THE IMPACT OF THE TAX SHELTERING OF BENEFITS ON EMPLOYER-EMPLOYEE CONTRACTING

By

CAROLYN C. PATTERSON

Bachelor of Science
University of Tulsa
Tulsa, Oklahoma
1978

Master of Science
University of Tulsa
Tulsa, Oklahoma
1989

Submitted to the Faculty of the
Graduate College of the
Oklahoma State University
in partial fulfillment of
the requirements for
the Degree of
DOCTOR OF PHILOSOPHY
May, 1994

THE IMPACT OF THE TAX SHELTERING OF BENEFITS ON EMPLOYER-EMPLOYEE CONTRACTING

Thesis Approved:

Thesis Adviser

Dean of the Graduate College

ACKNOWLEDGMENTS

I express my sincere gratitude to Dr. Don R. Hansen for his guidance and encouragement. Without his willingness to share his knowledge, I could not have accomplished this task. Appreciation is also expressed to Dr. Kevin Currier and Dr. Charlotte Wright.

Special gratitude is expressed to my husband, David, for his encouragement and tolerance for yet one more goal for me to achieve. Thank you to my son Matthew, who was born during the lengthy process of obtaining a Ph.D., for tolerating my occasional inattentiveness during this project.

TABLE OF CONTENTS

LIST OF TABLES

CHAPTER I

INTRODUCTION

The tax preferential treatment of employee benefits was among the largest revenue losers for the United States Treasury in 1992.[1] The Treasury estimated revenue losses of $51.2 billion for the tax preference of pension contributions and pension fund earnings for 1992. Another $33.5 billion of lost revenue was estimated for the tax exclusion of employer contributions for medical insurance and care. These estimates include only two of the many tax-sheltered benefits that employers may provide to their employees.

With the emphasis on increasing government revenue and reducing the deficit, the government has considered streamlining or even eliminating the tax preference of employee benefits. Consequently, the relationship between tax-preferred benefits and employer-employee contracting costs could have important current tax policy implications.

1.1 Purpose and Research Issues Addressed in the Study

The primary purpose of this study is to determine the effect of tax policies on employer-employee contracting costs, on employee effort, and on government revenue. The research questions are addressed using a principal-agent framework. The analysis involves the development of a principal-agent

1 Refer to Appendix D, Table I, for a list of the top ten tax revenue losers.

model that is extended to include situations involving current and potential tax policy issues relative to benefits.

Initially, the effect on contracting costs of the current tax policy permitting the tax sheltering of benefits is addressed and mathematically derived. The favorable outcome of this analysis justifies the existence of employer provided tax-sheltered benefits. More importantly, however, the present study ascertains the effect of the tax sheltering of benefits on employee effort and on government revenue. With the tax sheltering of benefits the implementation of a lower effort level by the employer is not possible. Subject to the agent's tax rate, a higher effort level will be implemented by the employer as a result of the tax sheltering of benefits. In addition, contrary to intuitive beliefs, this study concludes that subject to the principal's tax rate government revenue will be enhanced as a result of the tax sheltering of benefits and a shift to a higher effort level.

Other factors impacting contracting costs that are incorporated into the model are an employer purchase advantage and administrative costs. The study indicates that these exogenous variables can impact the employer's decision to provide tax-sheltered benefits. Moreover, these considerations have empirical implications to the research issues modeled in the study.

The principal-agent model is extended beyond the analysis of employee effort and government revenue to include the following additional research issues:

1) What is the impact of an increase in the employee's tax rate when the employer provides tax-sheltered benefits? What is the impact of this increase on the employer's overall contracting costs and on the decision to

provide tax sheltered benefits? Although labeled as a potential tax policy in this study, such a tax increase was included in recent tax legislation.[2]

2) What is the impact of a partial reduction in the tax preference of benefits? An example of a partial reduction is the repeal of the tax exclusion for employer contributions to health insurance. As one of the largest revenue loser for the government, this tax preference has frequently been a target for reform. In fact, a cap on tax preferred employer contributions for health insurance has been suggested as a means of funding a national health plan.[3] Another example of a partial reduction in tax-sheltered benefits is the lowering of the compensation limits for qualified retirement plans. This tax reform was also included in recent tax legislation.[4]

3) What is the impact on contracting costs of a potential tax policy to completely repeal the tax preferences for benefits? Is there any incentive for an employer to continue to provide benefits without the opportunity to tax shelter? The response to this question includes the extension of the purchase advantage analysis to a no tax sheltering of benefits situation. Is the employer better off by providing benefits if an employer purchase advantage exists but benefits can no longer be sheltered from tax for the employee?

4) What is the impact on contracting costs of a tax policy repealing the employer deductibility of benefits while maintaining the tax-sheltering for the employee? Would cost savings remain available to the employer?

5) What is the optimal benefits plan available to the employer? Can an employer's wealth increase with the adoption of a plan that provides more flexibility to the employee?

---

2 A significant tax rate increase for both individual and corporate taxpayers was included in the Omnibus Budget Reconciliation Act of 1993.

3 Refer to *The Wall Street Journal*, October 28, 1993, page A8.

4 Refer to the Omnibus Budget Reconciliation Act of 1993.

Analytical methodology is most effective when used to rigorously develop hypotheses that can be empirically tested. According to Watts (1982):

> "A theory is a structure by which we interpret the data. We make assumptions about the world and then apply logic to derive predictions and insights. The assumptions and logic often take the form of mathematical modeling. Mathematical modeling is a method of deriving implications from assumptions. In this setting, logic or math cannot determine the acceptance of a theory by researchers or practitioners. Presumably the derivation of implications in competing theories (models) will be logically correct, given the theories' assumptions. What determines the acceptance of a theory, I believe, is the usefulness of its predictions or the insights it provides" (page 49).

Thus, empirical testing strengthens predictions developed in mathematical modeling. Potential empirical implications are pointed out as they emerge in the analytical development. This study concentrates on contributing to research through the mathematical modeling. The mathematical analyses can be extended to empirical testing. Empirical extensions of this research, however, are reserved for consideration at a later time.

1.2 Contribution of the Study

Few researchers have mathematically modeled the impact of tax policy decisions on employer-employee contracting costs, on employee effort, and on government revenue.[5] The results of the mathematical analysis in this study contribute to tax policy research by providing a timely evaluation of the impact of current and potential tax policy decisions on contracting costs, on effort, and on government revenue. This evaluation is timely considering the current concern

[5] A literature review follows in Chapter III.

over the cost of employee benefits and the need to generate additional tax revenues.

1.3 Organization of the Study

The next chapter introduces the pertinent tax laws relative to employee benefits. This is followed by a brief review of the literature pertaining to the taxation of employee benefits in Chapter III. The research questions are addressed using a principal-agent framework which is developed in Chapter IV. The impact of the tax sheltering of benefits on employer-employee contracting costs, employee effort, and government revenue is presented in Chapter V. The final chapter includes a summary, extensions, and limitations of this study.

Four appendices follow Chapter VI. Appendix A provides a numerical illustration of the solutions to the contracting problems presented in this study. Appendix B numerically illustrates the impact of the purchase advantage and administrative costs on employer-employee contracting costs. Appendix C lists the mathematical solutions to the optimization problems presented in Appendix A. Appendix D includes the following: Tables I and II document tax legislation on employee benefits; Table III summarizes the notation used in the study; and finally, as a reference tool, Table IV includes the individual and corporation income tax rates for 1993.

CHAPTER II

REVIEW OF RELEVANT TAX LAWS PERTAINING TO EMPLOYEE BENEFITS

This section briefly summarizes the pertinent tax laws concerning employee benefits. The current tax law pertaining to employee benefits is that *all* benefits are taxable unless specifically excluded from taxation by the Internal Revenue Code. The Code does provide a tax exclusion or tax deferral for certain employee benefits. Although these benefits are not currently included in the employee's income, the employer is permitted a deduction for the benefits currently available to the employee. In addition, the majority of these tax-sheltered benefits escape Social Security tax, federal income tax, and state and local income tax. Under the current tax laws tax-sheltered benefits must fall into one of the following categories:

1) No additional cost fringe benefit: Benefits of this type must be free from any additional cost to the employer. An example of this type of benefit is free air travel for airline employees on planes that would not be fully occupied by customers.

2) Qualified employee discounts: Employees may obtain property or services for a price less than the price at which such property or services are being offered to the public.

3) Working condition fringe benefits: These benefits represent property or services that are provided to an employee in connection with the conduct of the employer's business and would normally be deductible as a

business expense by the employee. Examples of this type of benefit are the payment of professional expenses and the business use of an employer-provided auto.

4) De minimis benefits: These are benefits that have nominal value and are intended to promote goodwill. Examples are a holiday turkey or a company tee shirt.

5) Welfare benefit plans: These plans provide benefits such as group medical, dental, and life insurance. Cafeteria plans or flexible benefit plans also come under the definition of welfare benefit plan. These plans must comply with numerous tax regulations such as non-discrimination rules.[6]

6) Pension benefit plans: In addition to pension plans these benefit packages can include stock bonus, profit sharing, savings or thrift, and cash or deferred compensation plans. Generally benefits in this category are tax deferred rather than excluded from tax. Regulations for pension plans must meet strict requirements for eligibility, vesting, funding, non-discrimination, contributions, distributions, etc.

The most striking development in the employee benefits area has been the growing complexity of employee compensation. Fifty years ago employee compensation was limited to cash wages for hours worked. Today the standard components of a compensation package may include various types of insurance, i.e., medical, dental, vision, life, accident and disability, plus one or more forms of deferred compensation. In recent years, cash has represented a declining share of employee compensation.

The second most striking development in the employee benefits area is that government regulations have kept pace with the increasing emphasis on

---

6 Cafeteria plans will be explained in more detail in a later section.

employee benefits. As evidenced by Table II, Appendix C, tax legislation has been rampant since the Employee Retirement Income Security Act (ERISA) of 1974. The focus of much of this legislation has been on protecting the rank-and-file employees. Compliance with these complex rules, however, has placed a heavy administrative burden on employers.

