in the basic model. The players have full knowledge of the rules of the game and each other's utility function. Rules of the game include the actions each player may choose at any stage, how much information will be available to guide those actions and what the consequences of those actions will be for both players (Harsanyi, 1977). In particular, the players know the objective probabilities of the possible court decisions, implying that the conditions are those of risk rather than uncertainty (Harsanyi, 1977).

Summary of the Models

After the basic model has been analyzed, several of its primitive assumptions are relaxed in a progressive fashion to add further insight and enhance realism. The following sequence of situations serves as a framework for the project:

a. Basic Model I (Chapter III).

1. One taxpayer, with a single item of property to be valued.
2. One Revenue Service agent.
3. One court.
4. Risk neutrality.
5. Costless auditing.
6. Costless litigation.
7. Single filing period.
8. Complete information.

b. Basic Model II (Chapter IV). Same as I, with Assumption No. 1 relaxed, allowing for more than one taxpayer, still with one property each. The Revenue Service agent is assumed to have limited resources, enabling him to audit fewer than the full number of returns.

This raises issues of optimal selection of returns for audit and possible changes in taxpayers' strategies in response to a nonzero probability of escaping audit. Coalition formation, side-payments and communication between taxpayers are assumed impossible.

c. Basic Model III (Chapter V). Same as I, with Assumption No. 8 relaxed. This means that the players face conditions of uncertainty. The taxpayer and agent form subjective and possibly different probability distributions for possible court decisions.

d. Basic Model IV (Chapter VI). Same as II, with Assumption No. 8 relaxed. This again replaces risk with uncertainty.

Within each of these basic models, the fourth, fifth and sixth assumptions are relaxed individually and in combination. Each distinct combination of assumptions within a basic model is referred to as a "scenario." Figure 1 gives the list of scenarios, which aids in following the organization of the study.

Rationality Postulates

Background

Harsanyi (1977) sets forth five postulates of rational behavior and three postulates of rational expectations for game situations. These postulates form the basis for analysis in this study. Taken together, they provide a working definition of rationality. Before listing the postulates, a brief explanation of terminology is in order.[3]

A game situation is a situation in which the outcome depends on interaction between two or more rational players, each pursuing his own interests. (This study deals primarily with a two-person game,

	One Taxpayer	Risk Neutrality	Costless Auditing	Costless Litigation	Complete Information
S1	X	X	X	X	X
S2	X	X	X		X
S3	X		X	X	X
S4	X		X		X
S5	X	X		X	X
S6	X	X			X
S7	X				X
S8		X	X	X	X
S9		X	X		X
S10			X	X	X
S11			X		X
S12		X		X	X
S13		X			X
S14					X
S15	X	X	X	X	
S16	X	X	X		
S17	X		X	X	
S18	X		X		
S19	X	X		X	
S20	X	X			
S21	X				
S22		X	X	X	
S23		X	X		
S24			X	X	
S25			X		
S26		X		X	
S27		X			
S28					

X--Indicates assumption maintained in scenario

Figure 1. List of Scenarios

but the theory of games has been extended to situations involving more than two players.) Each player is assumed to behave as if he assigned a numerical utility or payoff to each possible physical outcome, according to a certain utility function. The greater the payoff the more the player prefers a particular outcome.

At a particular stage of a game a player may have several alternative courses of action available; these are called choices. A full description of which choice a player would make at every possible stage is called a strategy. Thus a strategy (or pure strategy) consists of a sequence of choices. A set of strategies containing exactly one strategy for each of two or more players is called a joint strategy. (In the case of two players, a joint strategy is sometimes referred to as a strategy pair.)

The rules of the game, as noted previously, specify the actions each player can take, the amount of information he will have available and the consequences of his actions for all players. Technically a game is a game situation with fully specified rules. A stochastic event influencing the course of the game may be modeled as a set of alternative choices of an imaginary chance player. The rules of the game must specify the probability distribution over alternative outcomes of this chance event. (For example, nature could be treated as a chance player, with "rain" and "shine" being two alternative states of nature, having respective probabilities of, say, 0.2 and 0.8.) The strategies selected by the players determine the outcome of the game and their utility functions determine their payoffs. (Of course, if there is a chance event in the game, the strategies chosen by the human players determine only probability distributions over payoffs.)

Now, in a two-person game, if the strategy s_i^* gives player i (i = 1,2) the greatest payoff of all available strategies when player j (j = 1,2; j ≠ i) uses strategy s_j, then s_i^* is said to be player i's <u>best reply</u> to s_j. Player i's best reply to a given strategy s_j of player j is not necessarily unique; if it <u>is</u> unique, it is called player i's <u>only best reply</u> to s_j. A set of strategies in which every strategy is a best reply to the strategy (combination) of the remaining player(s) is called an <u>equilibrium point</u>.

If player i has no definite expectation about the strategy player j will use but can form only a subjective probability distribution over all possible strategies of player j, the strategy s_i^* yielding the highest payoff <u>on average</u> (based on the mean of the subjective probability distribution over player j's strategies) is called player i's <u>subjective best reply</u> to player j's expected mean strategy.

Assume that player i uses strategy s_i. Then the lowest payoff he can obtain, regardless of the strategy employed by player j, is called player i's <u>security level</u> for strategy s_i. The highest security level player i can obtain with <u>any</u> strategy s_i is called player i's <u>maximin payoff</u>. A player can be assured of receiving at least his maximin payoff; moreover, it is the highest payoff he can <u>count on</u> receiving (though in a given game it might be possible to receive a higher payoff). Any strategy having the maximin payoff as its security level is called a <u>maximin strategy</u>. A game in which a player cannot rationally expect to receive more than his maximin payoff is said to be <u>unprofitable</u> to that player; all other games are said to be <u>profitable</u> to the player.

Game theorists have found it useful to assume that every game is preceded by a bargaining game, in which the players make offers in an attempt to agree on their strategies for the main game and hence their payoffs from the main game. It is bargaining games which are of interest in the current study. A player's strategy in a bargaining game is called a bargaining strategy, and it consists of a decision rule which tells the player whether (1) to make a concession (that is, to accept a lower payoff than previously demanded) or (2) to insist on his last offer.

It is now possible to list the rationality postulates paraphrased from Harsanyi (1977) and adapted to the two-person situation.

The Postulates

A1. Maximin postulate. In any game unprofitable to a given player, that player should always use a maximin strategy. (If one cannot expect to receive more than his maximin payoff, then he should use a strategy which assures at least that much.)

A2. Best-reply postulate. In any game profitable to a given player, that player should always use a best-reply strategy to the strategy of the other player, to the extent any binding agreements between the players allow.

A3. Subjective-best-reply postulate (Bayesian expected-utility maximization postulate). In a bargaining game associated with a game profitable to a given player, that player should always use a bargaining strategy which is a subjective best reply to the expected mean strategy of the other player. (In general, in a bargaining game a player cannot definitely predict the other player's bargaining strategy and therefore cannot be expected to identify an actual best-reply strategy as in postulate A2.)

A4. Acceptance-of-higher-payoffs postulate. (1) In the course of a bargaining game, if a given player is willing to agree to a joint strategy s for the main game, then he must be even more willing to agree to another joint strategy s* which yields a higher payoff. (2) In a bargaining game if, lacking any special agreement to the contrary, both players would use a joint bargaining strategy (b_1,b_2), then player i (i = 1,2) must be willing to enter into an agreement whereby both players will shift to a joint bargaining strategy (b_1^*,b_2^*) yielding player i a higher payoff.

A5. Equiprobability postulate. Given a set of alternative strategies, all equally consistent with the other rationality postulates and all expected to yield the same payoff, a player will be equally likely to use any particular strategy in the set.

The three postulates which follow are postulates of rational expectations.

B1. Mutually expected-rationality postulate. A rational player (that is, one who follows these eight rationality postulates) must expect, and act on the expectation, that the other player will also conform to the rationality postulates.

B2. Symmetric-expectations postulate. A player cannot choose a bargaining strategy on the expectation that a rational opponent will choose a different bargaining strategy and, in particular, that he will choose a more concessive strategy. (In other words, player i cannot expect palyer j, who is equally rational, to behave more concessively than player i would in the same situation.)

B3. Expected-independence-of-irrelevant-variables postulate. A player cannot expect a rational opponent to make his bargaining strategy dependent on variables whose relevance to bargaining decisions cannot be established on the basis of these rationality postulates. This rules out some completely extraneous, arbitrary decision rules that might be consistent with the other postulates but lack any demonstrable connection with expected utility maximization.

Summary

This chapter has introduced the basic models and their assumptions and has outlined the structure of the remaining chapters. A brief discussion of some fundamental game theory concepts led into a specification of the postulates which are assumed to guide the behavior of rational individuals in an interactive setting. In the next chapter, Basic Model I is presented.

ENDNOTES

[1]Posner (1972, 1973) internalizes the court decision as an endogenous function of the two parties' legal expenditures but is unable to find what he considers to be a satisfactory way to avoid making arbitrary assumptions about their reaction patterns to changes in each other's level of expenditures.

[2]It could be assumed that the Revenue agent is compensated by a principal (the "government") as an increasing function of the tax "won" from the taxpayer, net of any costs incurred in auditing and litigating. Although this is not empirically the case, it would tend to encourage behavior such as that exhibited by IRS representatives in contested valuation cases. Such an assumption about an incentive function would not alter the results in this study if one assumes fixed audit and litigation costs and hence a one-to-one functional relationship between the agent's compensation and the value of the property in question. (An agency theory approach to the study of incentive contracts for IRS representatives could form the basis of an interesting related study.)

[3]Chapters 5 and 6 of Harsanyi (1977) provide detailed discussions of these concepts.

CHAPTER III

BASIC MODEL I

One Taxpayer, Complete Information

Overview

This chapter explores, in seven progressively complex scenarios, the implications of alternative sets of assumptions for taxpayer-IRS behavior in valuation disputes. It is assumed throughout that both parties have complete information about the situation and that there is only one taxpayer. The primary issues addressed are (1) the effects of litigation costs, audit costs and risk aversion on the decision to litigate or settle out of court and (2) the nature of any negotiated settlement. Numerical examples are included to illustrate selected results.

All Assumptions in Place (S1)

In this simplest setting it is assumed that the taxpayer (T) and the Revenue Service agent (R) are risk neutral and possess complete information. There are no direct costs of auditing or litigating (for example, attorney fees, lost time) to either party. Filing of the tax return is a one-time event; no past, future or other contemporaneous returns are considered.

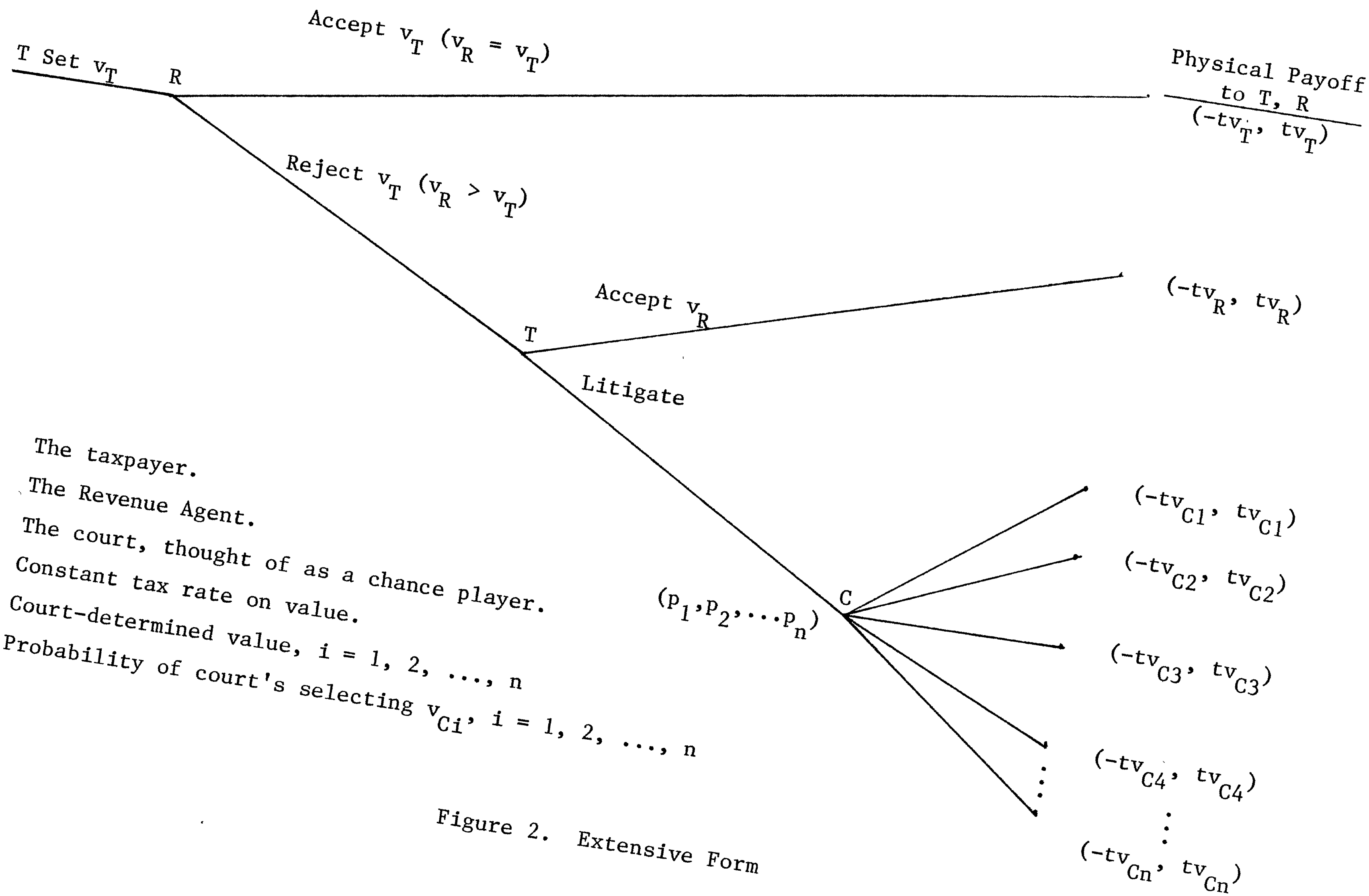
The court-determined value is viewed as a random variable V_C, distributed according to some known probability density function, independent of the values claimed by the litigants but limited by the "facts of the case" to some range between a minimum value v_{min} and a maximum value v_{max}. Thus the possible outcomes consist of the finite set of whole-cent amounts in the closed interval $[v_{min}, v_{max}]$, with $v_{min} \geq 0$. Plausible arguments can be formulated to support any value within this range.

For example, an estate might contend that the decendent's management services were indispensable to a closely-held corporation so that shares in that corporation reported on the return were of little value on the date of death or alternate valuation date. A survey of Internal Revenue Code Section 2031(a) on value of property in general, Section 2031(b) and Revenue Ruling 59-60 on unlisted stock, Treasury Regulations Section 20.2031-1(b) on "fair market value," textbooks and handbooks (such as Stephens, Maxfield, and Lind (1978) and Hoffman (1982)) suggests that the range of possible values is narrower for some types of assets than for others. It is usually easier to establish a reasonable range of values for an automobile than for an original art object or stock in a close corporation. Englebrecht and Davison (1977) cite a case in which the taxpayer's three expert witnesses valued the same closely-held stock at \$822, \$980, and \$1,320 per share while the Service produced two experts who valued the stock at \$3,400 and \$4,000 per share. The court finally returned a value of \$2,200 per share. The present analysis applies to any situation in which the Code and Regulations fail to pinpoint value (that is, virtually all cases where there is no observable market price) but is especially important in the many instances in which the difference between v_{min} and v_{max} is "large." At best, application of guidelines to the facts of a case can determine a reasonable v_{min} and v_{max}. Although "facts" will naturally be cited to support any particular position, the absence of specific formulas, procedures and weights for relevant factors (Englebrecht and Jamison, 1979; Boatsman and Baskin, 1981) means that both disputants can support any value they wish between v_{min} and v_{max}.

The taxpayer returns (reports on the tax return) a value v_T, resulting in a tax tv_T, there t is the tax rate, which is assumed constant. The agent, observing v_T, decides whether to audit the return and assert a value $v_R > v_T$ or to accept v_T as filed. Should the agent assert v_R, negotiations are permitted, allowing for the possibility of an out-of-court settlement.[1] Failure of negotiations to produce a settlement results in litigation--the bargainers do not simply walk away in a "no-trade" outcome.

Observe that this is a two-person, constant-sum game; the tax one player loses the other gains. The players are strict adversaries. They have strictly opposite interests, making this a noncooperative game (Harsanyi, 1977). Figure 2 illustrates the extensive form or game tree representation of the game, where the risk-neutrality assumption permits expression of payoffs or utilities in terms of money. Figure 3 illustrates the normal form, from which the maximin solution is evident.[2]

Use of maximin strategies by both players leads to auditing by the agent and nonacquiescence by the taxpayer, resulting in litigation. Obviously, in this simple scenario, there is no economic incentive to litigate or not to litigate, provided negotiations produce a settlement equal to the jointly held expectation $E(V_C)$. Equivalently, there is no



T: The taxpayer.
R: The Revenue Agent.
C: The court, thought of as a chance player.
t: Constant tax rate on value.
v_{Ci}: Court-determined value, $i = 1, 2, \ldots, n$
p_i: Probability of court's selecting v_{Ci}, $i = 1, 2, \ldots, n$

Figure 2. Extensive Form

reason for negotiations to fail to produce such a settlement since neither party expects to obtain a more favorable result by litigating. Thus the players should arrive at a settlement equal to $E(V_C)$ or go to court and obtain a value v_C (not necessarily equal to $E(V_C)$, of course).[3] It is clear that the existence of the court drives the litigants' behavior; the court either will decide the case directly or will provide the basis for a negotiated settlement.

Revenue Agent's Pure Strategies

Taxpayer's Pure Strategies

$$\begin{array}{l} \\ \text{Accept } v_R \\ \text{Litigate} \end{array}\begin{array}{c} \begin{array}{cc} \text{Accept } v_T \ (v_R = v_T) & \text{Reject } v_T \ (v_R > v_T) \end{array} \\ \left[\begin{array}{cc} (-tv_T,\ tv_T) & (-tv_R,\ tv_R) \\ (-tv_T,\ tv_T) & (-tE(V_C),\ tE(V_C)) \end{array}\right] \end{array}$$

Maximin Solution

$$E(V_C) = \sum_{i=1}^{n} v_{Ci}p_i$$

Figure 3. Normal Form

Example. Suppose the possible values of a certain asset in an estate are \$1, \$2, \$3, \$4, \$5, and \$6, depending on how one weights various valuation factors mentioned in the Code, Regulations, previous cases and other available guidance. The taxpayer favors a value of \$1 while the agent prefers a value of \$6. The court, if used, will decide the case by rolling a fair die and selecting the value which turns up. Both parties are aware of this uniform distribution and will compute the expected value $E(V_C)$ = \$3.50. Neither expects to achieve a more favorable solution than \$3.50 by litigating, and they are both risk neutral, so \$3.50 is the certainty equivalent of a litigated solution. Both would be indifferent between settling on a value of \$3.50 and litigating. The maximin postulate implies that neither would accept a less favorable settlement, and the mutually-expected-rationality and symmetric-expectations postulates imply that neither can expect the other to do so. In the language of the next scenario (S2), the value \$3.50 is the only point which satisfies both the individual rationality and joint rationality conditions.

Costly Litigation (S2)

Relax the costless litigation assumption, allowing for fixed costs L_T and L_R. Intuitively, these costs create an incentive to settle out of court. Analysis of the situation in light of postulates of rational behavior and rational expectations yields the same conclusion but proceeds even further by specifying a determinate bargaining outcome from two different perspectives.

Classical economic theory proposes the following rationality requirements for a bargaining solution (Harsanyi, 1977).

1. Individual rationality. The solution must provide payoffs to both players at least as favorable as those that are obtainable if negotiations break down (the conflict payoffs). In the present context, a rational player would not accept a negotiated value if he expected to fare better by litigating. In Figure 4, if the origin represents the conflict payoffs, and if the achievable payoff combinations are those within the triangular area AOB, then a bargained outcome must lie above and to the right of the origin.

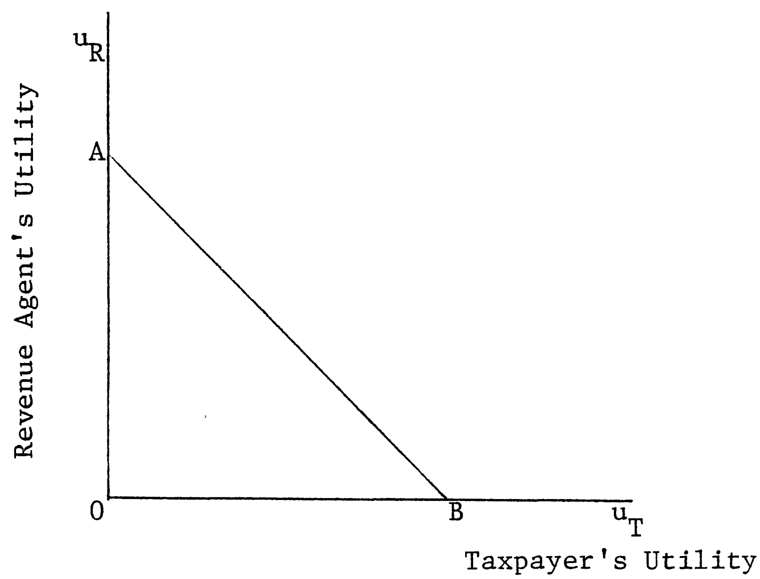


Figure 4. Payoff Space

2. Joint rationality or joint efficiency. The settlement cannot be improved upon for both players simultaneously. In the present context, the taxpayer and agent would not agree to a value if there is an available alternative that would increase the utility of both.

In Figure 4, this means that the agreement must lie on the upper right-hand boundary, AB.

Note that any costlessly negotiated agreement is efficient in the sense of the joint efficiency requirement; any alternative would reduce the payoff to either the taxpayer or the agent.

The individual rationality requirement implies that the taxpayer will not accept a negotiated value v unless the tax $t \cdot v$ is less than the expected outlay associated with litigation, $tE(V_C) + L_T$. Likewise, the agent will not accept a negotiated value v unless the tax $t \cdot v$ is at least as great as the expected net proceeds from litigation, $tE(V_C) - L_R$. In summary, a negotiated value v must produce a tax which satisfies

$$tE(V_C) - L_R \leq tv \leq tE(V_C) + L_T \tag{1}$$

In terms of value, dividing by t yields

$$E(V_C) - \frac{L_R}{t} \leq v \leq E(V_C) + \frac{L_T}{t} \tag{2}$$

Any value within the negotiation set specified by (2) is a potential settlement point. The key concept here is that the two parties may cooperate in order to avoid litigation costs. Any negotiated outcome within the negotiation set represents an allocation of the joint benefit of the saved litigation costs.

Harsanyi (1977) discusses two perspectives from which bargaining theorists have approached the problem of finding a determinate solution within the negotiation set. Nash's model, published in 1950, corresponds to the normal form of the bargaining game, specifying a solution without addressing the process or series of mutual concessions by which the solution might obtain. On the other hand, Zeuthen's earlier bargaining model, reported in 1930, corresponds to the extensive form of the bargaining game and does supply a description of how the bargaining process may unfold. It has been shown that the Nash and Zeuthen approaches, though very different, are mathematically equivalent; moreover, Harsanyi has shown that the choice rule which Zeuthen stated a priori for deciding whether to make a bargaining concession actually follows from rationality postulates A3, A4, B1, B2, and B3 in Chapter II of this study.

Nash (1930) showed that for rational bargainers an agreement point exists and is unique. Furthermore, it can be identified as that point v* which maximizes the Nash product (as applied to the taxpayer-Revenue agent setting)

$$N(v) = (U_T(v) - U_T(c))(U_R(v) - U_R(c)) \tag{3}$$

where c is the expected conflict outcome or court outcome which would occur in the absence of a settlement.[4]

In the present scenario, with risk neutrality, the utilities attached to a particular value v may be expressed in terms of dollars paid or received:

$$U_T(v) = -tv,$$

$$U_R(v) = tv.$$

(The minus sign reflects a cash outflow on the part of the taxpayer--utility decreases as value increases.) The utilities associated with the conflict or no-agreement situation are

$$U_T(c) = -tE(V_C) - L_T$$

and

$$U_R(c) = tE(V_C) - L_R \ .$$

To find the v* which maximizes (3), expand the expression as follows:

$$N(v) = (U_T(v) - U_T(c))(U_R(v) - U_R(c))$$

$$= (-tv + tE(V_C) + L_T)(tv - tE(V_C) + L_R)$$

$$= -t^2v^2 + 2t^2vE(V_C) - tvL_R - t^2(E(V_C))^2 + tE(V_C)L_R +$$

$$tvL_T - tE(V_C)L_T + L_TL_R$$

Differentiating with respect to v and setting the derivative equal to zero yields

$$N'(v) = -2t^2v + 2t^2E(V_C) - tL_R + tL_T = 0$$

So

$$v^* = \frac{2tE(V_C) - L_R + L_T}{2t} \tag{4}$$

Observe that $N''(v) = -2t^2$, which is always negative. Thus v* in (4) represents the value of v which maximizes the Nash product N(v).

Example. Let $E(V_C)$ = \$150, L_T = \$20, L_R = \$10 and t = 0.2. Then the negotiation set identified by inequality (2) is \$100 $\leq$ v $\leq$ \$250. That is, both parties would rather secure an agreement on the disputed value between \$100 and \$250 than go to court. This is evident from Table I. The taxpayer would not agree to a value higher than \$250 (tax of \$50) while the agent would not agree to a value lower than

\$100 (tax of \$20) because these payoffs are expected to be available through litigation. The third column of the table shows the result of the linear transformations $U_T^*(v) = U_T(v) + tE(V_C) + L_T$ and $U_R^*(v) = U_R(v) - tE(V_C) + L_R$, which translate the conflict point to (0,0). These transformations reveal the allocation of the saved litigation costs, a total of \$30, effected by each potential settlement. An agreement setting v = \$100 would permit the taxpayer to capture the entire \$30 cost saving, while a settlement with v = \$250 would shift the full benefit to the Revenue agent.

TABLE I

SOME POTENTIAL NEGOTIATED SETTLEMENTS

v	$(u_T,u_R) = (-.2v,.2v)$	Allocation of Saved Costs (u_T^*,u_R^*)
\$100	(-\$20, \$20)	(\$30, \$ 0)
110	(- 22, 22)	(28, 2)
140	(- 28, 28)	(22, 8)
150	(- 30, 30)	(20, 10)
160	(- 32, 32)	(18, 12)
175	(- 35, 35)	(15, 15)
200	(- 40, 40)	(10, 20)
250	(- 50, 50)	(0, 30)

It is interesting to note that the Nash solution, $v^* = \$175$, allocates the cost saving equally--\$15 to each player. Because in this example the respective litigation costs, $L_T = \$20$ and $L_R = \$10$, are unequal, the Revenue agent captures \$5 of the taxpayer's savings. In general, the player with greater litigation costs in such a setting has more to lose by litigating and will therefore have to behave more concessively.[5] Only if L_T and L_R were equal would the Nash solution equal the expected court value $E(V_C)$. Equivalently, only if L_T and L_R were equal would $E(V_C)$ be the midpoint of the negotiation set.

Zeuthen (Harsanyi, 1977) models the bargaining process as a succession of stages. Assume that at stage k the taxpayer has proposed v_T^k and the Revenue agent has proposed v_R^k as the value of the property. The taxpayer would prefer his own offer to that of the agent but would prefer either offer to the conflict situation, which entails litigation costs. Analogously, the agent would prefer his own proposal to that of the taxpayer but views either as superior to litigation. Thus

$$U_T(c) < U_T(v_R) < U_T(v_T)$$

and

$$U_R(c) < U_R(v_T) < U_R(v_R)$$

Consider a simplified bargaining situation in which each player is restricted to a choice between full insistence on his own last proposal and full acceptance of his opponent's last proposal (Harsanyi, 1977). Zeuthen uses this simplified setting to derive a measure of each player's willingness to risk a conflict and uses this measure to identify the player who will have to make the next concession.

To develop Zeuthen's measure, assume that the taxpayer, T, assigns the subjective probability p_{RT} to the event that the Revenue agent, R, will refuse to concede. Then the subjective probability which T assigns to the event that R will fully concede is $1 - p_{RT}$. Now, if T fully concedes, assume he will obtain the payoff $U_T(v_R)$ with certainty; but, if T refuses to concede, he may obtain the superior payoff $U_T(v_T)$ or the inferior payoff $U_T(c)$, depending on R's choice of whether to concede or hold out, respectively.