Although extremely popular with both employers and employees, the tax preference for employee benefits has been at risk almost since inception.[7] The country's current economic climate plus the Treasury's estimate of revenue loss increases the probability of alterations to the tax preference of employee benefits. The next chapter introduces some of the recent research in the area of taxation of employee benefits.

---

7 The Revenue Act of 1943 established comprehensive tax preferences for benefits.

CHAPTER III

LITERATURE REVIEW

This study investigates the impact of current and potential tax policy issues on employer-employee contracting costs, on employee effort, and on government revenue. Researchers in the area of employee benefits have addressed a number of related issues. Those pertinent to this study include: benefits as substitutes for wages; whether or not benefits should be taxed; equity and efficiency of the tax preference and the impact of taxes on employer profit and employee effort. A brief review of the research conducted in these areas follows.

3.1 Benefits as a Substitute for Wages

One avenue of research that has been pursued is to provide empirical support for the contention that benefits can be substituted for wages. Using survey data published by the Bureau of Labor, Woodbury (1983) concluded that wages and benefits easily substitute for each other. Generally, researchers have accepted this notion that benefits are a substitute for wages. The question, at what value can benefits be substituted for wages, was considered by Katz and Mankiw (1985). They developed a theoretical framework for the valuation of benefits. Others have suggested different valuation methods such as: fair market value, employee's willingness to pay for the benefit, or cost to the employer.

3.2 Should ALL Benefits Be Taxed?

A more prevalent avenue of benefits research concerns broad tax policy issues. A question asked by many researchers is: should *all* employee benefits be taxed (Adamache and Sloan, 1985; Clain and Leppel, 1989; Turner, 1989; and Burman and Rodgers, 1992). Currently, there is some agreement that tax revenue would be enhanced by discontinuing the tax preference for benefits. An exception to this contention is ascertained in this study.

Evidence also exists that the current tax preference for certain employee benefits causes efficiency and equity distortions. Most economists agree that without the tax preference for benefits, employers would adjust their behavior resulting in changes to the mix of compensation paid and to the total compensation paid. Estimates of revenue loss, such as Table I, Appendix C, appear to disregard this alteration to behavior.

3.3 Equity and Efficiency of the Tax Preferences of Benefits

Tax policy researchers frequently address equity and efficiency issues of the current tax structure. Equity can be achieved horizontally or vertically. When two individuals with equal total compensation face the same tax liability, horizontal equity is accomplished. If, however, one receives tax-sheltered benefits instead of wages while the other receives only cash wages, an inequity exists. Since tax-sheltered benefits are known to differ across firms, the tax preference of benefits cannot be justified on a horizontal equity basis (Turner 1989). Vertical equity is achieved if the desired individuals, i.e., the employees, receive most of the benefits of the tax preferences. If employers reap the benefits, vertical equity is lacking.

Efficiency may justify the existence of tax preferences if market failures would exist without this tax provision. The tax sheltering of benefits encourages the private sector to provide benefits such as health insurance and retirement savings. Thus, social efficiency is achieved if the tax preferences lead to more benefits being provided than the employer would otherwise provide. Social efficiency has been the basis for much of the legislation on the tax preference of benefits. Alternatively these same tax preferences can cause economic inefficiencies.

Woodbury (1983) and Burman and Rodgers (1990) suggested that larger employers because of the price advantages and the tax subsidies can pay a larger share of compensation in tax-preferred benefits. Smaller employers are at a disadvantage. Thus, a potential distortion of labor exists as a result of the tax preference of benefits. The tax subsidy for health insurance skews labor costs in favor of larger employers. In addition, the tax subsidy may distort the allocation of labor among firms and industries and may limit the kinds of insurance provided by the market.

3.4 Impact of Taxes on Employer Profit and Employee Effort

Few researchers have addressed the impact of taxes on the agency contract between the employer and the employee. Halperin and Tzur (1984) analyze the effects of nontaxable benefits on the employer-employee relationship. Their focus is on designing an employment contract in which benefits are substituted for wages while maintaining the employee's effort level. They conclude that a wealth maximizing employer should minimize the cost of employee compensation by providing the maximum level of benefits acceptable to the agent. In addition, they determine that there is an ambiguous effect on the

optimal combination of wages and benefits from an increase in the agent's tax rate. A graphical presentation of why a cafeteria plan may be beneficial to the employer is also included.

Similar to the Halperin and Tzur study, this study begins with a mathematical analysis of the impact of the tax sheltering of benefits on employer-employee contracting costs. Although a different solutions approach is used in this study, the results concur with Halperin and Tzur's conclusion that an employer should minimize the cost of employee compensation by providing the maximum level of benefits desired by an employee.[8] In contrast, however, the present study identifies a cost savings factor resulting from the tax sheltering of benefits that can be appropriated by the principal.

To further distinguish this study from Halperin and Tzur's work, the focus here is on the effects of current tax policy and potential tax policy on employer-employee contracting costs, employee effort, and government revenue. The important contribution of this study is the determination of the impact of the tax sheltering of benefits on employee effort and on government revenue. The conclusion presented in this study is that the employer will implement a higher effort level as a result of the tax sheltering of benefits subject to the agent's tax rate. Moreover, contrary to intuitive beliefs, this study determines that subject to the principal's tax rate, government revenue will be enhanced as a result of the tax sheltering of benefits.

An additional contribution of this study is the discussion of exogenous variables which were not addressed in the Halperin and Tzur study. Variables such as an employer purchase advantage and administrative costs are shown to significantly impact the employer's decision to provide tax sheltered benefits.

---

[8] Refer to section 4.3 for a discussion of the advantages of this alternative solution approach to the principal's optimization problem.

The impact of various potential tax policy issues on employer-employee contracting are also addressed.

To conclude, this study goes beyond simply determining the optimal combination of wages and benefits. A cost savings factor as a result of the tax sheltering of benefits is identified. Conditions for an effort shift and an increase in government revenue are isolated. Exogenous factors impacting contracting are determined to be important variables. Furthermore, potential tax policy issues such as the partial and complete repeal of the tax preference for benefits are examined.

The subsequent chapter describes the basic agency model. This is followed by an analysis of the impact of tax-sheltered benefits on contracting costs in Chapter V.

CHAPTER IV

AGENCY MODEL DEVELOPMENT

In simple terms, agency theory focuses on situations where one person, the principal, engages another, the agent, to exert effort or to perform an action on behalf of the principal. Agency theory research generally involves the study of contractual relationships that include the delegation of decision-making authority to one or more agents. Self interest motivates both the principal and the agent. Informational asymmetry, divergence of goals, and divergence of risk seeking behavior between the principal and agent characterize a typical agency relationship. The basic agency model used in this study is outlined in this chapter.

4.1 Basic Agency Model -- The Assumptions

Assume a simple one-period economy exists. A risk-averse and effort-averse employee (agent) contracts with a risk-neutral employer (principal) to perform an action, $a \in A$, where A represents a feasible set of effort levels, in exchange for a share of the output, $x \in X$, where X represents a set of payoffs or income. The agent's action or effort level is assumed unobservable by the principal. It is, therefore, not possible to structure the agent's incentive scheme to depend on his effort level. The principal must reward the agent based on the outcome, $\mathbf{x}$, where $x = x_1,\ldots,x_m$, which results from the agent's effort level choice, $\mathbf{a}$, where $a = a_1,\ldots,a_n$, and the unknown state of nature, $\theta \in \Omega$. This random component represents a set of possible states of nature outside the

agent's or principal's control. Assume, however, that the principal and the agent have common beliefs as to the probability of occurrence, $\pi(a)$, where $\pi(a) = \pi_1(a),\ldots,\pi_m(a)$, of the m outcomes if action a is selected. A result of not being able to observe the agent's action choice is that the principal can not determine if a high profit or output is because of the agent's action or because of the state of nature.

The principal and the agent act to maximize their expected utilities and are assumed to possess von Neumann-Morgenstern utility functions denoted as follows:

Principal's utility:	$G(W) = U(W);$
Agent's utility:	$H(W,a) = U(W) - V(a).$

Wealth, W, alone defines the principal's utility that is assumed to be twice differentiable. Thus, the principal is interested only in maximizing his own wealth. The agent's utility is defined over wealth and effort that are assumed to be additive and separable. The agent's utility function is differentiable with respect to wealth and is strictly increasing, $U' > 0$. The agent is assumed to be risk averse, $U'' < 0$. Additionally, assume that the agent's disutility from effort is differentiable and is strictly increasing, $V' > 0$.

As mentioned above, the total output, $x \in X$, depends on the agent's action choice, $a \in A$, and on a random component, $\theta \in \Omega$. Thus, the agent's wealth depends on his share of the output that is denoted by $s \in S$; where S represents a set of gross payoffs to the agent assuming $x(a,\theta)$. The principal's wealth depends on his share of the residual, the output or profit less the gross payoff to the agent, $x - s$.[9] Assume, additionally, that the support of the payoff

[9] In explaining this basic model, taxes are ignored.

does not change as the effort level changes. Hence, each possible output must have a probability of occurrence greater than zero at each effort level. This assumption is included to ensure that the principal cannot infer the agent's effort level from the observed payoff. Additionally, assume that for $a_1 < a_2$, $\pi(a_2)$ displays first order stochastic dominance over $\pi(a_1)$. This assumption provides that the agent is productive in the sense that a greater effort level, a_2, results in a greater probability of an increased output for any state of nature.