In order to maximize expected utility, T will compare the expected utility of holding out against the utility of accepting R's last offer. That is, T will choose to hold out only if

Expected utility of holding out $\geq$ Utility of R's last offer

$$(1 - p_{RT})U_T(v_T) + p_{RT}U_T(c) \geq U_T(v_R)$$

By rearranging terms, this condition becomes

$$p_{RT} \leq \frac{U_T(v_T) - U_T(v_R)}{U_T(v_T) - U_T(c)} \tag{5}$$

The fraction on the right-hand side in (5) is called T's <u>risk limit</u>, r_T. It represents a ceiling on the subjective probability p_{RT} of a conflict that T would be willing to face in order to obtain an agreement on his own terms as opposed to R's last proposal. Any higher value of p_{RT} would lead T to accept v_R. The greater r_T is, the greater T's incentive to risk a conflict rather than accept R's last offer. Thus r_T measures the taxpayer's willingness to risk a conflict.

All the foregoing discussion applies with the subscripts R and T reversed. Moreover, in the complete information setting, both players know each other's r value as well as their own, leading to what

Harsanyi (1977) calls "psychological pressure" on the one with the lower r value to make the next concession.

Zeuthen's Principle (Harsanyi, 1977), adapted to the taxpayer-Revenue agent setting, states that

1. If $r_T > r_R$, then the Revenue agent must make the next concession;
2. If $r_T < r_R$, then the taxpayer must make the next concession; and
3. If $r_T = r_R$, then both parties must make a concession.

The important point is not how large the concessions are but who makes them at each stage; as long as Zeuthen's Principle is followed, the same ultimate outcome will result, namely, the Nash solution. It is Zeuthen's Principle which Harsanyi (1977), as mentioned earlier, has shown to follow from the rationality postulates.[6] Zeuthen had accepted it on the basis of its plausibility.

Example. As in the preceding example, let $E(V_C) = \$150$, $L_T = \$20$, $L_R = \$10$ and $t = 0.2$. For convenience, use the transformed utility functions $U_T^*(v) = U_T(v) + tE(V_C) + L_T$ (that is, $U_T^*(v) = -.2v + 50$) and $U_R^*(v) = U_R(v) - tE(V_C) + L_R$ (that is, $U_R^*(v) = .2v - 20$). Under these transformations, $U_T^*(c) = U_T(c) + 50 = -50 + 50 = 0$, and $U_R^*(c) = U_R(c) - 20 = 20 - 20 = 0$. Thus

$$r_T = \frac{U_T^*(v_T) - U_T^*(v_R)}{U_T^*(v_T)}$$

and

$$r_R = \frac{U_R^*(v_R) - U_R^*(v_T)}{U_R^*(v_R)}$$

Now suppose T proposes $v_T = \$100$ and R proposes $v_R = \$250$. Then

$$r_T = \frac{(50 - .2(100)) - (50 - .2(250))}{50 - .2(100)} = 1$$

and

$$r_R = \frac{(.2(250) - 20) - (.2(100) - 20)}{.2(250) - 20} = 1$$

This indicates that both should make concessions.

Suppose $v_T = \$110$, $v_R = \$245$. Then $r_T = 0.9643$ and $r_R = 0.9655$. Since $r_T < r_R$, the taxpayer should make the next concession.

Luce and Raiffa (1957) observe that the Nash solution is equivalent to the two-person Shapley Value. Of the \$30 joint benefit of cooperation in the example, the Shapley allocation to the taxpayer is the average of (a) the amount of total litigation cost he can definitely save noncooperatively (\$0) and (b) the marginal amount (\$30 - \$0 = \$30) he contributes by cooperating with the Revenue agent (where the \$0 in the preceding parenthetical computation reflects the amount of joint cost R can save noncooperatively). The analogous computation yields the Shapley allocation to the agent. As in the Nash model, each player realizes \$15 of the total cost savings.

It should be noted that policy prohibits the IRS from explicitly considering court costs when forming a decision on whether to allow a case to go to court. This may have the artificial effect of setting $L_R = 0$ in both parties' decision models. The model implies that this will tend to make the Service less concessive in negotiations, to its own economic detriment (at least from a single-period, single-taxpayer perspective). On the other hand, the IRS does desire to limit the number of cases it litigates and therefore implicitly considers some type of court cost, perhaps nonpecuniary in nature.

Risk Aversion (S3)

In relaxing the risk-neutrality assumption, the most reasonable alternative is to assume that at least one of the parties is risk averse. The assumption of complete information remains in place in this scenario; the parties' subjective probability assessments coincide with the objective distribution of the court decision. Litigation is assumed costless in order to focus on the effect of risk aversion.

The taxpayer would just be willing to pay with certainty some tax CE_T (certainty equivalent) greater than $tE(V_C)$ in order to avoid the risk associated with the court decision. Similarly, a risk-averse Revenue agent would just be willing to accept with certainty some tax CE_R less than $tE(V_C)$ to avoid the risk associated with the court action. In summary, $CE_R < tE(V_C) < CE_T$.

Thus, even in the absence of litigation costs, an incentive exists for negotiating. The negotiation set is defined by the possible settlements which produce a tax within the closed interval $[CE_R, CE_T]$. Points in the negotiation set satisfy the individual and joint rationality conditions discussed in scenario S2. Clearly the negotiation set will be skewed in monetary terms in favor of the party who is less risk averse.

Example. Assume the taxpayer exhibits constant risk aversion and that the Revenue agent is risk neutral. The taxpayer's utility for a cash outflow of x dollars is $U_T(x) = -e^x$, while the agent's utility is $U_R(x) = x$. Observe that $U_T'(x) = -e^x < 0$, indicating decreasing utility for tax. Also, $U_T''(x) = -e^x < 0$, indicating risk aversion. The risk measure (Keeney and Raiffa, 1976, p. 183) is

$$q_T(x) = \frac{U''(x)}{U'(x)} = 1$$

so the taxpayer is constantly risk averse (Keeney and Raiffa, p. 186).

Now assume that the random variable V_C (the court decision) follows a uniform distribution, resulting in a tax between tv_{min} and tv_{max}. To simplify notation, let a = tv_{min} and b = tv_{max}. Then the expected utility to the taxpayer of litigating the uncertain tax X_c is

$$E(U_T(X_c)) = \int_a^b -e^x \frac{1}{b-a}\,dx$$

$$= \frac{e^b - e^a}{a - b}$$

To find the certainty equivalent tax, find the tax $\hat{x}$ which provides the same amount of utility as the expected utility of the litigation lottery:

$$\text{set } U_T(\hat{x}) = E(U_T(X_c))$$

$$-e^{\hat{x}} = \frac{e^b - e^a}{a - b}$$

$$\hat{x} = \ln\left(\frac{e^b - e^a}{b - a}\right)$$

For instance, suppose a = 0 and b = 10. Then $\hat{x} = \ln\left(\frac{e^{10} - 1}{10}\right) = \$7.70$. So the taxpayer in this case would be willing to pay as much as \$7.70 in tax for certain rather than litigate (where the expected outcome is a tax of only \$5 but is risky).

For the Revenue agent, the expected utility of litigation is

$$E(U_R(X_c)) = \int_a^b x \frac{1}{b-a}\,dx$$

$$= \frac{a + b}{2}$$

But this is just the expected court award so, as is characteristic of risk neutrality, $CE_R = E(X_c)$. If a = 0 and b = 10, then $CE_R = 5$.

The negotiation set in this example, then, is [5, 7.70]. Each party is aware of this and should attempt to obtain concessions from the other. The Nash product, in terms of tax, is

$$N(x) = (U_T(x) - U_T(c))(U_R(x) - U_R(c))$$

$$= (-e^x - \frac{e^b - e^a}{a-b})(x - \frac{a+b}{2})$$

Differentiating and setting N'(c) = 0 yields

$$e^x(\frac{a+b}{2} - x - 1) - \frac{e^b - e^a}{a-b} = 0$$

For a = 0 and b = 10, the above gives a Nash solution of x = \$6.70. Thus the Revenue agent in this example is able to exploit the taxpayer's risk aversion to obtain a negotiated tax which is 34 percent greater than the mutually expected court award.

Risk Aversion and Costly Litigation (S4)

This scenario combines the two aspects of a court solution just discussed--costs and risk. The former creates an incentive to settle out of court, as does the latter, for risk-averse players. These incentives manifest themselves as a negotiation set--a range of possible settlements which both parties would prefer to litigation. Which, if any, of these settlements will actually obtain depends on interaction of the two players. The Nash bargaining solution concept from game theory suggests that the settlement should be that which maximizes the product of the players' utilities (net of the respective conflict payoffs which each expects in the absence of agreement).

The essential difference between the present situation and the two preceding scenarios lies in a widening of the negotiation set. In the case of risk aversion without litigation costs, the negotiation set was $[CE_R, CE_T]$. Introduction of litigation costs L_T and L_R broadens this interval to $[CE_R', CE_T']$, where CE_R' is the Revenue agent's certainty equivalent for the litigation lottery, with cost L_R deducted from each consequence, and where CE_T' is the taxpayer's certainty equivalent with L_T added to each consequence of the lottery.

Proposition. Under the assumptions of scenario S4, the following are true:

a. $CE_R' < CE_R$

b. $CE_T' > CE_T$

Proof.

a. CE_R' is that tax $\hat{x}_R'$ such that

$$U_R(\hat{x}_R') = E(U_R(X_c - L_R))$$

where X_c is the court-determined tax. Likewise, CE_R is that tax $\hat{x}_R$ such that

$$U_R(\hat{x}_R) = E(U_R(X_c))$$

But subtracting the constant L_R makes $E(U_T(X_c - L_R)) < E(U_T(X_c))$, so $U_R(\hat{x}_R') < U_R(\hat{x}_R)$. Since U_R is monotonically increasing, $\hat{x}_R' < \hat{x}_R$, as claimed.

b. CE_T' is that tax $\hat{x}_T'$ such that

$$U_T(\hat{x}_T') = E(U_T(X_c + L_T))$$

Similarly, CE_T is that tax $\hat{x}_T$ such that

$$U_T(\hat{x}_T) = E(U_T(X_c))$$

But $E(U_T(X_c + L_T)) < E(U_T(X_c))$ since the taxpayer's utility decreases with cash outflow. Therefore, $U_T(\hat{x}_T') < U_T(\hat{x}_T)$ and by the monotonically decreasing property of U_T, $\hat{x}_T' > \hat{x}_T$, as claimed.

The foregoing proposition asserts that the negotiation set expands when nonzero litigation costs are included in the risk averse model. As the following example illustrates, the expansion is additive and linear in nature in the special case where a player exhibits constant risk aversion (that is, has an exponential utility function) or is risk neutral.[7]

Example. Assume the taxpayer is risk averse and the Revenue agent is risk neutral. $U_T(x) = -e^x$ and $U_R(x) = x$, as in the preceding example. In addition, the parties incur fixed litigation costs L_T and L_R with certainty if the court is used.

The taxpayer's expected utility for a uniformly distributed, court-decreed tax X_c, plus constant litigation cost L_T, is

$$E(U_T(X_c + L_T)) = \int_a^b -e^{x+L_T} \frac{1}{b-a}\, dx$$

$$= \frac{e^{L_T}}{a-b} \int_a^b e^x\, dx$$

where a and b are as in the preceding example. This reduces to

$$E(U_T(X_c + L_T)) = \frac{e^{L_T}(e^b - e^a)}{a-b}$$

Setting $U_T(\hat{x}) = E(U_T(X_c + L_T))$ to find the certainty equivalent,

$$-e^{\hat{x}} = \frac{e^{L_T}(e^b - e^a)}{a-b}$$

$$\hat{x} = L_T + \ln\left(\frac{e^b - e^a}{b-a} \right)$$

Notice that this is equal to $L_T + CE_T$ if CE_T represents the certainty equivalent computed without litigation costs. For instance, if a = 0 and b = 10, with $L_T = 2$, $\hat{x} = 2 + 7.70 = \$9.70$.

Now, for the Revenue agent, the expected utility of litigation is

$$E(U_R(X_c - L_R)) = \int_a^b (x - L_R) \frac{1}{b-a} \, dx$$

$$= \frac{a+b}{2} - L_R$$

Notice that if CE_R represents the certainty equivalent in the costless litigation case, the new certainty equivalent is $CE_R - L_R$. For instance, if a = 0 and b = 10, with $L_R = 1$, the Revenue agent's certainty equivalent is 5 - 1 = \$4.

The negotiation set in this numerical example is [4, 9.70], as compared with [5, 7.70] in the costless litigation case. Litigation costs skew the negotiation set in favor of the player with the smaller litigation costs.

The Nash product here is

$$N(x) = \left(-e^x - \frac{e^{L_T}(e^b - e^a)}{a-b}\right)\left(x - \left(\frac{a+b}{2} - L_R\right)\right)$$

Differentiating and setting $N'(x) = 0$ results in the equation

$$e^x\left(\frac{a+b}{2} - x - L_R - 1\right) = \frac{e^{L_T}(e^b - e^a)}{a-b}$$

If a = 0, b = 10, $L_R = 1$ and $L_T = 2$, the Nash solution is x = \$8.07, as compared to \$6.70 in the costless litigation case. Here the Revenue agent is able to obtain additional tax as a result of the taxpayer's greater litigation costs.

Costly Auditing (S5)

Although unrealistic, it is instructive to assume for the moment that the tax return examination process is costly to both parties but that litigation is not. This focuses attention on the manner in which communication arrangements affect the situation. Certainly pre-audit communication is different from that which occurs during an audit and subsequent pre-trial negotiations. Consideration of a pre-audit stage distinguishes the present study from previous work on out-of-court settlement such as Posner (1973), Rubin (1977), and Gould (1973) and economic analyses of labor-management negotiations such as those by Farber and Katz (1979) and Bloom (1981). Those studies do not address a possible pre-negotiation stage.

Assume fixed audit costs A_T and A_R are incurred with certainty in the event of an audit. There are no litigation costs. If the value returned by the taxpayer is unsatisfactory to the Revenue Service agent, a conflict situation (audit) arises. (In scenarios with litigation costs and/or risk aversion, the notion of a conflict applies to litigation. Here, however, where litigation is costless and the players are risk neutral with homogeneous expectations, neither player can inflict further damage on the other once audit costs have been incurred. The audit costs become sunk costs at that point.)