4.2 Basic Agency Model -- The Problem

The principal's objective is to maximize his expected wealth, $E(x-s)$. The agent requires a minimum level of utility before refusing to work or before going elsewhere to work. This minimal level of utility is called the agent's reservation price and is denoted by $\bar{H}$. Since the agent's actions are not observable, it is not possible for the principal to pay the agent based on his effort level. The principal must rely on the output to determine the agent's reward. Therefore, to induce the agent to implement a particular effort level, the agent's expected utility at this effort level must be greater than his expected utility at any other possible effort level. Given these assumptions, the principal's problem can be expressed as follows:

$$\text{Maximize} \quad E\left[G(x_i(a,\theta) - s_i(x))\right] \tag{1}$$

$$\text{subject to} \quad E\left[H(s_i(x), a_i)\right] \geq \bar{H}, \tag{2}$$

$$a \in \operatorname{argmax} E\left[H(s_i(x), a_i)\right] \tag{3}$$

where the notation "argmax" represents the set of arguments that maximize the objective function that follows, in this case, the agent's utility function.

4.3 Basic Agency Model -- The Solution Approaches

If the agent's effort level can be observed, the principal can write a forcing contract based on the effort level. The principal simply pays the agent an amount that will provide the reservation price if the effort desired is realized and zero otherwise. This insures that the desired action is implemented. The result is called the "first best" solution.

This study, however, assumes that the agent's actions are not observable by the principal. Thus, the principal is constrained by expression (3) and is limited to a "second best" solution. The inclusion of this incentive compatibility constraint complicates the solution to the maximization problem. Economic researchers have suggested two solution approaches to this second best situation. One solution approach, called the first-order approach, involves the replacement of expression (3) with the first order condition. The solution to the problem is then determined using a Lagrange multiplier. A flaw in this approach is that the results ignore the agent's second order conditions. At best, the solution may be a local maximum and will not necessarily correspond to the global maximum.[10]

Grossman and Hart (1983) provide an alternative to this first-order approach called the cost-benefit approach. This approach avoids the problem with the local versus global maximum of the first-order condition approach. The Grossman and Hart (1983) approach identifies two distinct roles related to the cost and to the benefit of the agent's output. First, the agent's action choice

---

[10] For further explanation see Grossman and Hart, 1983, Page 8, Figure 1.

contributes directly to the wealth of the principal who desires the maximum effort level from the agent. The *benefit* portion in the cost-benefit approach captures this aspect of the analysis. Secondly, the agent's output is a signal to the principal of the agent's unobservable effort level. The agent's compensation is based on this output level and is categorized as the *cost* portion in the cost-benefit analysis. Thus, the principal's objective is to maximize the expected benefit less the expected cost.

Computationally, the first step in achieving a second best solution is to determine the minimum expected cost to the principal of an incentive scheme necessary to implement a particular effort level. The principal wishes to choose the action-incentive combination that maximizes his wealth. The objective is to choose an incentive scheme, $s = s_1,\ldots,s_n$, which minimizes the cost of implementing a particular action choice, $\hat{a}$. This incentive scheme represents wealth to the agent before the introduction of taxes. The agent's expected utility, however, must be greater than or equal to his reservation price, $\bar{H}$. Also, the principal must provide an incentive for the agent to choose the desired effort level. These are the constraints mentioned above and noted in expressions (2) and (3). The problem of finding the least cost way of implementing $\hat{a}$ can be stated more formerly as follows:

Choose an incentive scheme, $s = s_1,\ldots,s_n$, to

$$\underset{a\in A}{\text{Minimize}} \quad \sum_{i=1}^{n} \pi_i(\hat{a}) s_i \tag{4}$$

$$\text{subject to} \quad \sum_{i=1}^{n} \pi_i(\hat{a}) H(\hat{a}, s_i) \geq \bar{H}, \tag{5}$$

$$\sum_{i=1}^{n} \pi_i(\hat{a}) H(\hat{a}, s_i) \geq \sum_{i=1}^{n} \pi_i(a) H(a, s_i). \qquad (6)$$

Thus, obtaining a solution to the above becomes a convex mathematical programming problem. The result is the determination of $\hat{s}$ the least cost way of implementing $\hat{a}$. The next step is to determine the least cost way of implementing all other possible action choices. Then, to find the second best solution for the principal, the action-incentive combination that maximizes the principal's objective function, is determined as follows: [11]

$$\underset{a \in A}{\text{Maximize}} \quad \bar{B}(a) - \bar{C}(a) \qquad (7)$$

where

$$\bar{B}(a) = \sum_{i=1}^{n} \pi_i(a) x_i$$

and

$$\bar{C}(a) = \sum_{i=1}^{n} \pi_i(a) s_i. \qquad (8)$$

4.4 Chapter Summary

This chapter presents the basic principal-agent model used in this study. The model is described in terms of the assumptions, the problem, and the solution approach. The subsequent chapter introduces taxes into this basic agency model. Researchers who have addressed taxes in an agency setting have almost exclusively applied the first order-condition approach. This study follows an alternative approach, called the cost benefit method, outlined by

[11] Appendix A provides a numerical illustration of the cost-benefit approach.

Grossman and Hart (1983). The advantage of this alternative is to avoid a potential problem with the solution arrived at using the first-order condition approach. With the first-order condition method the solution may be a local maximum that will not necessarily correspond to a global maximum.

CHAPTER V

THE IMPACT OF TAX-SHELTERED BENEFITS ON CONTRACTING

This chapter addresses the effects on employer-employee contracting costs, employee effort and government revenue of the tax sheltering of benefits using the basic agency model outlined in the previous chapter. Contracting costs are first considered without the tax sheltering of benefits in section 5.1 and then with the tax sheltering of benefits in section 5.2. The impact of the tax sheltering of benefits on the agent's effort is introduced in section 5.3. The possibility of a decrease and an increase in effort level as a result of the tax sheltering of benefits is analyzed in this section. In section 5.4 the impact on government revenue is investigated.

Following this, other factors effecting contracting costs, such as a purchase advantage and administrative expenses, are incorporated into the model in section 5.5. Potential tax policy issues relative to benefits are examined in section 5.6. Tax policy issues considered are a tax rate increase, partial and complete repeal of the tax preference for benefits and the repeal of the deductibility of tax preferred benefits by the principal. Finally, in section 5.7 a cafeteria plan is suggested as the optimal tax-sheltered benefits plan. Appendices A, B and C include numerical illustrations of the results obtained in these analyses using hypothetical numbers. Appendix D, Table III, provides a summary of the notation used in this study.

5.1 No Tax Sheltering of Benefits Policy

Assume that the principal does not provide tax-sheltered benefits to the agent. The agent desires a certain level of benefits and will purchase these benefits with after tax dollars. The principal knows the agent's utility function but cannot observe his effort level. The principal's objective is to maximize his expected benefit less his expected cost, $\overline{B}(a) - \overline{C}(a)$, subject to the agent achieving at least his reservation price and obtaining sufficient incentive to choose the principal's desired effort level.

Computationally, the first step is to determine the incentive scheme that minimizes the principal's expected cost for each feasible effort level. Assume an incentive scheme, $\underline{s} = (s_1,\ldots,s_n)$ is given, which implements a, where $a \in A$, and where s_i is the agent's gross compensation or the principal's cost. Now, let $I_i = (1-t^A)s_i = D_i + b_i$, where $\underline{I} = (i_1,\ldots,i_n)$ is the after tax compensation scheme that implements a, where $a \in A$. The notation can be summarized as follows:

s_i = Agent's gross compensation before tax;

I_i = Agent's net compensation after tax;

D_i = Agent's discretionary income after tax and after benefits are purchased;

b_i = Agent's desired level of benefits purchased by either the agent or the principal on behalf of the agent; and

t^A = Agent's tax rate; where $0 < t^A < 1$.

Further, let $I_i^* = (1-t^A)s_i^* = D_i^* + b_i^*$, where $i = 1,\ldots,n$. Assume that the I_i^* represents be the agent's payoff for implementing a^*, where a^* is the second best solution given the agent purchases his own benefits, and where $a^* \in A$. Thus, the net wealth to the principal of implementing a^* is greater than the net

wealth achieved at any other possible effort level. Formally, this is represented as follows:

$$\bar{B}(a^*) - \bar{C}(a^*, P_0) \geq \bar{B}(a) - \bar{C}(a, P_0),\ a \in A \qquad (9)$$

where P_0 represents a tax policy without the tax sheltering of benefits.

5.2 Tax Sheltering of Benefits Policy

Although an agent may desire a certain level of benefits and may be willing to substitute these benefits for cash wages, without a reduction in cost or an increase in effort, a wealth maximizing principal has no incentive to provide benefits to the agent. This section considers whether the tax sheltering of benefits provides the principal a sufficient incentive to substitute benefits for cash wages.

Consider a tax policy, P_1, which allows benefits to be tax sheltered. Assume that the agent desires a certain level of benefits and that the principal will purchase these benefits on behalf of the agent. By doing so, the principal can shelter these benefits from the agent's federal income, state and local income, and Social Security taxes. Additionally, assume that the agent and the principal face the same market price for purchasing benefits.

Proposition 1: If the principal tax shelters benefits on behalf of the agent, the principal is made better off as a result of the tax sheltering of benefits.

Proof: The cost of implementing a for P_0 is $s_i(P_0)$, where $i = 1,\ldots,n$, and where $(1 - t^A)s_i(P_0) = I_i(P_0) = D_i + b_i$. To implement a for P_1 choose $w_i = \frac{D_i}{1 - t^A}$, where w_i represents cash wages before tax. Thus, $I_i(P_1) = (1 - t^A)w_i + b_i = I_i(P_0)$;

and a would be implemented. The incentive scheme, $s_i(P_1)$, $i = 1,\ldots,n$, for implementing a can be expressed as follows:

$$\begin{aligned} s_i(P_1) &= w_i + b_i \\ &= s_i(P_0) - \frac{b_i}{1-t^A} + b_i \\ &= s_i(P_0) - \frac{t^A b_i}{1-t^A}. \end{aligned} \tag{10}$$

This implies that $s_i(P_1) \langle s_i(P_0)$, for all i's. Thus,

$$\bar{B}(a) - \bar{C}(a,P_1) \rangle \bar{B}(a) - \bar{C}(a,P_0),\ a \in A. \tag{11}$$

Let $\tilde{a}$ be the second best solution for P_1. Thus,

$$\bar{B}(\tilde{a}) - \bar{C}(\tilde{a},P_1) \geq \bar{B}(a) - \bar{C}(a,P_1),\ a, \tilde{a} \in A. \tag{12}$$

But, this immediately implies that

$$\bar{B}(\tilde{a}) - \bar{C}(\tilde{a},P_1) \geq \bar{B}(a^*) - \bar{C}(a^*,P_0). \tag{13}$$

Q.E.D.

Comment 1: The cost savings associated with the tax sheltering of benefits is $\frac{t^A b_i}{1-t^A}$. Hence, the principal would maximize his wealth by providing the agent with the highest level of tax-sheltered benefits desired by the agent and allowed under the tax laws.[12] One implication of this result is that benefits are a significant factor in determining the optimal employer-employee contract. A

12 Internal Revenue Code Section 415 limits the benefits and contributions under qualified plans.

wealth maximizing employer would attempt to convert wages into tax-sheltered benefits as much as possible.[13]

5.3 Impact on Effort Level of the Tax Sheltering of Benefits Policy

Consider the impact of the tax sheltering of benefits on the effort level implemented by the principal. Whether the principal will implement a higher or lower effort level as a result of the tax sheltering of benefits is explored here.

Definition: Let a normal economic good be defined as follows: If $\bar{C}(a_2,P_i) > \bar{C}(a_1,P_i)$; then $\bar{b}_2 > \bar{b}_1$, where $\bar{b}_2 = \sum_{i=1}^{n} \pi_i(a_2)(b_{i2})$ and $\bar{b}_1 = \sum_{i=1}^{n} \pi_i(a_1)(b_{i1})$; $a_2, a_1 \in A$; and $a_2 > a_1$.

Assumption A1: Assume the benefits desired by the agent are normal economic goods.

Definition: Let the marginal change in wealth to the principal resulting from an effort level shift be defined by ΔB; where $\Delta B = \bar{B}(a_2) - \bar{B}(a_1)$, and where $a_2, a_1 \in A$; and $a_2 > a_1$

Definition: Let the marginal change in cost to the principal resulting from an effort level shift and assuming P_0 be defined by ΔC_0; where $\Delta C_0 = \bar{C}(a_2,P_0) - \bar{C}(a_1,P_0)$; $a_2, a_1 \in A$; and $a_2 > a_1$.

Assumption A2: Assume the second best solution for P_0 implements a^*; and the second best solution for P_1 implements $\tilde{a}$; where $a^*, \tilde{a} \in A$.

---

13 Prior literature has supported the contention that benefits can be substituted for wages. Refer to the literature review in Chapter III.

Thus, the following is known:

$$\bar{B}(a^*) - \bar{C}(a^*, P_0) \rangle \bar{B}(\tilde{a}) - \bar{C}(\tilde{a}, P_0) \tag{14}$$

and

$$\bar{B}(\tilde{a}) - \bar{C}(\tilde{a}, P_1) \rangle \bar{B}(a^*) - \bar{C}(a^*, P_1). \tag{15}$$

Proposition 2: Assume A1 and A2. Then, a shift to a lower effort level as a result of the tax sheltering of benefits is not possible.

Proof: First, suppose a shift to a lower effort level is possible. Thus, assume that $a^* \rangle \tilde{a}$. By the stochastic dominance assumption $\bar{B}(a^*) \rangle \bar{B}(\tilde{a})$. By rearranging expression (14) and by substituting the following is known: $\Delta B \rangle \Delta C_0$.

Now, assume P_1. Hence, by rearranging expression (15) and by substituting yields the following:

$$\bar{C}(a^*, P_1) - \bar{C}(\tilde{a}, P_1) \rangle \Delta B. \tag{16}$$

Thus,

$$\sum_{i=1}^{n} \pi_i(a^*)\left(\frac{D_i^* + b_i^*}{1 - t^A} - \frac{t^A b_i^*}{1 - t^A}\right) - \sum_{i=1}^{n} \pi_i(\tilde{a})\left(\frac{\tilde{D}_i + \tilde{b}_i}{1 - t^A} - \frac{t^A \tilde{b}_i}{1 - t^A}\right) \rangle \Delta B. \tag{17}$$

By rearranging expression (17) and by substituting yields

$$\Delta C_0 - \Delta B \rangle \frac{t^A}{1 - t^A}\left[\sum_{i=1}^{n} \pi_i(a^*)(b_i^*) - \sum_{i=1}^{n} \pi_i(\tilde{a})(\tilde{b}_i)\right]. \tag{18}$$

Since $\Delta B > \Delta C_0$, the left hand side of expression (18) must be negative. Therefore, if $a^* > \tilde{a}$ holds, the right hand side must also be negative. This implies that $\sum_{i=1}^{n} \pi_i(\tilde{a})(\tilde{b}_i) > \sum_{i=1}^{n} \pi_i(a^*)(b_i^*)$.

Now, since $\Delta B > 0$, expression (16) implies that $\overline{C}(a^*, P_1) > \overline{C}(\tilde{a}, P_1)$.

Therefore, since benefits are normal economic goods, $\sum_{i=1}^{n} \pi_i(a^*)(b_i^*) > \sum_{i=1}^{n} \pi_i(\tilde{a})(\tilde{b}_i)$ should hold. Hence, expression (18) contradicts assumption A1. Thus, $a^* \leq \tilde{a}$ must hold.

Q.E.D.

Now, consider the possibility of a shift to a higher effort level as a result of the tax sheltering of benefits.

Definition: Let the marginal change in the agent's desired level of benefits resulting from an effort level shift be defined by Δb; where

$\Delta b = \sum_{i=1}^{n} \pi_i(a_2)(b_{i2}) - \sum_{i=1}^{n} \pi_i(a_1)(b_{i1})$ and where $a_2, a_1 \in A$; and $a_2 > a_1$.

Proposition 3: Let a^* be the second best solution for P_0. Let $a > a^*$, $a \in A$. If $t^A > \frac{\Delta C_0 - \Delta B}{\Delta C_0 - \Delta B + \Delta b}$, then $\overline{B}(a) - \overline{C}(a, P_1) > \overline{B}(a^*) - \overline{C}(a^*, P_1)$ and a shift to a higher effort level occurs as a result of the tax sheltering of benefits.

Proof: By definition and by equation (14), $\Delta C_0 - \Delta B + \Delta b > 0$ is known.

Thus, if $t^A > \frac{\Delta C_0 - \Delta B}{\Delta C_0 - \Delta B + \Delta b}$ holds, then

$$t^A \Delta C_0 - t^A \Delta B + t^A \Delta b > \Delta C_0 - \Delta B;$$

and

$$\Delta B\left(1-t^{A}\right)-\Delta C_{0}\left(1-t^{A}\right)+t^{A}\Delta b \rangle 0 \tag{19}$$

Thus,

$$\Delta B-\Delta C_{0}+\frac{t^{A}\Delta b}{1-t^{A}} \rangle 0. \tag{20}$$

Since $a \rangle a^{*}$, substituting and rearranging provides:

$$\begin{aligned} &\overline{B}(a)-\overline{C}(a,P_{0})+\sum_{i=1}^{n}\pi_{i}(a)\left(\frac{t^{A}b_{i}}{1-t^{A}}\right) \rangle \\ &\qquad \overline{B}\left(a^{*}\right)-\overline{C}\left(a^{*},P_{0}\right)+\sum_{i=1}^{n}\pi_{i}\left(a^{*}\right)\left(\frac{t^{A}b_{i}^{*}}{1-t^{A}}\right). \end{aligned} \tag{21}$$

Now, from Proposition 1 it is known that $s_{i}(P_{1})=s_{i}(P_{0})+\frac{t^{A}b_{i}}{1-t^{A}}$. This implies that $\overline{C}(a,P_{1})=\overline{C}(a,P_{0})-\sum_{i=1}^{n}\pi_{i}(a)\left(\frac{t^{A}b_{i}}{1-t^{A}}\right)$. Hence, expression (21) can be rewritten as follows:

$$\overline{B}(a)-\overline{C}(a,P_{1}) \rangle \overline{B}\left(a^{*}\right)-\overline{C}\left(a^{*},P_{1}\right). \tag{22}$$

Q.E.D.

5.4 The Impact on Government Revenue of the Tax Sheltering of Benefits

Consider the impact of the tax preferential treatment of benefits on government revenue. Whether government revenue will increase or decrease as a result of the tax sheltering of benefits is examined here.

Definition: Let government revenue from the principal's net wealth and the agent's payoff for the implementation of a, $a \in A$, for P_1 and P_0 be defined as follows:

$$\bar{R}(P_1) = t^P\left[\bar{B}(a) - \bar{C}(a,P_1)\right] + t^A\left[\sum_{i=1}^{n}\pi_i(a)\left(\frac{D_i}{1-t^A}\right)\right]; \tag{23}$$

and

$$\bar{R}(P_0) = t^P\left[\bar{B}(a) - \bar{C}(a,P_0)\right] + t^A\left[\sum_{i=1}^{n}\pi_i(a)\left(\frac{D_i + b_i}{1-t^A}\right)\right] \tag{24}$$

where $\bar{R}(P_1)$ and $\bar{R}(P_0)$ represent government revenue with and without the tax sheltering of benefits, respectively; and where t^P represents the principal's tax rate, and $0 < t^P < 1$.

Proposition 4: If the effort level associated with the second best solution is maintained for P_1 and P_0, then, government revenue decreases as a result of the tax sheltering of benefits.