When the taxpayer files his return in this scenario, he irrevocably commits himself to accepting a particular value v_T and concomitant tax tv_T. The return-filing procedure serves to inform the Revenue Service agent of this fact before the agent has selected his own demand. The taxpayer's commitment is irrevocable and constitutes an ultimatum in that the agent has a choice only between a conflict (audit) and full acceptance of v_T. He can challenge v_T only by paying A_R to audit. Harsanyi (1977) calls such a situation an ultimatum game. Empirically, ultimatum games are unusual. They can occur between two rational players only if the communication facilities are strongly biased in favor of one of the players. This is the situation which exists in a "voluntary" self-assessment system of tax compliance. The Revenue Service normally becomes aware of an estate or gift tax liability only when a return is filed.

The outcome of an ultimatum game differs from that of an ordinary bargaining game. In the ordinary bargaining games of scenarios S2, S3, and S4, the solution tended to lie reasonably near the center of the negotiation set. The more similar the two players' risk and cost profiles, the stronger this tendency. However, the solution of an ultimatum game lies close to an end point of the negotiation set. In the present scenario, the taxpayer will set his "ultimatum value" v_T such that $tv_T = tE(V_c) - A_R + \varepsilon$, where the ε represents any nominal amount, say \$0.01. This ultimatum value is essentially equal to the Revenue Service agent's concession limit.

Example. Let A_T = \$3, A_R = \$4, t = 20% and $E(V_c)$ = \$150. Litigation is costless. Then the apparent negotiation set in terms of cash flows is $[tE(V_c) - A_R, tE(V_c) + A_T]$, which in this example is [26, 33]. Both players would prefer any settlement in the interior of this interval to going through an audit and arriving at a settlement of $tE(V_c)$ as in scenario S1. However, because the taxpayer has the initiative, he can set v_T so that tv_T lies just above the agent's concession limit of \$26, say v_T = \$130.05 (making tv_T = \$26.01). It would then be irrational in this one-period world for the agent to audit because the best payoff he can expect to net from that course of action is $tE(V_c) - A_R$ = \$26. Auditing would not allow him to obtain a more favorable settlement from the taxpayer, whose audit cost would then become a sunk cost.

Costly Auditing and Costly Litigation (S6)

When litigation costs are reintroduced into the model in conjunction with audit costs, two levels of conflict emerge. The occurrence of an audit is one level of conflict situation--outcomes for both players are reduced by their respective audit costs, which would have been avoidable if the taxpayer had returned a value satisfactory to the agent. The second level of conflict situation is litigation, with its attendant costs and risks--the result of failure to reach a negotiated settlement.

Because the taxpayer communicates his demand v_T first and since the agent must either accept v_T or force the first level of conflict (audit), an ultimatum game exists in this scenario. However, if an audit were to occur, the game would become an ordinary bargaining game from that point on. Audit costs would then become sunk costs, and the two players would negotiate the Nash solution v* based solely on the expected court decision and their respective litigation costs, as in scenario S2.

Now, because the Revenue Service agent can always achieve the Nash solution (Harsanyi, 1977), his concession limit with respect to the initial value v_T is $tv^* - A_R$. That is, the agent will audit if and only if $tv_T < tv^* - A_R$. Comparison with the preceding scenario reveals that the tax based on the Nash value has replaced that based on the expected court-determined value alone in the agent's concession limit.

Accordingly, the taxpayer will choose v_T such that $tv_T = \max(tv^* - A_R + \varepsilon, 0)$. (Again, the ε is an illustrative nominal amount, say \$0.01.) Observe that the greater the agent's audit cost A_R the lower the value the taxpayer can return. Moreover, impounded in the Nash value v^* are the relative bargaining strengths of the two players with respect to litigation costs. For instance, a relatively high litigation cost L_T for the taxpayer tends to increase v^*, resulting in a higher reported v_T.

Note also that the taxpayer's audit cost A_T is irrelevant in this one-taxpayer, single-period setting. Because of the ultimatum character of the return-filing stage, with communications biased in favor of the taxpayer, the Revenue Service agent cannot effectively use the taxpayer's audit cost as a bargaining threat.

Basing v_T on the Nash solution obviates actual verbal bargaining and thus constitutes an example of tacit bargaining.[8]

<u>Example</u>. As in the preceding example, let $A_T = \$3$, $A_R = \$4$, $t = 20\%$, and $E(V_c) = \$150$. Let the utility functions be those in the examples in scenario S2, with $L_T = \$20$ and $L_R = \$10$, resulting in a Nash solution of $v^* = \$175$.

The taxpayer in this situation will set $tv_T = tv^* - A_R + \$0.01 = \$31.01$. Then $v_T = \$155.05$. This provides the Revenue agent slightly more revenue than he expects to net by auditing. The taxpayer does not wish to induce an audit since that would be expected to result in a total cash outflow of $tv^* + A_T = \$38.00$. Even if A_T were zero, an audit would produce an expected cash requirement of \$35.00.

Risk Aversion with Costly Auditing and Litigation (S7)

In scenario S4 it was found that the negotiation set is skewed in monetary terms in favor of the player who is less risk averse.[9] This produces a (possibly) different Nash solution from that negotiated by risk-neutral players. This is one difference between the present situation and the preceding scenario. In addition, where utilities are not assumed to be linear in money, it is appropriate to replace cash outcomes with utilities in the exposition.

Accordingly, the taxpayer will now return an ultimatum value v_T just a nominal amount above that value which yields to the Revenue Service agent the same utility as the Nash solution less audit cost. That is, $U_R(tv_T) = \max[U_R(tv^* - A_R + \varepsilon), U_R(0)]$, where v^* is the Nash solution in the presence of risk aversion.[10] Thus the reintroduction of risk aversion at this stage of the analysis produces little conceptual difference from the preceding scenario. The essence of risk aversion is captured in the Nash solution itself.

Chapter Summary

This chapter has addressed rational bargaining behavior between one taxpayer and a Revenue Service agent in a setting of complete information. It was shown that litigation costs and risk aversion create incentives for resolving estate and gift tax valuation disputes out of court. Similarly, audit costs create an incentive for settling without even going through the audit process, but here the communication system is strongly biased in favor of the taxpayer. Consequently, a rational taxpayer will return a value equal to the expected negotiated settlement, discounted by an amount reflecting the agent's auditing cost.

With respect to the nature of any negotiated settlement, rational behavior and rational expectations lead the taxpayer and agent to the Nash-Zeuthen-Harsanyi bargaining solution. This agreement point was computed for some illustrative examples. The negotiation set of potential settlements tends to be skewed in favor (monetarily) of the party with lower litigation costs and less risk aversion.

Since in no situation in the chapter was there an incentive to litigate, a tentative implication of this basic analysis is that policymakers might encourage out-of-court settlements by attempting to approximate an environment of complete information. For example, a requirement that the courts write lucid and informative decisions would presumably enhance litigants' attempts to estimate the objective probability distribution of valuation decisions. (Whether this is an appropriate conclusion will become more apparent in Chapter IV, where the complete information assumption is relaxed.)

ENDNOTES

[1]This is consistent with the settlement authority of the Internal Revenue Service.

[2]Recall that the normal form displays the game as if each player chose a full strategy in advance. The matrix entries give the expected payoff for each combination of strategies of the two players. The taxpayer's maximin strategy is represented by Row 2 (litigate) because the "worst" possible loss from employing that strategy is $-tE(V_C)$, which is superior to the worst possible loss ($-tv_R$) from employing strategy 1. Similarly, the agent's maximin strategy is Column 2 (reject v_T) because the worst possible gain ($tE(V_C)$) with that strategy is superior to the worst possible gain (tv_T) from employing strategy 1. Note that the lower left-hand entry of the matrix in Figure 3 represents the irrational but technically feasible possibility that the taxpayer would litigate even though the agent had accepted v_T. This corresponds to a bifurcation of the top branch of the extended form in Figure 2 whereby the technical possibility of litigation in such a situation could be portrayed; this option is omitted from Figure 2 as unrealistic. Also, litigation is loosely referred to as a strategy or choice; actually, institutional characteristics of the situation make litigation the automatic result of a breakdown in negotiations.

[3]Following the usual convention, the random variable V_c is represented by a capital letter while the particular value v_c is denoted in lower case.

[4]Sundem (1979) applied the Nash solution in another accounting-related context--that of the information evaluator (IE) - decision maker (EM) in information economics. He advises that the Nash concept is not above criticism and observes that such theories provide insights but not unique solutions to the IE-DM problem. Perhaps the taxpayer-Revenue agent setting, for which numerical data may be obtainable, will provide an arena for empirical testing of the Nash concept. Problems arising in similar efforts in the area of labor negotiations are discussed by Hamermesh (1973), Bognanno and Dworkin (1975), Bowlby and Shriver (1978) and Svejnar (1980).

[5]For instance, if the taxpayer viewed publicity associated with litigation as a cost (Norwood et al., 1979), the agent's bargaining position would be improved.

[6]Harsanyi (1977) supplies details of these arguments. His Theorem 8.4 (p. 158) states that the condition that the two players conform to the rationality postulates is sufficient to assure the Nash solution.

[7]This additive, linear expansion does not hold in general.

[8]The principle of <u>tacit bargaining</u> (Harsanyi, 1977) implies that rational players, if sufficiently "intelligent," can reach any agreement they would reach by ordinary bargaining by mere tacit or nonvocal bargaining. Fellner (1965) and Schelling (1960), two proponents of the tacit bargaining principle, suggest that agreements may be reached by signaling each other's intentions without actually negotiating. In some cases, a certain agreement point may seem obvious or at least conspicuous to both parties, and they might therefore propose that point independently (Schelling, 1960). In the complete information setting the only rational settlement point is the Nash solution.

[9]In the special case of the exponential utility function, the expanded negotiation set is $[CE_R - L_R - A_R, CE_T + L_T + A_T]$.

[10]Since the Nash solution is available with certainty (Harsanyi, 1977), the utility function notation is not strictly necessary; cash outcomes would suffice.

CHAPTER IV

BASIC MODEL II

Multiple Taxpayers, Complete Information

Overview

Throughout this chapter the Revenue Service agent faces more than one taxpayer, each with one property to be valued. Other assumptions of the basic model are maintained or relaxed in the same sequential manner as in Chapter III, resulting in seven scenarios, numbered S8 through S14. In those settings where auditing and/or litigation are costly activities, it is assumed that the Revenue Service agent must operate with limited resources. If there are n taxpayers, time and/or budgetary constraints allow the agent to audit or litigate only k ($k < n$) cases.

All Assumptions in Place (S8)

In this setting, a risk-neutral Revenue Service agent faces n ($n > 1$) risk-neutral taxpayers. Auditing and litigation are costless. Each taxpayer has full information regarding the other taxpayers and the Revenue Service agent, and the agent has full information about all taxpayers. This information includes all players' utility functions, the range of possible values of properties in question and the objective probability distribution of court-determined values. This somewhat approximates real conditions in that a taxpayer normally has a reasonable idea of how his situation compares with that of other taxpayers. It is assumed that taxpayers cannot form coalitions.

Because no constraints exist on auditing and litigating, this scenario parallels the first scenario (S1) in Chapter III. The agent will treat each case independently, settling each in precisely the manner described in S1. Each taxpayer and the agent will be indifferent between a court-determined value v_c or an out-of-court settlement equal to the mutually expected $E(V_c)$. No new issues arise from considering multiple taxpayers.

Costly Litigation (S9)

The assumptions of this setting are the same as those of the preceding scenario except that litigation causes the Revenue agent and taxpayer to incur fixed costs L_R and L_{Ti} ($i = 1, 2, \ldots, n$), respectively. The agent is assumed to be able to observe all n tax returns within a single period and to base his audit and litigation strategy on information about all of them; in other words, he may wait until all n returns are received before making commitments to audit any of them.

Now, if the Revenue Service agent has adequate resources to litigate against all n taxpayers, he can and should treat each case independently, negotiating a Nash settlement precisely as in the one-taxpayer situation (S2). No new issues arise beyond those addressed in the one-taxpayer case.

The more interesting situation is that in which the agent has resources (money and/or time) to litigate against only k taxpayers, where $1 \leq k < n$. Assume for the moment that there are no audit costs. (Audit costs are considered in scenarios S12, S13, and S14.)

In such a situation, there is no incentive for the ith taxpayer to return a value v_{Ti} greater than zero. If audited, the worst expected outcome is a cash payment of $tE(V_{ci}) + L_{Ti}$, and a more favorable outcome should be available through negotiation. Furthermore, if the Revenue agent's litigation capability is exhausted, the taxpayer will be invulnerable to the litigation threat and can negotiate a zero tax.

However, consider the problem from the agent's perspective. He can list the taxpayers in decreasing order of $E(V_{ci})$, for i = 1, 2, ..., n. Thus the taxpayer with the greatest enforceable potential tax liability is numbered T_1. If the agent audits T_1 first, then a Nash settlement will be attainable as in scenario S2. Rational behavior on the part of T_1 and the agent results in a negotiated agreement which avoids litigation costs and is preferred by both players to litigation. (From T_1's point of view there is no incentive to litigate. Were the taxpayers able to collude, they could litigate until the agent's resources were exhausted, leaving the remaining n-k taxpayers free to pay no tax; a scheme of side payments could then be used to allocate the joint benefit of cooperation.) Thus a binding agreement is obtained, and the case of T_1 is closed.

Now the Revenue Service agent audits taxpayer T_2, who has the second largest potential tax liability. Still armed with a credible threat strategy, the agent negotiates a Nash settlement with T_2. Continuing in this manner, the agent obtains a mutually satisfactory agreement with each of the n taxpayers. The only requirements are that the agent be capable of litigating against one and they they not collude.

Suppose that, instead of beginning with the taxpayer with the greatest potential tax liability, the Revenue agent selected first some other taxpayer T_i for audit. Under the assumption of complete information, T_i knows how many cases the agent can litigate and how many taxpayers have a greater potential tax liability than his own. If the agent can litigate against k taxpayers, if the taxpayers are listed in descending order of potential tax (from T_1 through T_n), and if $i > k$, then T_i knows it would be irrational for the agent to expend scarce litigation resources against him. Litigating these "small" cases to the extent of exhausting his litigation resources would eliminate the agent's threat strategy. Consequently, T_i may be in a position to negotiate a zero tax.