Proof: Let a^* be the second best solution for P_1 and P_0. Now, comparing government revenue with and without the tax sheltering of benefits at a constant effort level generates the following result:

$$\begin{aligned}\bar{R}(P_1) - \bar{R}(P_0) &= t^P\left[\bar{C}(a^*,P_0) - \bar{C}(a^*,P_1)\right] - t^A\left[\sum_{i=1}^{n}\pi_i(a^*)\left(\frac{b_i^*}{1-t^A}\right)\right] \\ &= t^P\left[\sum_{i=1}^{n}\pi_i(a^*)\left(\frac{t^A b_i^*}{1-t^A}\right)\right] - t^A\left[\sum_{i=1}^{n}\pi_i(a^*)\left(\frac{b_i^*}{1-t^A}\right)\right].\end{aligned} \tag{25}$$

Thus,

$$\bar{R}(P_1) - \bar{R}(P_0) = \left[\frac{t^A\left(t^P - 1\right)}{1-t^A}\right]\left[\sum_{i=1}^{n}\pi_i(a^*)(b_i^*)\right] < 0. \tag{26}$$

Q.E.D.

Now, consider the impact on government revenue if a higher effort level is implemented as a result of the tax sheltering of benefits.[14]

Definition: Let the marginal change in cost to the principal resulting from an effort level shift and assuming P_1 be defined by ΔC_1; where $\Delta C_1 = \overline{C}(a_2, P_1) - \overline{C}(a_1, P_1)$; $a_2, a_1 \in A$; and $a_2 \rangle a_1$.

Definition: Let the marginal change in the agent's discretionary income after tax and after benefits be defined by ΔD; where $\Delta D = (\overline{D}_2) - (\overline{D}_1)$;

$\overline{D}_2 = \sum_{i=1}^{n} \pi_i(a_2)(D_{i2})$ and $\overline{D}_1 = \sum_{i=1}^{n} \pi_i(a_1)(D_{i1})$; $a_2, a_1 \in A$; and $a_2 \rangle a_1$.

Proposition 5: Assume A1, A2, and $t^A \rangle \frac{\Delta C_0 - \Delta B}{\Delta C_0 - \Delta B + \Delta b}$. Then, if $t^P \rangle \frac{t^A(\overline{b}_1 - \Delta D)}{t^A \overline{b}_1 + (\Delta B - \Delta C_1)(1 - t^A)}$, government revenue increases as a result of the tax sheltering of benefits.

Proof: First, from Proposition 3, $t^A \rangle \frac{\Delta C_0 - \Delta B}{\Delta C_0 - \Delta B + \Delta b}$ implies that $\tilde{a} \rangle a^*$, where $\tilde{a}$ is the second best solution for P_1. By definition and by equation (15), $t^A \overline{b}_1 + (\Delta B - \Delta C_1)(1 - t^A) \rangle 0$ is known. Thus, if $t^P \rangle \frac{t^A(\overline{b}_1 - \Delta D)}{t^A \overline{b}_1 + (\Delta B - \Delta C_1)(1 - t^A)}$ holds:

$$t^P \Delta B(1 - t^A) - t^P \Delta C_1(1 - t^A) + t^A t^P \overline{b}_1 - t^A \overline{b}_1 + t^A \Delta D \rangle 0 \qquad (27)$$

[14] Refer to Proposition 3 for proof that the implementation of a higher effort level occurs as a result of the tax sheltering of benefits.

and

$$t^P\left(\Delta B - \Delta C_1 + \frac{t^A \bar{b}_1}{1-t^A}\right) + t^A\left(\frac{\Delta D - \bar{b}_1}{1-t^A}\right) \rangle 0. \tag{28}$$

Further substituting and rearranging yields:

$$t^P\left[\bar{B}(\tilde{a}) - \bar{C}(\tilde{a},P_1)\right] + t^A\left[\frac{\bar{D}_2}{1-t^A}\right] \rangle$$
$$t^P\left[\bar{B}(a^*) - \bar{C}(a^*,P_1) - \frac{t^A \bar{b}_1}{1-t^A}\right] + t^A\left(\frac{\bar{D}_1 + \bar{b}_1}{1-t^A}\right). \tag{29}$$

Now, since $\bar{C}(a,P_1) = \bar{C}(a,P_0) - \sum_{i=1}^{n} \pi_i(a)\left(\frac{t^A b_i}{1-t^A}\right)$, then expression (29) can be rewritten as follows:

$$t^P\left[\bar{B}(\tilde{a}) - \bar{C}(\tilde{a},P_1)\right] + t^A\left[\sum_{i=1}^{n} \pi_i(\tilde{a})\left(\frac{\tilde{D}_i}{1-t^A}\right)\right] \rangle$$
$$t^P\left[\bar{B}(a^*) - \bar{C}(a^*,P_0)\right] + t^A\left[\sum_{i=1}^{n} \pi_i(a^*)\left(\frac{D_i^* + b_i^*}{1-t^A}\right)\right] \tag{30}$$

Q.E.D.

Corollary: Let $t^A = t^P = t$. Then, if $\Delta B \rangle \bar{b}_2$, government revenue increases as a result of the tax sheltering of benefits.

Proof: If $\Delta B \rangle \bar{b}_2$, then by substituting, the following holds:

$$\bar{B}(\tilde{a}) - \sum_{i=1}^{n} \pi_i(\tilde{a})(\tilde{b}_i) \rangle \bar{B}(a^*);$$

Now, by adding and subtracting the identical factors the following is obtained:

$$\bar{B}(\tilde{a}) - \sum_{i=1}^{n} \pi_i(\tilde{a}) \left(\frac{\tilde{D}_i + \tilde{b}_i}{1 - t^A} \right) + \sum_{i=1}^{n} \pi_i(\tilde{a}) \left(\frac{\tilde{D}_i + \tilde{b}_i}{1 - t^A} \right) - \sum_{i=1}^{n} \pi_i(\tilde{a}) \left(\frac{\tilde{b}_i (1 - t^A)}{1 - t^A} \right) \rangle$$
$$\bar{B}(a^*) - \left[\sum_{i=1}^{n} \pi_i(a^*) \left(\frac{D_i^* + b_i^*}{1 - t^A} \right) \right] + \left[\sum_{i=1}^{n} \pi_i(a^*) \left(\frac{D_i^* + b_i^*}{1 - t^A} \right) \right]. \quad (31)$$

Now, since $\bar{C}(a,P_1) = \bar{C}(a,P_0) - \sum_{i=1}^{n} \pi_i(a) \left(\frac{t^A b_i}{1 - t^A} \right) = \sum_{i=1}^{n} \pi_i(a) \left(\frac{D_i + b_i}{1 - t^A} - \frac{t^A b_i}{1 - t^A} \right)$, then expression (31) can be rewritten as follows:

$$\bar{B}(\tilde{a}) - \bar{C}(\tilde{a},P_1) + \sum_{i=1}^{n} \pi_i(\tilde{a}) \left(\frac{\tilde{D}_i}{1 - t^A} \right) \rangle$$
$$\bar{B}(a^*) - \bar{C}(a^*,P_0) + \left[\sum_{i=1}^{n} \pi_i(a^*) \left(\frac{D_i^* + b_i^*}{1 - t^A} \right) \right]. \quad (32)$$

Therefore, comparing government revenue where $t^P = t^A = t$ yields:

$$t \left[\bar{B}(\tilde{a}) - \bar{C}(\tilde{a},P_1) + \sum_{i=1}^{n} \pi_i(\tilde{a}) \left(\frac{\tilde{D}_i}{1 - t^A} \right) \right] \rangle$$
$$t \left[\bar{B}(a^*) - \bar{C}(a^*,P_0) + \sum_{i=1}^{n} \pi_i(a^*) \left(\frac{D_i^* + b_i^*}{1 - t^A} \right) \right]. \quad (33)$$

Q.E.D.

This corollary is particularly interesting since under current tax laws the top individual and corporate tax rates are approximately equal.[15]

---

15 Refer to Table IV for individual and corporate tax rates for 1993.

5.5 Other Factors Impacting Contracting Costs

By providing tax-sheltered benefits, an employer can reduce employer-employee contracting costs.[16] Exogenous factors can impact the employer's decision to provide tax-sheltered benefits. Two of these factors, which are considered in the following sections, are a purchase advantage and administration costs.

5.5.1 Purchase Advantage Scenario

Assume that the principal for various reasons can obtain a purchase advantage over the agent. Reasons include economies of scale for large employers; preferred customer status with insurance companies because of pooled risk; or the use of self insured plans; among other reasons. To incorporate this purchase advantage with the tax sheltering of benefits, assume that the principal has the ability to provide the same level of benefits desired by the agent for less cost.

Proposition 6: If the principal possesses a purchase advantage for tax-sheltered benefits, the principal is made better off as a result of the tax sheltering of benefits.

Proof: Let $\rho_i b_i$ represent the principal's purchase price where $0 \rangle \rho_i \rangle 1$. Also, let the incentive scheme that implements a, $a \in A$, given a purchase advantage be denoted by

$$s_i(P_1, \rho) = w_i + \rho_i b_i, \qquad i = 1,\ldots,n. \tag{34}$$

---

16 Refer to the results of the proof of Proposition 1.

From Proposition 1, wages can be expressed as: $w_i = s_i(P_0) - \frac{b_i}{1-t^A}$. Thus,

$$s_i(P_1,\rho) = s_i(P_0) - \frac{b_i}{1-t^A} + \rho_i b_i$$

$$= s_i(P_0) - \frac{b_i + \rho_i b_i - t^A \rho_i b_i}{1-t^A}$$

$$= s_i(P_0) - \frac{t^A b_i}{1-t^A} - (1-\rho_i)b_i. \qquad (35)$$

Hence, $s_i(P_1,\rho) < s_i(P_1) < s_i(P_0)$, which implies that

$$\bar{B}(a^\rho) - \bar{C}(a^\rho,P_1) \geq \bar{B}(\tilde{a}) - \bar{C}(\tilde{a},P_1) \qquad (36)$$

where a^ρ, $a^\rho \in A$, is the second best solution given the existence of a purchase advantage.

Q.E.D.

Comment 4: Presuming a purchase advantage is a function of firm size, the tax sheltering of benefits may provide larger firms with an advantage over smaller firms. A larger firm could provide the same level of benefits at less cost; possibly resulting in higher profit margins for larger firms. Alternatively, the larger firm could supply a higher level of benefits for the same cost as a smaller firm with the possibility of extracting more effort from the agent or of attracting more desirable employees. Potentially, this could be empirically tested to determine if firms with a purchase advantage do provide a different level of benefits.

5.5.2 Administrative Costs Scenario

The principal can incur additional administrative costs for providing tax-sheltered benefits to the agent. Examples of administrative costs associated with tax-sheltered benefit plans include the cost of preparing and amending plan documents, tax filings, maintaining records, investment advisory fees, actuarial fees, etc. The following analysis demonstrates how these administrative costs can have an offsetting effect on the principal's cost savings from the tax sheltering of benefits and the purchase advantage discussed above.

Let α represent administrative costs, where $\alpha > 0$. Also assume that α is constant across all states of nature. The total cost to the principal for implementing a, $a \in A$, can now be represented by:

$$s_i(P_1, \rho, \alpha) = w_i + \rho_i b_i + \alpha$$

$$= s_i(P_0) - \frac{t^A b_i}{1 - t^A} - (1 - \rho_i) b_i + \alpha, \quad i = 1, \ldots, n. \tag{37}$$

Now, comparing $s_i(P_1, \rho, \alpha)$ to $s_i(P_0)$, yields

$$\alpha < \frac{t^A b_i}{1 - t^A} + (1 - \rho_i) b_i. \tag{38}$$

Thus, the principal will be better off providing tax-sheltered benefits if administrative expenses are less than the cost savings associated with the tax sheltering of benefits and the cost savings associated with the purchase advantage. Conceivably, if administrative costs exceeded the combination of these two savings factors, a wealth maximizing principal would drop benefits. Hence, the agent would be forced to purchase benefits with after tax dollars. The conclusion from this analysis is that administrative costs are an important factor in the principal's decision to provide tax-sheltered benefits.

Comment 5: Apparent from this analysis is that administrative costs can erase the advantages derived from the tax sheltering of benefits. This analysis has tax policy implications if tax legislation designed to protect the employee-agent causes increases in administrative expenses. An example of this type of tax legislation is the non-discrimination rules enacted to ensure that benefits do not favor highly compensated employees.[17] Compliance with these laws could cause administrative costs to exceed the savings derived by the principal from offering tax-sheltered benefits. A profit maximizing principal faced with this situation would reduce benefits or even terminate them to avoid additional costs. This negative result could occur in a case where the primary purpose of the tax legislation was to enhance the agent's welfare.

5.6 Potential Tax Policy Issues

This section examines the effect on employer-employee contracting costs of potential tax policy issues relative to benefits. In section 5.6.1, an increase to the agent's tax rate results in an increase in the principal's contracting costs. The partial repeal and the complete repeal of the tax preference for benefits, which are examined in sections 5.6.2 and 5.6.3, respectively, also result in an increase in contracting costs. Another possible tax policy issue examined in section 5.6.4 is the repeal of the deductibility of tax-sheltered benefits in computing the principal's tax. Whether the principal is better off continuing to provide tax-sheltered benefits to the agent after the repeal of the deductibility of these tax-preferred benefits depends on the agent's and principal's tax rates.

---

[17] To comply with non-discrimination rules extensive testing is required to establish that highly compensated employees are not receiving excessive benefits when compared with the non-highly compensated employees. Refer to Internal Revenue Code Section 401.

To simplify the analysis, the possibility of a purchase advantage and administrative costs are ignored in the analysis of potential tax policies, with the exception of the discussion of a complete repeal of the tax preference for benefits, section 5.6.3. In all other situations, a purchase advantage would have a favorable impact on the principal's contracting costs while administrative costs would have an unfavorable impact. Thus, the result of including these items depends on whether the purchase advantage exceeds the administrative costs.

5.6.1 Increase to the Agent's Tax Rate Policy

A potential tax policy issue is an increase in the agent's tax rate. Assume that the principal provides the agent with the desired level of tax-sheltered benefits. Additionally, assume that the agent and the principal face the same market price for purchasing benefits. The effect of a tax rate increase on employer-employee contracting costs is explored by the following proposition:

Proposition 7: If benefits are tax sheltered and the agent's tax rate increases, then the principal is made worse off.

Proof: Let $s_i(P_1) = w_i + b_i$ be the cost of implementing a. Since $D_i = (1 - t^A)w_i$, the following is known:

$$s_i(P_1) = \frac{D_i}{1 - t^A} + b_i, \qquad i = 1,\ldots,n. \tag{39}$$

Further,

$$\frac{\partial s_i}{\partial t^A} = \frac{\partial w_i}{\partial t^A} = \frac{D_i}{(1 - t^A)^2} > 0. \tag{40}$$

Expression (43) implies that $s_i(a, t_1^A) < s_i(a, t_2^A)$, where $t_1^A < t_2^A$. Thus,

$$\bar{B}(a) - \bar{C}(a, t_2^A) < \bar{B}(a) - \bar{C}(a, t_1^A),\ a \in A \tag{41}$$

where t_2^A and t_1^A represent a tax sheltering of benefits policy with and without an increase in the agent's tax rate, respectively. Now, assume $\tilde{a}$ is the second best solution given t_1^A. Thus,

$$\bar{B}(\tilde{a}) - \bar{C}(\tilde{a}, t_1^A) \geq \bar{B}(a) - \bar{C}(a, t_1^A),\ a \in A. \tag{42}$$

Let $\hat{a}$, where $\hat{a} \in A$, be the second best solution for the new tax policy, t_2^A. Thus,

$$\bar{B}(\hat{a}) - \bar{C}(\hat{a}, t_2^A) \geq \bar{B}(a) - \bar{C}(a, t_2^A),\ a \in A. \tag{43}$$

Expressions (41), (42), and (43) imply that

$$\bar{B}(\hat{a}) - \bar{C}(\hat{a}, t_2^A) < \bar{B}(\tilde{a}) - \bar{C}(\tilde{a}, t_1^A). \tag{44}$$

Q.E.D.

Comment 6: Thus, the principal is worse off with a tax rate increase while the agent's utility is maintained. The principal bears the full cost of the tax rate increase. However, as long as the tax sheltering of benefits is available, this increase in the tax rate will enhance the incentive to provide tax-sheltered benefits. Therefore, as the tax rate increases, the principal will attempt to substitute more tax-sheltered benefits for wages.

In addition to a tax policy increasing the agent's tax rate, the current graduated tax rate structure could create this same incentive to the principal to provide higher tax-sheltered benefits to higher wage earners. These high wage earners would presumably experience a higher marginal tax rate. Department of Labor statistics indicate that the average wage of employees differs by

industry.[18] Certain industries, for example the retail industry, employ more unskilled workers than other industries such as high technology sectors of the economy. Thus, the analysis has a potentially testable implication. That is, employers in higher wage industries have an increased incentive to substitute tax-sheltered benefits for wages.

5.6.2 Partial Repeal of the Tax Preference for Benefits

Consider a tax policy, P_{01}, that provides for the partial repeal of the tax preference for benefits. An example of a partial repeal is the decrease in the maximum contribution to pension plans which was included in recent tax legislation.[19] Another example which has been suggested as a revenue raising tool is the repeal of the deductibility of employer contributions to medical plans.[20]

Now, assume that some of the agent's desired benefits can no longer be tax sheltered. Let the incentive scheme that implements a, $a \in A$, given P_{01} be denoted as:

$$s_i(P_{01}) = \frac{D_i}{1-t^A} + \frac{\varphi_i b_i}{1-t^A} + (1-\varphi_i)b_i, \qquad i = 1,\ldots,n, \qquad (45)$$

where φ_i represents the portion of benefits taxable after the partial repeal of the tax preference for benefits; and where $0 < \varphi_i < 1$.

---

18 "Employment Hours and Earnings, 1909-90," March 1991, Bureau of Labor Statistics, Bulletin 2370.

19 Refer to the Omnibus Budget Reconciliation Act of 1993.

20 Source is "Deloitte & Touche Review," March 8, 1993.

Since the agent's incentive scheme without tax sheltering can be expressed as $s_i(P_0) = \frac{D_i + b_i}{1 - t^A}$, then by rearranging expression (45) and by substituting the following is obtained:

$$s_i(P_{01}) = \left[\frac{D_i}{1-t^A} + \frac{b_i}{1-t^A}\right] + \left[\frac{\varphi_i b_i}{1-t^A} + (1-\varphi_i)b_i - \frac{b_i}{1-t^A}\right]$$

$$= s_i(P_0) - \frac{t^A b_i(1-\varphi_i)}{1-t^A}. \qquad (46)$$

Thus,

$$\bar{B}(\breve{a}) - \bar{C}(\breve{a}, P_{01}) \rangle \bar{B}(a^*) - \bar{C}(a^*, P_0) \qquad (47)$$

where $\breve{a}$, $\breve{a} \in A$, is the second best solution given P_{01}; and where a^*, $a^* \in A$, is the second best solution given P_0. However,

$$\bar{B}(\tilde{a}) - \bar{C}(\tilde{a}, P_1) \rangle \bar{B}(\breve{a}) - \bar{C}(\breve{a}, P_{01}). \qquad (48)$$

where $\tilde{a}$, $\tilde{a} \in A$, is the second best solution given P_1.