Simply stated, the agent will audit the top "layer" of k taxpayers on the list first, then the next k, and so on. Order is unimportant within a given layer, but departure from the layer scheme places the agent in a bargaining situation with no credible threat strategy.

The foregoing arguments support the following conclusion.

Proposition. Assume the following:

a. The assumptions of scenario S4 hold, with n noncolluding taxpayers;

b. The Revenue Service agent can litigate k cases ($1 \leq k < n$); and

c. The n taxpayers are numbered $T_1, T_2, \ldots, T_n$, in nonincreasing order of expected court-determined property value $E(V_{ci})$ ($i = 1, 2, \ldots, n$).

Then a rational Revenue Service agent will negotiate Nash bargaining agreements first with taxpayers $T_1, \ldots, T_k$; then with $T_{k+1}, \ldots, T_{2k}$; . . . ; $T_{mk+1}, \ldots, T_{(m+1)k}$; etc., ($m = 0, 1, \ldots$) until the list of taxpayers is exhausted.

Risk Aversion (S10)

As in Chapter III, allowing risk aversion on the part of one or more players is presumably the most appropriate alternative to the risk-neutrality assumption. In this scenario auditing and litigation are costless so that the direct effect of risk aversion can be isolated.

The absence of auditing and litigation costs enables the Revenue agent to audit and settle every case independently; processing one case does not affect the agent's ability to process others. Therefore, in those cases involving risk-neutral taxpayers, a risk-neutral agent will obtain in-court or out-of-court settlements as in scenarios S1 and S8. In those cases where the agent and/or taxpayer are risk averse, the analysis of scenario S3 applies. One would expect to observe an out-of-court settlement between the two certainty equivalents. As in S3, the Nash solution is offered as the rational settlement point.

A plausible speculation is that in a multiple-taxpayer environment the Revenue Service agent will tend to exhibit risk neutrality. Faced with numerous cases, a diversification effect should occur, with the prospect of "winning" some cases offsetting the prospect of "losing" some others. However, the agent's aversion to risk seems likely to be stronger when the variance is higher--that is, in the relatively few large cases. This suggests one partial explanation for published data from The Wall Street Journal (1973) cited by Gould (1973) and reproduced as Table II. The data, released by the IRS in compliance with a court order, indicate that the Service settles over 90 percent of disputed cases out-of-court and that the settlement, as a percent of the initially alleged extra tax, decreases as the size of the case increases.

As in scenario S3, the negotiation set may be less skewed in favor of the Service in larger cases.[1]

TABLE II

PERCENT OF AGENT-ALLEGED EXTRA TAX DUE SETTLED FOR BY APPELLATE DIVISION IN CASES NOT DOCKETED FOR LITIGATION

Initial Alleged Shortage	Percent Settled For 1971	1972
\$ 1 - \$ 999	68%	67%
1,000 - 9,999	63	61
10,000 - 49,999	50	53
50,000 - 99,999	44	44
100,000 - 499,999	38	39
500,000 - 999,999	37	35
\$1 million and over	24	34

Source: Gould (1973).

Risk Aversion and Costly Litigation (S11)

As in scenario S9, the agent's optimal strategy is to partition the n taxpayers into layers of size k according to amount of potential tax. The presence of risk aversion merely widens each of the n negotiation sets and results in possibly different Nash solutions from those achieved in S9.

Costly Auditing (S12)

An interesting shift of the focus of the game appears when audit costs are admitted into the analysis. Although the game between each taxpayer and the Revenue Service agent is still present, a budgetary or time constraint preventing the agent from auditing everyone induces a game among the taxpayers themselves. Whether a certain taxpayer is audited depends partially on the other taxpayers' situations and strategies.

In this scenario it is assumed that an audit imposes a fixed cost on one or both parties to an audit but that litigation is costless. (Litigation cannot be conducted, however, unless an audit has occurred.) Under these conditions, if the Revenue agent has adequate resources to audit all taxpayers (albeit at some cost), the situation takes on the character of n independent copies of scenario S5. Each taxpayer T_i will return the ultimatum value v_T for which $tv_T = \max(tE(V_{ci}) - A_{Ri} + 1¢, 0)$. This makes it unprofitable for the agent to audit anyone.

Now assume a budgetary and/or time constraint permits the agent to conduct only k audits, where $1 \leq k < n$. Assume, however, that he can and does observe all reported values, confirming them in light of his complete information. Thus information gathering is not a role of auditing in this scenario. This screening process fully reveals the potential gains from auditing (up to the probability distribution of court-determined values).

Any taxpayer T_i who returns v_{Ti} such that $tv_{Ti} < tE(V_{ci}) - A_{Ri}$, as in the one-taxpayer setting, is safe from audit. Returning the minimum such "ultimatum value" is preferable to being audited, which would result in an expected payout of $tE(V_{ci}) + A_{Ti}$. But in the present scenario, in which the Revenue Service agent can conduct a limited number of audits, the question arises whether a taxpayer could successfully return a value lower than the ultimatum value. In the one-taxpayer setting, such action would draw an audit with certainty; in the multiple-taxpayer environment it might appear that a "low-priority" taxpayer--one with a relatively small potential tax--could, with impunity, report a zero value.

Nevertheless, this conjecture fails. All the Revenue Service agent need do is annouce a policy of auditing all returns for which $tv_{Ti} < tE(V_{ci}) - A_{Ri}$, in descending order of $E(V_{ci})$. Unable to collude with other taxpayers, the one with the greatest $E(V_{ci})$, say T_1, will then set $tv_{Ti} = tE(V_{c1}) - A_{R1}$. This frees the agent to audit T_2, who has the second largest $E(V_c)$. Knowing this, T_2 will set $tv_2 = tE(V_{c2}) - A_{R2}$. The pattern continues through all n taxpayers. No audits occur, but if $tE(V_{ci}) - A_{Ri} > 0$ for all i, the total revenue collected is $\sum_{i=1}^{n} (tE(V_{ci}) - A_{Ri})$, which equals the expected amount that would be collected if the agent could and did audit every return.

The only complication arises if there exists a stratum of m taxpayers $(k < m \leq n)$ with the same $tE(V_{ci}) - A_{Ri}$. Consider the situation a taxpayer T_i in such a stratum faces. If he returns his ultimatum value, he will, with certainty, escape audit. If he returns an amount less than his ultimatum value, he may or may not escape audit, depending on what the other m-1 taxpayers in the stratum do. Note that his security level for any strategy of reporting a value lower than the ultimatum value is $tE(V_{ci}) + A_{Ti}$. This is his expected payoff if the other members of the stratum report their ultimatum values. Moreover, this is the security level of any probability mixture of strategies which involves a strategy of returning less than the ultimatum value. On the other hand, his security level for the strategy of returning his ultimatum value is $tE(V_{ci}) - A_{Ri}$. This is the most favorable security level for any strategy and is therefore T_i's maximin payoff. Returning the ultimatum value, then, is a maximin strategy.

Lemma 1. Let $s = (s_1, s_2, \ldots, s_m)$ be any equilibrium point for the m taxpayers with the same value of $tE(V_{ci}) - A_{Ri}$. Then s is a maximin point.

Proof. An equilibrium point always yields each player at least his maximin payoff (Harsanyi, 1977). If any strategy component s_i of s involves reporting a v_{Ti} lower than the ultimatum value, then at least one taxpayer will be audited, producing for that taxpayer a payoff less favorable than his maximin payoff, contrary to the assumption that s is an equilibrium point. Therefore, all strategies in s must report the ultimatum value, making s a maximin point.

Lemma 2. The game is unprofitable to all m taxpayers in the stratum.

Proof. Since, by Lemma 1, no equilibrium point yields any taxpayer a payoff superior to his maximin payoff, every equilibrium point is unprofitable to every player. Thus no player can rationally expect to receive better than his maximin payoff and the game is unprofitable to every player.

The arguments in the foregoing paragraphs establish the following.

Proposition. In a one-period, complete-information setting with n risk-neutral, noncolluding taxpayers and costly auditing, every taxpayer will return a value v_{Ti} just large enough to make it unprofitable for the Revenue Service agent to audit that taxpayer.

The threat of an audit, with its attendant cost, induces every taxpayer to return v_T such that $tv_T = tE(V_{ci}) - A_{Ri}$ (plus, say, 1¢).

To summarize this scenario, the following observations were made:

a. Even though the Revenue Service agent cannot audit everyone, every taxpayer will behave as if the agent would audit if it were profitable to do so. This stems from the agent's complete information and the inability of taxpayers to form coalitions.

b. Because of this behavior, there will be no actual audits or litigation. The Revenue Service agent will collect total revenue of $\sum_{i=1}^{n} (tE(V_{ci}) - A_{Ri})$, provided $tE(V_{ci}) - A_{Ri} > 0$ for all i.

Costly Auditing and Costly Litigation (S13)

In the preceding scenario, in which litigation was costless, the rational solution to a dispute over the value of property was $E(V_{ci})$. When litigation costs are considered, a rational Revenue Service agent would arrive at the Nash solution v_i^* with taxpayer T_i if an audit were to occur.

Now, as in the one-taxpayer case, the costliness of an audit, coupled with the communication bias in favor of the taxpayer, enables the taxpayer to return the ultimatum value v_{Ti} (such that $tv_{Ti} = \max(tv_i^* - A_{Ri} + 1¢, 0)$) on a take-it-or-leave-it basis. The agent will "leave it" because in this one-period setting with complete information there is nothing to be gained by conducting random unprofitable audits. But the question again arises whether a taxpayer could successfully avoid audit while returning lower than his ultimatum value when the agent lacks the capability to audit all n taxpayers. This question was addressed in scenario S12, where it was found that the answer is negative in a noncooperative, complete-information environment.

Reintroducing litigation costs produces no conceptual difference from scenario S12, except for the substitution of the Nash value v_i^* in place of $E(V_{Ci})$. Thus every potential conflict will be tacitly resolved at the return-filing stage, with each taxpayer returning his ultimatum value. Because the Nash solution impounds relative litigation costs, the ultimatum value does so as well. Consequently, it is to the agent's advantage to reduce litigation (and auditing) costs even though under the complete information assumption no litigation or audits will actually occur.

Risk Aversion with Costly Auditing and Litigation (S14)

As in scenario S7, the reintroduction of risk aversion causes no conceptual change from the risk-neutrality situation, except for the use of the Nash settlement v_i^* for (possibly) risk-averse players. Taxpayer T_i will return a value v_{Ti} such that $U_R(tv_{Ti}) = \max[U_R(tv_i^* - A_{Ri} + 1¢), U_R(0)]$. This v_{Ti} is the taxpayer's ultimatum value, and the agent will accept it. The threat of an audit induces the n noncolluding taxpayers to play their maximin strategies of reporting their ultimatum values as in S12.

Chapter Summary

This chapter extends the one-taxpayer analysis of Chapter III to a multiple-taxpayer environment. The results are similar. Even with a limited capacity to audit, the Revenue agent is able to extract a "reasonable" tax, based on the "true" or court-determined value, from every taxpayer. With taxpayer collusion disallowed, each taxpayer essentially faces the agent independently. Although the fact that the taxpayer has the first move allows him to submit an ultimatum value which takes advantage of the agent's audit cost, a rational taxpayer would not unilaterally return a lower value in an environment of complete information. Luce and Raiffa (1957) discuss such a situation, in which rational pursuit of self interest forces players into a socially undesirable outcome. They acknowledge that the players will be "completely frustrated." Harsanyi (1977) suggests the term "quasi-solution" for such a maximin "solution." The players (taxpayers) are simply protecting their maximin payoffs; each player is setting an objective which can be achieved without cooperation.

In conclusion, in order to find a rationale for auditing and litigating, apart from their threat or deterrent value, it will be necessary to relax the assumption of complete information. This is the theme of the following chapter.

ENDNOTE

[1]This does not explain why the percents drop off so drastically as case size increases. Posner (1972) argues that an administrative agency may vigorously pursue small cases in the aggregate because of a higher anticipated success rate, and that smaller disputants tend to be relatively pessimistic about their chances in court (a manifestation of incomplete information, to be discussed in the next chapter), giving the agency more bargaining power in small cases. Of course, larger taxpayers probably tend to employ more aggressive attorneys and accountants.

CHAPTER V

BASIC MODEL III

One Taxpayer, Incomplete Information

Overview

Since the complete information assumption implies that all players know the rules of the game, relaxing that assumption requires a specification of which rules or aspects of the situation are unknown to whom. Total ignorance on the part of all players is needlessly severe, so one must be selective with respect to the amount and type of information assumed unknown.

It seems appropriate to assume (1) that the tax return does not necessarily reveal full information about the property being valued, so there is an information asymmetry, (2) that an audit removes the asymmetry, and (3) that despite equal information the disputants may have divergent probability beliefs about the court decision.[1] All other aspects of the complete information assumption are retained.

All Assumptions in Place (S15)

Because there are not audit costs in this scenario, the return will be audited, and the parties will have equal information. The difference, then, between this scenario and previous setting lies in the possibility of divergent probability assessments of the court-determined outcome.

Although the parties are assumed to possess equal information at the conclusion of an IRS examination, that information may not reveal the objective probability distribution of the court decision. As a product of differing backgrounds, roles, preferences and information processing techniques, the players may form divergent subjective probability beliefs. For instance, Raiffa (1982) reports that experimental subjects with identical information and with roles of plaintiff or defendant assigned, tended to view their own chances in litigation as better than their opponents viewed them. On the other hand, control subjects without assigned roles tended to agree on their probability assessments.

In order to keep the range of possible combinations of directions of divergence and relative litigation costs and risk premiums manageable and to enhance realism, it will be assumed throughout this study that where probability assessments diverge it is in the "mutually optimistic" direction reported by Raiffa (1982). This eliminates the apparently unlikely situation in which each disputant views his own chances in court as worse than his opponent views them.

Now, if the taxpayer's subjective probability distribution has mean $E_T(V_c)$, the Revenue agent's has mean $E_R(V_c)$, and $E_R(V_c) > E_T(V_c)$, then the negotiation set is empty and all cases will be litigated. Each party has no incentive to litigate and, in this particular scenario, no incentive not to litigate.

Note that if the court selects any value v_c between $E_T(V_c)$ and $E_R(V_c)$, both litigatns may be expected to express dissatisfaction with the outcome. This phenomenon, which is anomalous in a constant-sum situation, is said to be observed from time to time in actual litigation.

Costly Litigation (S16)

With costless auditing, the return will be audited, placing the Revenue Service agent on an equal footing with the taxpayer with regard to information. If, despite equal information, they are still mutually optimistic about going to court, they have an incentive to litigate. However, litigation costs constitute a disincentive. Thus whether a case goes to court depends on the relative strengths of these conflicting incentives.

Case 1. Assume that $E_T(V_c) < E_R(V_c)$ but $tE_T(V_c) + L_T > tE_R(V_c) - L_R$. That is, the taxpayer expects the court to determine a value which is lower than the Revenue agent expects, but when litigation costs are considered, the taxpayer expects to pay more than the agent expects to net. This creates a negotiation set. Any outcome in the interval $(tE_R(V_c) - L_R,\ tE_T(V_c) + L_T)$ would make both players better off than would a litigated solution.

If the players communicate their expectations during negotiations, the game becomes essentially one of complete information; all the inputs for computing the Zeuthen risk limits (scenario S2) are present, and rational bargaining will lead to the Nash solution.[2]

Example. Let $E_T(V_c) = \$150$, $E_R(V_c) = \$160$, $L_T = \$20$, $L_R = \$10$, and $t = 20\%$. Then $tE_T(V_c) + L_T = \$50$ and $tE_R(V_c) - L_R = \$22$, yielding a negotiation set of (22, 50) in terms of dollars received and paid, or (110, 250) in terms of property value. The Nash product, from equation (3) of Chapter III, is

$$\begin{aligned} N(v) &= (U_T(v) - U_T(c))(U_R(v) - U_R(c)) \\ &= (-tv + tE_T(V_c) + L_T)(tv - tE_R(V_c) + L_R) \\ &= -t^2v^2 + t^2vE_R(V_c) - tvL_R + t^2vE_T(V_c) - t^2E_T(V_c)E_R(V_c) + \\ &\quad tE_T(V_c)L_R + tvL_T - tE_R(V_c)L_T + L_TL_R \end{aligned}$$

$$N'(v) = -2t^2v + t^2E_R(V_c) - tL_R + t^2E_T(V_c) + tL_T$$

Setting $N'(v) = 0$ and solving for the maximizing value v^* yields

$$v^* = \frac{t(E_R(V_c) + E_T(V_c)) - L_R + L_T}{2t} = \$180$$

Note that $N''(v) = -2t^2 < 0$, so v^* maximizes the Nash product. Thus the Nash settlement is a value of \$180, producing a tax of \$36. Since the two players have the same utility function in this scenario, the Nash solution lies at the midpoint of the negotiation set. Note that, in addition to impounding relative litigation costs, the Nash settlement captures the players' expectations. The less optimistic a player is about the court decision, the less willing he will be to risk a conflict and hence the more concessively he will behave.

<u>Case 2</u>. Suppose $E_T(V_c) < E_R(V_c)$ and $tE_T(V_c) + L_T < tE_R(V_c) - L_R$. Here the players are mutually optimistic about litigation, even in the presence of fixed litigation costs. The negotiation set is empty, and all cases will be litigated. The taxpayer and agent are willing to spend L_T and L_R, respectively, to obtain a court decision. This would be irrational in a complete information context and, since the court merely redistributes utility and does not create it, is undesirable in any case.

Consequently, factors which contribute to reducing the "litigation illusion" fostered by incomplete information about the objective probability distribution of court decisions should in turn reduce caseload and inefficient spending for litigation. One such factor is precedent (Schotter, 1978). Development of clear precedent tends to cause convergence of expectations which, when complete, leads to situations such as scenario S2 wherein the costs of the litigation process are saved. If the effectiveness of an external conflict resolution mechanism is inversely related to the frequency of its use, the foregoing arguments support the writing of clear, instructive case decisions as a tool for reducing docket congestion. Thus the consistency with which Englebrecht and Davison (1977) observed the Tax Court to "split the difference" in valuation cases may have some redeeming value as reliable precedent despite its apparent lack of grounding in valuation theory.[3] Similarly, the Bader and Central Trust cases provide usable precedent, though they too have little if any basis in financial theory (Englebrecht and Leeson, 1978).

Risk Aversion (S17)

With costless auditing, the return will be audited, removing any asymmetry of information. If divergence of expectations about a litigated solution persists despite equal information, whether a case goes to court depends on the strength of the players' optimism relative to their aversion to the risk associated with litigating.

Case 1. Suppose $E_T(V_c) < E_R(V_c)$ but $CE_T > CE_R$. That is, the disputants are mutually optimistic with respect to the means of their subjective distributions, but the taxpayer's certainty equivalent is greater than that of the Revenue agent. Thus the taxpayer would be willing to pay CE_T with certainty rather than go to court, and the agent would be willing to accept a lesser amount CE_R to avoid litigating. A diagram of the situation is shown in Figure 5. (Of course, for a risk-averse taxpayer CE_T is always greater than $tE_T(V_c)$ (Keeney and Raiffa, 1976); conversely, for a risk-averse Revenue agent, CE_R is always less than $tE_R(V_c)$ (Keeney and Raiffa, 1976).)

Figure 5. Sketch of Scenario S17, Case 1

This circumstance creates a negotiation set between CE_R and CE_T. This negotiation set is not unlike that of scenario S3 but is narrower for a given level of risk aversion because now the expected values do not coincide. The Nash solution again describes the rational resolution of the conflict.

Example. Assume, as in the example in scenario S3, that $U_T(x) = -e^{x}$ and $U_R(x) = x$. Assume that the taxpayer believes that the random variable V_c follows a uniform distribution, resulting in a tax between a and b. The Revenue agent also believes V_c is uniformly distributed but results in a tax between a and d, where d > b. Then $tE_T(V_c) = \frac{a+b}{2} < \frac{a+d}{2} = tE_R(V_c)$.

As in S3, $CE_T = \ln(\frac{e^b - e^a}{b-a})$. Similarly, $CE_R = \frac{a+d}{2}$. For instance, if a = 0, b = 10, and d = 12, $CE_T = \ln((e^{10} - 1)/10) = \$7.70$ and $CE_R = \$6.00$, so $CE_R < CE_T$, as required. The negotiation set is [6.00, 7.70], which is narrower than the interval [5.00, 7.70] from the example in S3. The Nash product, in terms of dollars paid and received, is

$$N(x) = (U_T(x) - U_T(c))(U_R(x) - U_R(c))$$

$$= (-e^x - \frac{e^b - e^a}{a-b})(x - \frac{a+d}{2})$$

Differentiating and setting N'(x) = 0 yields

$$e^x(\frac{a+d}{2} - x - 1) - \frac{e^b - e^a}{a-b} = 0$$

For a = 0, b = 10 and d = 12, the Nash solution in terms of tax dollars is x = \$7.00 (which is equivalent to an underlying property value of \$35). This exceeds the Nash solution of \$6.70 in the example in scenario S3 because the Revenue agent in the present case, being more optimistic, is more willing to risk a conflict and therefore will behave less concessively.

Case 2. Suppose $E_T(V_c) < E_R(V_c)$ and $CE_T < CE_R$. This means that mutual optimism prevails to the extent that the amount the taxpayer would be willing to pay to stay out of court falls short of the minimum amount the agent would be willing to accept. Thus the negotiation set is empty and every such case will be litigated.

Risk Aversion and Costly Litigation (S18)

Again, with costless auditing, the Revenue Service agent will audit, thereby removing any information asymmetry. Whether litigation will occur depends on whether the disputants' optimism toward a court solution is sufficiently strong to overcome two sources of aversion to litigation--cost and risk.

As demonstrated in scenario S4, the presence of litigation costs increases the amount a risk-averse taxpayer is willing to pay with certainty to avoid litigation. Likewise, the presence of litigation costs decreases the amount a risk-averse Revenue agent is willing to accept with certainty rather than go to court. This increase or decrease is linear and additive in the special case of players who exhibit constant risk aversion; that is, a taxpayer who was willing to pay CE_T to avoid costless litigation would now be willing to pay $CE_T + L_T$, and a Revenue agent who was willing to accept CE_R would now be willing to accept $CE_R - L_R$. Clearly, then, players in this scenario are more likely to negotiate a settlement than players in the preceding two settings.

Case 1. Suppose $E_T(V_c) < E_R(V_c)$ but $CE_T' > CE_R'$, where the primed certainty equivalents impound litigation costs as in scenario S4. (Thus $CE_T' > CE_T$ if $L_T > 0$, and $CE_R' < CE_R$ if $L_R > 0$.) Figure 6 illustrates the situation. (Note that the condition $CE_T' > CE_R'$ can be fulfilled even if $CE_T < CE_R$ if litigation costs are sufficiently great. Therefore, some case 2 instances in scenario S17 may become case 1 situations upon introduction of litigation costs.)

The interval $[CE_R', CE_T']$ constitutes the negotiation set, within which the Nash solution should be negotiated as in S4.

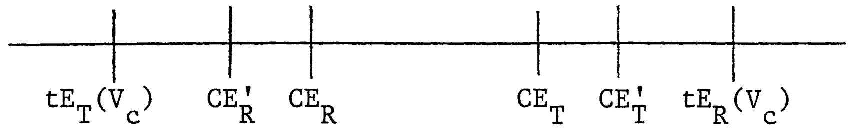


Figure 6. Sketch of Scenario S18, Case 1

Case 2. Suppose $E_T(V_c) < E_R(V_c)$ and $CE_T' < CE_R'$. Then, as in case 2 of scenario S17, the negotiation set vanishes, and litigation will occur. Such instances should be more rare than they would be in a world without either litigation costs or risk aversion, both of which create incentives for out-of-court settlements.[4]

Costly Auditing (S19)

In the complete information environment of S5 it was found that the concept of an ultimatum game is helpful in understanding the situation which arises when auditing costs are considered. Because of the institutional arrangement whereby the taxpayer initiates communication, the taxpayer is able to commit himself to a certain value v_T which the Revenue Service agent can reject only by incurring a decrease in expected net revenue. Consequently, a rational agent in the single-period setting will accept v_T, and no audit will occur.

Relaxing the assumption that both parties have complete information before an audit leaves the ultimatum character of the situation fundamentally intact; the taxpayer still has the communication initiative. Now, however, as in the preceding scenario in this chapter, auditing takes on an information-gathering role inasmuch as the taxpayer normally has private information regarding the property whose value is in question. Unlike the preceding scenarios, if auditing is costly, it is not immediately clear whether an audit will occur.

Upon receipt of the estate tax return, the Revenue Service agent will form a subjective probability distribution of court-determined property values based on available information. This information set includes the information supplied on the return as well as generally available information about similar properties. The agent realizes that the taxpayer may have some private information which is accessible to the agent only through an audit with fixed cost A_R.[5]

Let $E_R(V_c)$ be the mean of the agent's subjective distribution and let t be the tax rate. Then <u>before</u> audit, the agent's assessment of the net proceeds to be received <u>after</u> audit is $tE_R(V_c) - A_R$. (After audit, of course, $E_R(V_c)$ might be adjusted to, say, $E_R'(V_c)$, but the agent does not enjoy the benefit of this hindsight at the point the audit decision must be made.) Now suppose for the moment that the taxpayer, who has access to all information available to the agent, can compute $E_R(V_c)$. Then the situation essentially collapses to that of scenario S5; the taxpayer will return v_T such that tv_T is slightly greater than $tE_R(V_c) - A_R$, and no audit will occur. Suppose, on the other hand, that the taxpayer does not know $E_R(V_c)$. Then he must suffer the consequences of any estimation errors he makes. If he overestimates $E_R(V_c)$, he will pay more tax than necessary. If he underestimates $E_R(V_c)$, he will draw an audit and incur some fixed cost A_T.

If the taxpayer underestimates $E_R(V_c)$, setting $tv_T < tE_R(V_c) - A_R$, the agent's subjective best reply (based on the mean of the subjective probability distribution over the court or chance player's strategies) is to audit. Upon completion of the audit, the scenario becomes identical to S15. Convergent expectations will lead to an out-of-court settlement, while mutually optimistic expectations will encourage litigation. In either case, each party experiences a deadweight loss equal to his audit cost.

Costly Auditing and Costly Litigation (S20)

As in previous scenarios incorporating litigation costs, these costs constitute a deterrent to direct use of the court as a resolution mechanism. If, after audit, the disputants agree on the distribution of possible court decisions, there is an unambiguous out-of-court Nash bargaining solution v^* which will achieve the joint benefit of saving litigation costs. Rational players will negotiate this solution. (Recall that, in contrast, heterogeneous expectations after audit may result in litigation.) Assuming for the moment that homogeneous expectations will obtain after audit, the Nash solution, rather than the court decision itself, becomes the object of prediction prior to audit. Of course, the Nash solution is a derivative of the expected court decision, so the latter is still relevant.

Before audit, the Revenue Service agent will form a prediction v_R^* of v^*. His concession limit with respect to the taxpayer's returned value v_T is $tv_R^* - A_R$. That is, the agent will audit if and only if $tv_T < tv_R^* - A_R$.

Accordingly, the taxpayer will report v_T such that $tv_T = \max(tv_R^* - A_R + \varepsilon, 0)$, where ε is a small positive amount. This construction assumes that the taxpayer can calculate v_R^*. If so, the v_T so established will prevail, and no audit will occur.

If, on the other hand, the taxpayer cannot reliably estimate v_R^*, he may either pay more tax than he could otherwise have paid or may draw an audit. This is a phenomenon of the incomplete information setting which did not exist in the complete information environment of Chapter III.

Now, if there is no assurance that homogeneous expectations will obtain after audit, the situation described in scenario S16 arises. That is, if, despite equal information, the two parties remain sufficiently mutually optimistic about going to court, they may litigate. Case 2 of scenario S16 describes this possibility.

Thus incompleteness of information tends to induce both costly audits and costly litigation.

Risk Aversion with Costly Auditing and Litigation (S21)

Risk averse behavior and litigation costs were combined and considered in scenario S18. It was shown that in a setting of incomplete information risk aversion can overcome mutually optimistic expectations about the court outcome so that out-of-court settlements are possible. Audit costs and litigation costs were combined and considered in scenario S20.

When there is a negotiation set, the presence of risk aversion induces a possibly different Nash solution $v^{*\prime}$ from that negotiated by risk-neutral players. The difficulty the taxpayer faces in calculating $v_R^{*\prime}$, the agent's forecast of the Nash solution, is compounded by the taxpayer's lack of knowledge of the agent's utility function. Previously it was implicitly assumed that both players knew that both utility functions were linear.