The conclusion here is that the principal is better off with the partial repeal of the tax preference for benefits than with no tax sheltering of benefits, expression (47). However, the principal is worse off with the partial repeal than with full tax sheltering of benefits, expression (48). As a result of the partial repeal of the tax preference, the cost savings from tax sheltering are reduced as follows:

$$s_i(P_{01}) - s_i(P_1) = \left[s_i(P_0) - \frac{t^A b_i(1-\varphi)}{1-t^A}\right] - \left[s_i(P_0) - \frac{t^A b_i}{1-t^A}\right]$$

$$= \frac{\varphi\, t^A b_i}{1 - t^A}. \qquad (49)$$

5.6.3 Complete Repeal of the Tax Preference for Benefits

Now, consider a tax policy completely repealing the tax preference for benefits. That is, assume a reversion to a tax policy with no tax sheltering of benefits, P_0. Thus, tax savings incentive for the principal to provide benefits to the agent is eliminated. Assume, however, that the agent continues to desire a certain level of benefits and that the principal can obtain a purchase advantage over the agent.

Proposition 8: If the principal possesses a purchase advantage for benefits that can not be tax sheltered, the principal is made better off by providing these benefits to the agent.

Proof: Let the incentive scheme that implements a, $a \in A$, given P_0 and a purchase advantage, ρ_i, be denoted by:

$$s_i(P_0, \rho) = \frac{D_i + b_i}{1 - t^A} - (1 - \rho_i) b_i \qquad i = 1, \ldots, n, \qquad (50)$$

where $(1 - \rho_i) b_i$ represents the cost savings associated with the principal's purchase advantage. Now, by substituting the following is obtained:

$$s_i(P_0, \rho) = s_i(P_0) - (1 - \rho_i) b_i. \qquad (51)$$

Now, since $0 < \rho_i < 1$, then $s_i(P_0, \rho) < s_i(P_0)$. This immediately implies that:

$$\bar{B}(\hat{a}) - \bar{C}(\hat{a}, P_0) \geq \bar{B}(a^*) - \bar{C}(a^*, P_0) \qquad (52)$$

where $\hat{a}$, $\hat{a} \in A$, is the second best solution given P_0 and ρ_i.

Q.E.D.

Without the tax sheltering of benefits, an employer has an incentive to provide benefits if a purchase advantage exists. This assumes, however, that the purchase advantage exceeds any additional administrative expenses incurred to provide these benefits. Again, large firms could have an advantage over smaller firms by providing the same level of benefits at less cost.

5.6.4 Repeal of the Deductibility of Tax-Sheltered Benefits by the Principal

Consider a tax policy, P_2, which allows for the tax sheltering of benefits but repeals the deductibility of these benefits when computing the principal's tax. Assume that the agent desires a certain level of benefits and that the principal can purchase these benefits on behalf of the agent at the same market price.

Let the after tax cost to the principal of implementing a, $a \in A$, for P_2 be

$$\left(1-t^P\right)\left[s_i(P_2)\right] = \left(1-t^P\right)\left(\frac{D_i}{1-t^A}\right) + b_i, \qquad i = 1,\ldots,n, \qquad (53)$$

By substituting and by rearranging yields the following:

$$\left(1-t^P\right)\left[s_i(P_2)\right] = \left(1-t^P\right)\left[s_i(P_0)\right] + \left[\frac{b_i\left(t^P - t^A\right)}{1-t^A}\right]. \qquad (54)$$

Therefore, whether the principal is better off by providing tax-sheltered benefits after the repeal of the deductibility of these benefits depends on the agent's and principal's tax rates. If $t^A > t^P$, the principal is better off substituting

wages for benefits. If the reverse occurs, the principal is better off terminating all nondeductible benefits.

Comment 7: Limiting the employer deductibility of tax-sheltered benefits has been suggested as a method of funding a national health care system.[21] A wealth maximizing employer would eliminate employee tax-sheltered benefits if the cost of these benefits exceeded the savings. Thus, with the repeal of the deductibility of tax-sheltered benefits employers with high marginal tax rates would have an incentive to discontinue tax-sheltered benefits. This could potentially be empirically tested.

5.7 Optimal Benefits Package -- Cafeteria Plan

The principal is better off by providing the maximum level of tax-sheltered benefits that an agent will accept, subject to the cost savings exceeding administrative expenses.[22] The analysis thus far assumes that the principal knows the agent's utility function and knows the agent's desired level of benefits. Realistically, however, the principal will not know the agent's desired combination of discretionary income and benefits.

An option for the principal to induce the agent to reveal his desired level of benefits is to institute a cafeteria plan. These plans permit the agent to choose among two or more alternative benefits. A principal contributes a certain dollar amount per agent. The agent then chooses among tax-sheltered benefits, taxable benefits, or cash.[23] The plan can include a reimbursement feature that

---

21 Refer to Ernst & Young "Taxation and Corporate Growth," Tax Notes, April 5, 1993, Page 134, and more recently to *The Wall Street Journal*, October 28, 1993, page A8.

22 Refer to the proof of Proposition 3.

23 Although the tax laws covering cafeteria plans provide only cash and qualified (tax-sheltered) benefits can be provided, taxable benefits may be offered by an employer and treated as an employee's election to receive cash.

provides additional tax-sheltering possibilities to the agent. The agent uses before tax dollars to purchase such items as child care, prescription and non-prescription drugs, dental, hearing and vision care, among others. In effect, a cafeteria plan permits an agent to purchase benefits that are normally not tax sheltered with before-tax dollars. Thus, a cafeteria plan can increase the benefit options available to the agent.

Now, assume that the principal institutes a cafeteria plan that provides the agent with additional benefit options. Assume that the agent's desire for benefits increases as a result of the availability of a cafeteria plan.[24] The following proposition investigates the impact of a cafeteria plan on employer-employee contracting costs.

Proposition 9: Assume cost savings as a result of providing tax sheltered benefits exceeds administrative costs. Then, if the principal institutes a cafeteria plan, the principal is made better off.

Proof: Let b_i^c represent the additional benefits that the agent desires to purchase with before tax dollars through a cafeteria plan. The cost of implementing a, $a \in A$, now becomes

$$s_i\left(P_1^c\right) = \frac{D_i - b_i^c}{1 - t^A} + b_i + b_i^c$$

$$= \frac{D_i}{1 - t^A} + b_i - \frac{t^A b_i^c}{1 - t^A}, \qquad i = 1,\ldots,n, \qquad (55)$$

where P_1^c represents a tax policy permitting the tax sheltering of benefits through a cafeteria plan. Thus $s_i\left(P_1^c\right) < s_i(P_1)$, which implies that

---

[24] The analysis assumes that the new desired level of benefits, is within the limits set out in Internal Revenue Code Section 415.

$$\bar{B}(a) - \bar{C}(a,P_1^c) \rangle \bar{B}(a) - \bar{C}(a,P_1),\ a \in A. \tag{56}$$

Let a^c, $a^c \in A$, be the second best solution for P_1^c. Thus,

$$\bar{B}(a^c) - \bar{C}(a^c,P_1^c) \geq \bar{B}(a) - \bar{C}(a,P_1^c),\ a \in A. \tag{57}$$

But, this immediately implies that

$$\bar{B}(a^c) - \bar{C}(a^c,P_1^c) \rangle \bar{B}(\tilde{a}) - \bar{C}(\tilde{a},P_1) \tag{58}$$

Q.E.D.

Additional administrative expenses may be incurred with a cafeteria plan as a result of government reporting requirements and compliance with non-discrimination rules.[25] Offsetting these administrative expenses is a purchase advantage if available to the principal. However, to simplify the analysis, administrative costs and purchase advantage are ignored in the mathematical calculations.

5.8 Chapter Summary

This chapter introduces the tax sheltering of benefits into the basic agency model outlined in Chapter IV. Initially the mathematical analysis proves that by substituting benefits for cash wages the principal can appropriate the cost savings associated with the tax-sheltering of benefits. Thus, these cost savings provide an incentive for the principal to substitute the agent's desired benefits for cash wages.

More significantly, however, the analysis determines that a decline in effort as a result of tax sheltering is not possible. A shift to a higher effort level

---

[25] Refer to Internal Revenue Code Section 125.

is possible as a result of the tax sheltering of benefits if the agent's tax rate exceeds a specified level. With this increase in production, government revenue will be enhanced as a result of the tax sheltering of benefits, subject to the principal's tax rate exceeding a specified level. This result is contrary to the intuitive belief that government revenue will decrease with the addition of the tax preference for benefits.

Following this analysis, exogenous variables such as a purchase advantage and administrative costs are factored into the model. These variables are determined to be important in the principal's decision to provide benefits. Finally, potential tax policy issues are analyzed for the impact on contracting costs.

CHAPTER VI

SUMMARY AND CONCLUSIONS

The present study has explored from a theoretical perspective the effect of tax policy on optimal employer-employee contracting, on employee effort and on government revenue. The analysis involves the development of a principal-agent model that is extended to include situations involving current and potential tax policy issues relative to benefits. The following summarizes the conclusions of this study.

6.1 Current Tax Policy Issues

Initially, without the tax sheltering of benefits there is no incentive for the employer to supply the employee's desired level of benefits as shown in Chapter V. Then, with the introduction of the tax preference of benefits as permitted by current tax policy, the analysis demonstrates that the employer can appropriate the tax savings associated with the nontaxable feature of benefits. The model proves that a wealth maximizing employer is better off as a result of the tax sheltering of benefits. Thus, tax sheltering justifies the substitution of benefits for cash wages in an employee's compensation package. A conclusion of the analysis is that tax-sheltered benefits are an essential characteristic of optimal employer-employee contracting.

A more notable aspect of this study is the determination of the impact of the tax sheltering of benefits on the employee's effort. The study proves that a lower effort as a result of the tax sheltering of benefits is not possible; while a

higher effort will be implemented by the principal as a result of the tax sheltering of benefits. This increase in effort is subject to the agent's tax rate exceeding a specified level. Appendix A provides numerical evidence of the feasibility of this shift to a higher effort as a result of the tax sheltering of benefits.