The present setting, then, is like scenario S20, with $v_R^{*'}$ replacing v_R^*. The taxpayer will now tend to be less successful in selecting his ultimatum offer v_T in order to pay as little tax as possible while avoiding an audit, owing to a diminished ability to compute $v_R^{*'}$.

Once an audit has occurred, audit costs become sunk costs and the situation becomes identical to scenario S18. Risk aversion will help to mitigate the tendency toward litigation caused by mutual optimism.

Chapter Summary

The chief result of this chapter is the intuitively appealing conclusion that incompleteness of information makes audits and especially litigation more likely despite their cost and even despite aversion to the hazards of litigation. Indeed, risk aversion plays a beneficial role from the two-party, social perspective, in that it creates some otherwise absent negotiation sets.

This chapter sheds light on but does not establish the conjecture offered in the summary of Chapter III that out-of-court settlements are more likely when information is more complete. Whereas in a setting of complete information there is no incentive to litigate, incompleteness of information may foster divergent expectations and thus may lead to costly litigation. On the other hand, incompleteness of information presumably increases the variance of each player's subjective probability distribution of the court outcome. This strengthens risk-averse players' preference for an out-of-court settlement. Thus the general effect of incompleteness of information on the likelihood of litigation is ambiguous.

Another product of incompleteness of information is that the taxpayer may be unable to determine the optimal value to report on the return, leading either to unnecessary tax payments or costly audits.

ENDNOTES

[1]This third assumption, although contrary to the opinion of Rubin (1977), is consistent with empirical findings reported by Raiffa (1982) and theoretical analysis by Schotter (1978).

[2]According to an IRS Appeals Officer questioned during preparation of this study, it is typical for both sides, during negotiations, to communicate their probability estimates regarding the court decision.

[3]The IRS Appeals Officer mentioned in endnote 2 commented that, although unaware of the Englebrecht and Davison study, it had long been his perception that the court used a split-the-difference approach to valuation; he emphasized that court behavior is basic to the appellate process.

[4]It should be noted that incompleteness of information presumably increases the variance of a player's subjective probability distribution of the court decision. Consequently, one would find the negotiation set between risk averse players to be larger, ceteris paribus, than in the complete information setting. The taxpayer's certainty equivalent increases while that of the agent decreases, giving rise to more case 1 and fewer case 2 situations. In the incomplete information case, where the objective distribution of court decisions is not assumed known, conditions are actually those of uncertainty rather than risk.

[5]In a similar valuation context, the Deficit Reduction Act of 1984 requires individual income taxpayers making charitable contributions of property valued at more than $5,000 to attach an independent appraisal to their tax returns. This type of rule provides information to the agent without necessitating an audit.

CHAPTER VI

BASIC MODEL IV

Multiple Taxpayers, Incomplete Information

Overview

This chapter combines issues considered separately in the preceding two chapters. Here the Revenue agent faces more than one taxpayer, each with one property to be valued. In contrast to the multiple taxpayer model considered in Chapter IV, the complete information assumption is now relaxed in the same sense as in Chapter V. Otherwise the development parallels that of Chapter IV, moving through the standard set of scenarios. In those settings where auditing and litigation are not assumed costless, it is assumed that the Revenue Service agent must operate with limited resources. If there are n taxpayers, time and/or budget constraints permit the agent to audit or litigate only k ($k < n$) cases.

All Assumptions in Place (S22)

In this setting, a risk-neutral Revenue Service agent faces n ($n > 1$) risk-neutral taxpayers. Auditing and litigation are costless. The tax return does not necessarily reveal full information about the property being valued, so the taxpayer may have private information. An audit will remove this information asymmetry, but, despite equal information, the taxpayer and agent may have different probability beliefs concerning the court decision.

The absence of auditing and litigation costs reduces this n-taxpayer situation to a set of n independent one-taxpayer situations. The agent will audit all n returns, negotiating or litigating n settlements in conformity with the pattern of the single-taxpayer scenario, S15, in Chapter V. No new issues emerge beyond those considered in S15.

Costly Litigation (23)

Since auditing is costless, the Revenue Agent will audit all n returns, placing him, by assumption, on an equal footing with all n taxpayers with respect to information. Litigation costs provide an incentive for all parties to settle their cases out of court.

If the Revenue Service agent has adequate resources to litigate all n cases, he is in a position to handle each case independently, as in the n-taxpayer, complete information scenario, S9. Incompleteness of information gives each situation the character of case 1 or case 2 of the one-taxpayer scenario, S16. Thus no new conceptual issues arise in the multiple-taxpayer environment provided the agent faces no constraints. The more interesting situation, then, is that in which the agent has the ability to litigate against only k taxpayers, where $1 \leq k < n$.

Again, as a result of costless auditing, the agent will have information on each case equal to that of the taxpayer. Each taxpayer has knowledge of his own case but no specific information about any other. He would be expected to have some general notion of the magnitude of his potential tax relative to that of other taxpayers.

Thus he can estimate whether his case makes him, say, a "big taxpayer," a "small taxpayer" or a "medium-sized taxpayer." It is instructive to assume for the moment that public records of litigated cases are immediately available, making each taxpayer aware of how many cases have already gone to court during the period. Also assume that the Revenue agent's litigation constraint is a matter of public knowledge. Then in a hypothetical situation in which the agent had already litigated k cases during the period, the remaining taxpayers would know they were invulnerable to litigation and would amend their returns to report zero values.

Suppose the agent were to select a tax return haphazardly. Consistent with previous analysis, the situation would have the character of either case 1 or case 2 of scenario S16. That is, mutually optimistic expectations regarding the court decision would either be overcome by or would overcome the effect of litigation costs on the players' decision to litigate. A case-2 situation would result in litigation. After k such cases, the agent's litigation resources would be exhausted and all other taxpayers would escape tax. Some systematic approach to the selection of returns is therefore desirable to the agent if net revenues are to be maximized.

First note that, in the absence of a penalty for underpayment of tax, the possibility of being selected for audit does not induce any taxpayer in this scenario to report a higher property value than he otherwise would. At worst, a Nash settlement can be negotiated or the taxpayer can willingly litigate. Therefore, any auditing strategy that depends on random selection of returns will fail to deter non-compliance unless there is a penalty for underreporting.

The agent, then, will seek to maximize net revenues by pursuing cases in descending order of expected potential tax. He will form an expectation $E_R(V_{ci})$ of each property's court-determined value, for i = 1, 2, ..., n. (This expectation will be formed with the benefit of audit information since auditing is costless.) As in the complete information setting (S9), the agent will take on the largest k taxpayers first. As long as he has the capability of litigating against one taxpayer, he has a credible threat strategy and can achieve the Nash solution in any case-1 solution (that is, in any case in which litigation costs are sufficient to deter litigation despite mutual optimism about the court decision). The problem here which the agent did not face in the complete information environment is that some cases may be litigated. For example, in the extreme case of k = 1, the agent is stripped of his threat strategy as soon as one case goes to court.

Let T_1 be the taxpayer with the greatest expected tax liability; that is,

$$E_R(V_{c1}) = \max_i E_R(V_{ci})$$

If $k > 1$, the agent has a credible threat strategy against T_1, and either the Nash agreement will be achieved, or, if mutual optimism is sufficiently strong, litigation will occur. If k = 1 (or, equivalently, if m cases have already been litigated and k - m = 1), the question arises whether the agent's threat to allow litigation is credible. The taxpayer knows that his is the last case the agent can litigate and that the aggregate tax potentially owed by the remaining taxpayers (which will be foregone by the agent if he litigates this case) may exceed the tax the agent could obtain in the present instance. Will the agent be willing to carry out his threat, or will he conserve resources in the hope of extracting tax from some or all of the remaining (smaller) taxpayers?

If the agent backs down and allows T_1 to report a zero tax, his threat strategy loses credibility. Therefore, if T_1 refuses to concede, the agent must carry out his threat and allow litigation. All remaining taxpayers will then amend their returns to escape tax. It may appear that this constitutes a large opportunity cost to the agent--that exhausting his litigation capability could be disastrous; however, unlike the complete information setting, there was no guarantee that those revenues could ever have been obtained.

To summarize the discussion to this point, the agent may have to exhaust his litigation budget in this environment of incomplete information. This phenomenon should occur despite the taxpayers' inability to collude. Since the tax revenues the agent obtains may come from fewer than the full set of n taxpayers, he should select returns in descending order of expected potential tax. Under the assumption that his litigation constraint is publicly known, he will not necessarily capture the Nash tax from every taxpayer as was possible in the complete information setting of scenario S9. It would seem advantageous, then, for the agent to conceal his litigation budget.

The preceding may suggest why, in practice, IRS negotiators are instructed not to consider litigation costs explicitly in any particular case. This has the effect of withholding information from the taxpayer about the Service's propensity to litigate. In other words, a given taxpayer can be less certain than is assumed in the preceding discussion about the exact number of cases the agent will allow to go to court;

the number k, therefore, is not publicly known, and the agent's threat strategy remains credible even after several cases have been litigated. A review of the foregoing analysis from this perspective suggests that the agent will be able to extract more revenues than indicated in that analysis.

Risk Aversion (S24)

The absence of auditing and litigation costs permits the Revenue Service agent to handle each case independently. The analysis provided in scenario S17 of Chapter V then applies to each case. Recall that a negotiation set arises under the condition that the taxpayer's certainty equivalent tax exceeds that which the agent would be willing to accept.

Risk Aversion and Costly Litigation (S25)

Reintroducing litigation costs, now in the presence of risk aversion, poses no special analytical problems beyond those considered in the costly litigation situation of S23. On the "micro" level, risk aversion affects the nature of each negotiation set but, on the "macro" level, has no effect on the agent's stratified approach to return selection.

Risk aversion widens negotiation sets and creates some sets where none would otherwise have existed. In particular, in the sense of scenario S16, the added incentive to negotiate resulting from risk aversion augments that incentive produced by litigation costs. Thus more cases should be settled out of court than would be negotiated in the presence of litigation costs alone. In a multiple-taxpayer environment, then, the Revenue Service agent will be able to conserve litigation resources more easily than he could in scenario S23. His threat strategy will tend to be credible even longer, and he will be able to extract Nash settlements from more taxpayers before exhausting his capability. Not only will each risk-averse taxpayer who settles with the agent pay more tax, but taxpayers will pay who otherwise would have escaped tax.

Costly Auditing (S26)

Suppose that auditing is not a costless activity. Recall that its role includes, in addition to allowing initiation of negotiations, placing the Revenue Service agent on an equal basis with the taxpayer as to information about the property being valued. That is, auditing has an information-gathering function. Before audit, the agent's estimate of the value a court would determine is presumably inferior to that estimate which is possible after audit.

If the agent has adequate resources to audit all n taxpayers, then each taxpayer will report a value slightly above his estimate of the agent's concession limit, as in the single-taxpayer scenario, S19. Some audits may occur because of taxpayers' inability to determine the agent's estimate of the court decision.

The more interesting consequences of allowing for multiple taxpayers arise when the agent must operate under a constraint which permits only k audits, where $1 \leq k < n$. In the complete information setting of scenario S12 it was found that even under such a constraint the agent received the sum of the n individual ultimatum taxes. In that setting, the agent initiated communications by announcing a policy of auditing all returns for which $tv_{Ti} < tE(V_{ci}) - A_{Ri}$, in descending order of expected court decision, $E(V_{ci})$. This succeeded because all parties knew $E(V_{ci})$ and the taxpayers could not collude. The taxpayer with the greatest potential tax was effectively forced to report his ultimatum tax, as were the other n-1 taxpayers in somewhat of a "domino" pattern.

If it is assumed that all taxpayers can compute the agent's expectation $E_R(V_{ci})$ of each court decision, then the present scenario collapses to that considered in scenario S12; each taxpayer will report v_{Ti} such that tv_{Ti} is slightly greater than $tE_R(V_{ci}) - A_{Ri}$, and no audits will occur. Consider, however, the more plausible condition that the taxpayers cannot necessarily compute all $E_R(V_{ci})$. They may be able to classify themselves approximately as "big," "medium", or "small" taxpayers, as in scenario S23 and actual practice, but they cannot produce a reliable ranking by $E_R(V_{ci})$. Moreover, any approximate ranking one taxpayer might produce is not known by the other taxpayers.

Again, consider a possible audit policy of selecting returns arbitrarily, haphazardly or randomly for audit. No action by the taxpayer, including correct reporting, can afford protection from such a scheme. Therefore, any such approach provides no deterrent to underreporting unless a penalty is imposed for being caught. In the absence of a penalty structure, therefore, the agent must consider a systematic approach to return selection in order to maximize net revenue (tax revenue minus audit cost).

Each taxpayer has an incentive (audit cost) to avoid being audited. Two conditions would enable the Revenue Service agent to exploit this incentive:

1. The agent's audit policy should reward "correct" reporting by decreasing the probability that returns reporting values consistent with the agent's expectations will be audited.

2. The taxpayers must believe that the agent has the capability of conducting at least one audit. The greater the agent's audit capacity, the more correct reporting will occur. (Note the contrast between this statement and the results under complete information in scenario S12. There the ability to conduct only one audit was sufficient to extract the ultimatum tax from any number of taxpayers.)

The natural audit policy, then, is that which selects returns based on the agent's estimate of amount of underpayment. Returns should be selected in descending order of

$$tE_R(V_{ci}) - A_{Ri} - tv_{Ti}$$

Because of errors by taxpayers in estimating $E_R(V_{ci})$, there will be some audits (as in scenario S19). This means that the Revenue Service agent will wish to utilize limited audit resources on the largest cases.

The behavior this policy induces among noncolluding taxpayers depends partially on the size of k relative to n. The k/n ratio or other comparison is an argument in the ith taxpayer's subjective assessment of the probability of being audited. Let $f[k/n, t\hat{E}_R(V_{ci}) - \hat{A}_{Ri} - tv_{Ti}]$ represent this subjective probability function, where $\hat{E}_R(V_{ci})$ is the taxpayer's estimate of the agent's expectation of court-determined value and $\hat{A}_{Ri}$ is the taxpayer's estimate of the agent's audit cost. Then f is an increasing function of both arguments.

If audited, the ith taxpayer expects to pay a tax of $tE_T(V_{ci})$ plus audit cost A_{Ti}. His total expected cash payment, then, is $[tE_T(V_{ci}) + A_{Ti}]f(\cdot,\cdot)$. Holding k/n constant, the expected payment if audited is

$$[tE_T(V_{ci}) + A_{Ti}]f(t\hat{E}_R(V_{ci}) - \hat{A}_{Ri} - tv_{Ti}|k/n)$$

If not audited, the taxpayer's expected payment is $tv_{Ti}(1-f(\cdot))$. The expected cash payment in this game, for a given value of k/n, is therefore equal to

$$[tE_T(V_{ci}) + A_{Ti}]f(t\hat{E}_R(V_{ci}) - \hat{A}_{Ri} - tv_{Ti}) + tv_{Ti}[1 - f(t\hat{E}_R(V_{ci}) - \hat{A}_{Ri} - tv_{Ti}]$$

The taxpayer's decision problem is to select v_{Ti} to minimize this expected payment.

At this point a subtle distinction should be noted between two potential subjective probability distributions a taxpayer might form. One of the n taxpayers might estimate the probability that any taxpayer will be audited, as a function of k/n and the spread between the estimate of the agent's expected court-decreed tax and the tax on the reported value, net of audit cost. The latter argument, $t\hat{E}_R(V_{ci}) - \hat{A}_{Ri} - tv_{Ti}$, clearly contains three variables when all taxpayers are considered ($i = 1, 2, \ldots, n$). In contrast, the taxpayer would be expected to estimate the probability that his particular return will be audited, again as a function of k/n and the spread between the tax on the estimated valuation according to the agent and the tax on the taxpayer's reported value, net of audit cost. Here the $\hat{E}_R(V_{ci})$ and $\hat{A}_{Ri}$ are constant since only one taxpayer is being considered (i is fixed). The probability of audit now varies only as v_{Ti} changes and is conditional not only on k/n but on $\hat{E}_R(V_{ci})$ and $\hat{A}_{Ri}$ as well. For notational convenience, the function $f(v_{Ti}|k/n, \hat{E}_R(V_{ci}), \hat{A}_{Ri})$ will be written as $f(v_T)$ in the following.

The taxpayer's expected cash outflow may now be written

$$[tE_T(V_c) + A_T]f(v_T) + tv_T[1 - f(v_T)] \tag{1}$$

If f is differentiable, setting the first derivative equal to zero yields a necessary condition for a payment-minimizing value of v_T.

$$[tE_T(V_c) + A_T]f'(v_T) + t[1 - f(v_T)) - v_T f'(v_T)] = 0$$

$$[tE_T(V_c) + A_T]f'(v_T) + t - tf(v_T) - tv_T f'(v_T) = 0 \tag{2}$$

Depending on the explicit formulation of $f(v_T)$, it may be possible to solve (2) for the desired v_T. The sufficient condition for v_T to minimize (1) is

$$[tE_T(V_c) + A_T]f''(v_T) - 2tf'(v_T) - tv_T f''(v_T) > 0$$

at that value of v_T.

Observe that an ultimatum game situation exists here as in previous scenarios in which the costless audit assumption was relaxed. The taxpayer's decision model calls for a reported value not exceeding the (estimated) ultimatum value. In other words, the taxpayer makes an irrevocable commitment to a value before the Revenue Service agent chooses his demand. In making that commitment, the taxpayer considers the agent's economic incentives not to waste audit resources. These considerations, in the absence of an underpayment penalty, tend to result in a reported value near or perhaps even below the agent's concession limit, which itself is lower than the property's probable court-decreed value. Unlike the one-taxpayer setting, the present situation calls for the taxpayer to contemplate a nonzero probability of escaping audit. This was not possible even in the multiple-taxpayer setting when complete information was assumed.

Costly Auditing and Costly Litigation (S27)

The analysis of the preceding scenario holds in the present situation with the following modifications:

1. Instead of simply estimating $E_R(V_c)$ as an argument of the probability of audit, the taxpayer will form an estimate $\hat{v}^*_R$ of v^*_R, the agent's prediction of the Nash solution achievable after audit. For example, if the taxpayer believes the agent expects heavy litigation costs, $\hat{v}^*_R$ will be lower than it would otherwise be.

2. Similarly, the taxpayer's own prediction v^*_T of v^* replaces $E_T(V_c)$ in the analysis. The Nash solution, as the expected ultimate outcome, captures relative litigation costs and is the relevant object of prediction.

The appropriateness of a bargaining solution as the predicted ultimate outcome is subject to the existence of enough homogeneity of expectations to produce a "case-1" situation in the sense of scenario S16. A case-1 situation is one in which the players are both optimistic about going to court, but litigation costs are sufficient to dominate their optimism and lead them to a settlement. Otherwise, they will litigate (a "case-2" situation).

To determine whether a taxpayer can predict at the return-filing stage whether case 1 or case 2 will ultimately prevail, consider the condition which distinguishes the two cases. That condition is subjective in nature--each party lacks knowledge of the objective distribution of the court decision, and, moreover, each subjective distribution tends to be biased (in the direction of optimism). It is the extent of this bias that distinguishes the two cases. Given the subjectivity of this condition which sends cases to court, it seems probable that each player is surprised that the other refuses to make a concession. Each is unable to detach himself from his own beliefs and thinks the other must surely be making a mistake by allowing litigation. It is unlikely, then, that at the outset the taxpayer would anticipate litigation; consequently, he will estimate the Nash agreement rather than simply the court decision unadjusted for relative litigation costs.

As always when audit costs are present, the taxpayer is in a position to make an ultimatum offer which makes it barely unprofitable for the Revenue Service agent to perform an audit. Estimation errors in a world with incomplete information, however, will give rise to some audits, raising the possibility that some taxpayers, because of the agent's time and/or budget limitation, will escape audit.

Risk Aversion with Costly Auditing and Litigation (S28)

In scenario S25, where risk aversion was combined with litigation costs, it was found that risk aversion and litigation costs tend to affect the number and size of out-of-court settlements negotiated following audit. Since there were no audit costs in that scenario, the problem of attempting to avoid audit costs was not addressed.

It now becomes potentially important, in the presence of audit costs, for the taxpayer at the return-preparation stage to consider the agent's certainty equivalent tax. In scenarios in this chapter where risk neutrality was assumed it was also implicitly assumed that each player correctly considered the other to be risk neutral. Now the taxpayer should incorporate an estimate of the Revenue Service agent's utility for possible outcomes (rather than simply the dollar amounts of the outcomes) when formulating an optimal value v_T to place on the tax return. This additional estimation problem introduces additional potential error; it is more difficult to estimate the agent's forecast of the Nash solution when that solution is influenced by an unknown utility function.

Compared to the preceding scenario, the taxpayer's diminished ability to discern the agent's utility for potential outcomes should result in (1) a tendency for the occurrence of more audits and (2) a tendency for more taxpayers to pay more tax than necessary to avoid audit. With audit and litigation capabilities limited, the agent will continue to pursue cases from largest to smallest in terms of potential tax. Taxpayers will continue to report ultimatum values in an effort to pay the least tax while avoiding audit. These ultimatum values will be based on the estimated risk-adjusted Nash settlement achievable after audit.

As noted in scenario S10 of Chapter IV, it is possible that any risk aversion on the part of the Revenue Service agent is mitigated by a diversification effect inherent in a multiple-taxpayer environment. This would generally increase the size of negotiated tax settlements.

Chapter Summary

Chapters III, IV, and V served as building blocks for the model discussed in this chapter. Here the Revenue agent faces multiple taxpayers in a setting of incomplete information. Although analysis and conclusions are less precise and more qualitative when the complete information assumption is relaxed, the basic patterns of behavior portrayed in the complete information case remain largely unchanged. Except as explained below, a settlement exists which both players would prefer to litigation because of aversion to litigation costs and to the risk associated with court behavior. Moreover, a tax exists which the taxpayer would rather pay and the Revenue Service agent would rather receive than experience the costs of an audit. Therefore, with restrictions imposed by limited information about the agent's utility function and predicted outcome, the taxpayers will report taxes which they believe are just large enough to prevent audit. Within restrictions stemming from limited information regarding the properties being valued, the agent will pursue cases in descending order of perceived tax deficiency. Perceived tax deficiencies arise when taxpayers have underestimated the agent's expected settlement. Such cases will draw audits, up to some exogenously imposed limit on the agent's auditing capacity. Some taxpayers, because of this limit and because of the relatively small values of their properties, may significantly understate their tax (absent a penalty for underpayment). This was not true in the complete information setting.

After an audit has occurred, it is possible that negotiations may fail to produce a settlement. This will occur when each disputant expects to fare better in court, notwithstanding litigation costs and risk, than his opponent expects him to fare. In one sense, incomplete information produces this phenomenon of "litigation illusion," thereby contributing to usage of the court as a conflict resolution mechanism.

In another sense, for risk-averse disputants, incomplete information creates uncertainty about the court's behavior, thereby reducing usage of the court.

CHAPTER VII

SUMMARY AND CONCLUSIONS

This study supplies an economic analysis of the conflict between estate taxpayers and an Internal Revenue Service representative over the value of estate property whose transfer is subject to tax. Because values of many properties are difficult to determine, there is frequently a broad range of possibilities from which a single value must emerge. The federal estate tax system provides for the filing of a tax return, followed by possible examination (audit), negotiation and litigation. This study explores, from a theoretical perspective, conditions under which a resolution of the conflict may arise at one of these stages and specifies the nature of the resolution.

Chapter I provides an introduction to the study. It includes a discussion of the valuation problem and a summary of some previous applications of quantitative methods to tax conflict research.

Chapter II describes the game-theoretic framework used in the study. Included are the rationality postulates assumed to guide disputants' behavior and an enumeration of the assumptions maintained and relaxed in the 28 scenarios examined in the remaining chapters.

Chapter III covers the first of four basic models. One taxpayer faces one Revenue Service agent in an environment with complete information; the court is treated as a chance player. In this setting, complete information permits all valuation disputes to be settled out of court, avoiding audit costs, litigation costs and the risk associated with the chance player's stochastic behavior. Interestingly, the communication system initially is strongly biased in favor of the taxpayer, who will report a value equal to the expected negotiated settlement, discounted by an amount reflecting the agent's auditing cost. This is an example of a fairly rare situation known as an ultimatum game.

The presence of costs and risk aversion turns a noncooperative game into a cooperative one, as both players seek to obtain a settlement which saves those costs and allocates the savings between them. The negotiated settlement implied by the rationality postulates is the Nash-Zeuthen-Harsanyi bargaining solution. This agreement point captures the two players' relative litigation costs and aversion to the risk of litigation. Chapter III furnishes details and examples of the agreement.

Chapter IV extends the one-taxpayer analysis with complete information to a multiple-taxpayer environment. Contrary, perhaps, to intuition, no taxpayer will be able to avoid paying tax, even if the Revenue agent has the capacity to audit only one return. However, no taxpayer will pay more than that tax which makes it just unprofitable for the agent to audit. Costly audits, as well as costly and risky litigation, are avoided; but the taxpayer exploits the communication initiative by capturing the agent's audit cost.

Chapter V returns to the one-taxpayer environment but relaxes the complete information assumption. Unlike the complete information setting, incompleteness of information may foster overly optimistic subjective probability assessments regarding the outcome of litigation, thus sending cases to court which otherwise would have been settled in the appellate process. This suggests that the court might help to reduce its own caseload by writing clear precedent which improves potential litigants' information about future court behavior. Previous research indicates this is not generally being done by the Tax Court in the valuation area. On the other hand, however, incompleteness of information tends to increase the variance of potential litigants' subjective probability distributions, making risk-averse players less likely to litigate. This beneficial aspect of incomplete information, however, seems less appealing than the benefits to be achieved by improving information regarding the court.

In Chapter VI the Revenue Service agent faces multiple taxpayers in a setting of incomplete information. Analysis and conclusions are less rigorous and more qualitative in this environment, but the basic patterns of behavior portrayed in the earlier chapters remain fairly constant. The most notable difference is that in this setting it is possible for some taxpayers to understate their tax and still escape audit. This is a product of the agent's limited capacity to audit, combined with the possibility that some audits and litigation will occur in the absence of complete information.

In Chapter I the question was raised as to whether the observed tendency on the part of the Tax Court toward compromise valuation in estate tax cases is a reasonable surrogate for negotiated settlements. The analysis in this study suggests that such would be true only if the players' utility functions and audit and litigation costs were similar. Only then would the Nash solution "split the difference." A limitation of the study is that it does not consider such aspects of negotiation as relative bargaining skills and notions of fairness or equity. Consequently, it provides insight into this question but not a definitive answer.

This study suggests certain behavioral effects of provisions of the Tax Equity and Fiscal Responsibility Act of 1982 with respect to (1) recovery of litigation costs and (2) penalties for using the Tax Court to argue a groundless position. Item (1) tends to encourage litigation by establishing a reduction in expected litigation costs in the taxpayer's analysis. An expected litigation cost, which, for any nonzero probability of recovery, is smaller than the "certain" litigation cost L_T considered in the analysis, replaces L_T. This produces a narrowing of the negotiation set and moves the Nash solution downward, in favor (in dollar terms) of the taxpayer. In contrast, item (2) should move the Nash solution upward, in favor of the Revenue Service, especially if the taxpayer is risk averse. The penalty provision increases the taxpayer's expected cash outflow upon litigation as well as the variance of the probability distribution of the court decision. These conditions broaden the negotiation set by shifting the taxpayer's concession limit upward and move the Nash value upward as well.

In addition to limitations regarding equity and bargaining skill mentioned above, it should be noted that only a one-period model is considered herein. Behavioral incentives potentially arising from the possibility of repeated estate tax (or income tax) confrontations between the IRS and taxpayers are not addressed. Also, other abstractions are present, such as treatment of the IRS as a single person, compensated as a simple function of net revenues obtained, the use of of constant auditing and litigation costs, and modeling the court as an exogenous chance player. Removal of these restrictions might extend the study. In particular, research on optimal incentive contracts for Revenue Service agents and appeals officers and for tax practitioners could prove interesting and worthwhile.

Empirical tests for the existence of the Nash solution in the taxpayer-IRS context might be beneficial to both the tax literature and the game theory literature. One avenue of such research involves studying data from actual out-of-court settlements. An alternative or complementary approach is to conduct laboratory experiments to observe the behavior of subjects in an artifically formulated tax environment. As noted by Hamermesh (1973), the Nash solution is defined in utility space while empirical results are observable only in monetary terms. This makes empirical testing difficult to interpret.

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