An alternative attribute of this nontaxable feature of benefits, investigated in section 5.4, is the effect on government revenue. Intuitively, government revenue would decrease with the allowance for the tax sheltering of benefits.[26] This study demonstrates that, contrary to intuition, government revenue will be enhanced with an effort shift resulting from the tax sheltering of benefits. This result is subject to the principal's tax rate exceeding a specified level. Appendix A provides numerical evidence of this favorable impact on government revenue as a result of the tax sheltering of benefits.

Thus, the conclusions of the analysis of the employee's effort and government revenue are an important contribution of this study. As a result of the tax sheltering of benefits, the employer is unconditionally better off while the employee's utility is maintained. Moreover, this study identifies an exception to the intuitive belief that government always decreases as a result of the tax sheltering of benefits. An interesting aspect of these results is that although some general assumptions are made relative to the agent, the conclusions reached are independent of the agent's utility. The assumed variables, such as effort aversion and risk aversion, are characteristics common to all agents and are not reliant on individual preferences.

In section 5.5, the analysis incorporates exogenous factors such as a purchase advantage and administrative costs into the model of employer-employee contracting. The study concludes that an employer purchase

---

[26] Revenue generators included in President's Clinton's national health care proposal provide evidence of this contention.

advantage and administrative costs can impact the employer's decision to provide tax-sheltered benefits. Moreover, the study identifies potential empirical implications of these considerations. Thus, possible extensions of the research issues modeled are presented in this study.

6.2 Potential Tax Policy Issues

This study also addresses potential tax policy issues such as an increase in the employee's tax rate. The analysis demonstrates that a rate increase has a detrimental effect on the employer's overall contracting costs but a positive effect on the decision to provide tax-sheltered benefits. Thus, with an increase in the employee's tax rate the employer's incentive to substitute benefits for cash wages is enhanced.

The partial repeal and the complete repeal of the nontaxable feature of benefits are additional tax policy issues that are examined in sections 5.6.2 and 5.6.3, respectively. As expected, the principal is worse off with the partial repeal of the tax preference for benefits while the employee's utility remains the same. Similarly, with the complete repeal of the tax sheltering of benefits, the employer is worse off. However, if a purchase advantage is available to the employer, substituting benefits, taxable or nontaxable, for cash wages, continues to be attractive to a wealth maximizing employer. This analysis assumes, however, that administrative costs do not exceed the purchase advantage.

Another potential tax policy issue that has recently been suggested as a government revenue generator is the limiting of the employer's deductibility of tax-sheltered benefits. Obviously, this tax policy would increase contracting costs. More relevant, however, is that this tactic could cause a wealth maximizing employer to terminate benefits if the employer's tax rate exceeds the

employee's tax rate. Hence, social efficiency, which has been the basis for much of the legislation on the tax preference of benefits, may be thwarted with the repeal of the deductibility of tax-sheltered benefits by an employer.

In the final section of Chapter V, a cafeteria plan is suggested as an option for an employer to induce the employee to reveal his desired level of benefits. With a cafeteria plan, the employer broadens the employee's benefit options and possibly increases the employee's desired level of benefits. Thus, the opportunity is available for the employer to substitute more benefits for cash wages and thereby appropriate the savings.

6.3 Limitations and Extensions of the Study

The implications of the analytical results of this study are limited by the use of a one period, single principal-agent model. Removal of these restrictions might extend this study. For instance, payments to the agent could be extended over a multi-year horizon. Moreover, the model could be expanded to include a taxing authority as a principal. The objective of the taxing authority would be to maximize net wealth that is obtained from tax revenues less audit and administrative costs.

In addition to these analytical extensions, the study identifies potential empirical testing of the mathematical results. For example, firms that employ higher wage earners experiencing higher marginal tax rates have a greater incentive to substitute tax-sheltered benefits for wages as determined in section 5.6.1. As a result, do these firms provide a higher level of benefits than firms employing lower wage earners? Another example in section 5.5.1 is that larger firms may obtain volume discounts or a purchase advantage over smaller firms. Hence, larger firms would have a labor advantage over smaller firms. Also large

firms may have a greater opportunity to reduce costs through tax sheltering of benefits by taking advantage of administrative costs spread over a greater number of employees. Thus, the break-even point identified in section 5.5.2 may differ across firms.

REFERENCES

Adamache, K. W., and F. A. Sloan, "Fringe Benefits: To Tax or Not To Tax?" National Tax Journal, Vol. XXXVIII, No. 1 (1985): pg. 47-64.

Baiman, S., "Agency Research in Managerial Accounting: A Second Look," Accounting, Organizations and Society, Vol. 15, No. 4 (1990): pg. 341-371.

Binger, B. R., and E. Hoffman, Microeconomics with Calculus, Scott, Foresman and Company, 1988.

Brown, C., and J. Medoff, "The Employer Size-Wage Effect," Journal of Political Economy, Vol. 97, No. 5 (1989): pg. 1027-1059.

Burke, T. P., and J. D. Morton, "How firm size and industry affect employee benefits," Monthly Labor Review, December 1990: pg. 35-43.

Burman, L. E., and J. Rodgers, "Tax Preferences and Employment-Based Health Insurance," National Tax Journal, Vol. XLV, No. 3 (September 1992): pg. 331-346.

Chaing, A. C., Fundamental Methods of Mathematical Economics, McGraw-Hill Book Company, 1984.

Clain, S. H., and K. Lappel, "Fringe benefits and the effect of tax reform," Applied Economics, Vol. 21 (1989): pg. 681-695.

Demski, J. S., J. M. Patell, and M. A. Wolfson, "Decentralized Choice of Monitoring Systems," The Accounting Review, Vol. LIX, No. 1 (January, 1984): pg. 16-34.

Eisenhardt, K. M., "Agency Theory: An Assessment and Review," Academy of Management, Vol. 14 (1989): pg. 57-74.

Fellingham, J. C., and M. A. Wolfson, "Taxes and Risk Sharing," The Accounting Review, Vol. LX, No. 1 (January, 1985): pg. 10-17.

Grossman, S. J., and O. D. Hart, "An Analysis of the Principal-Agent Problem," Econometrica, Vol. 51, No. 1 (January, 1983): pg. 7-45.

Halperin, R. and J. Tzur, "The Effects of Nontaxable Employee Benefits on Employer Profits and Employee Work Effort," National Tax Journal, Vol. XXXVII, No 1 (March, 1984): pg. 65-79.

Halperin, R., and J. Tzur, "Monetary Compensation and Nontaxable Employee Benefits: An Analytical Perspective," The Accounting Review, Vol. LX, No. 4 (October, 1985): pg. 670-680.

Halperin, R., "Analytical Methodology in Tax Research," A Guide to Tax Research Methodologies, Edited by C. R. Enis, American Taxation Association Section of American Accounting Association (1991): pg. 1 - 13.

Harris, M., and A. Raviv, "Some Results on Incentive Contracts with Application to Education and Employment, Health Insurance, and Law Enforcement," American Economic Review, Vol. 68, No. 1 (March, 1978): pg. 20-30.

Henderson, J. M., and R. E. Quandt, MICROECONOMIC THEORY A Mathematical Approach, McGraw-Hill Book Company, 1980.

Irish, L. E., "Twenty Years of Employee Benefits," Tax Notes, November 12, 1992

Jensen, M. C., and W. H. Meckling, "Theory of the Firm: Managerial Behavior, Agency Costs and Ownership Structure," Journal of Financial Economics Vol. 3 (1976): pg. 305-360.

Katz, A., and G. Mankiw, "How Should Fringe Benefits Be Taxed?" National Tax Journal, Vol. XXXVIII, No. 1 (March, 1985): pg. 37-46.

Long, J. E., and F. A. Scott, Jr., "The Impact of the 1981 Tax Act on Fringe Benefits and Federal Tax Revenues," National Tax Journal, Vol. XXXVII, No. 2 (June, 1984): pg. 185-194.

Ross, S. A., "The Economic Theory of Agency: The Principal's Problem," American Economic Review, Vol. 63, No. 2 (May, 1973): pg. 134-139.

Strong , N., and M. Walker, "Information and Capital Markets," Basel Blackwell (1987).

Tax Notes, "A Tax Bill Baedeker—A Guide to the 1993 Tax Law," Vol. 60, No. 8 (August 12, 1993)

Turner, R. W., "Are Taxes Responsible for the Growth in Fringe Benefits?" National Tax Journal, Vol. XL, No. 2 (1987): pg. 205-219.

Turner, R. W., "Fringe Benefits: Should We Milk This Sacred Cow?" National Tax Journal, Vol. XLII, No. 3 (September, 1989): pg. 293-300.

The Wall Street Journal, "Clinton's Health-Care Bill Is Delivered to Congress," (October 28, 1993).

U.S. Office of Management and Budget, The Budget for Fiscal Year 1992, 1991, Section XI, "Tax Expenditures," Part Three, Pg. 40.

Watts, R. L., "A Discussion of the Use of Mathematical Models in Financial Accounting," Journal of Accounting Research, Vol. 20 (Supp. 1982): pg. 48-55.

White, R. A., "Employee Preferences for Nontaxable Compensation Offered in a Cafeteria Compensation Plan: An Empirical Study," The Accounting Review, Vol. LVIII, No. 3 (July, 1983): pg. 539-561.

Woodbury, S. A., "Substitution Between Wage and Nonwage Benefits," American Economic Review, Vol. 73, No. 1 (March 1983): pg. 166-182.

APPENDIX A

NUMERICAL ILLUSTRATION OF SOLUTIONS TO CONTRACTING PROBLEMS

The purpose of this appendix is to illustrate examples of the solutions to the employer-employee contracting problems presented in this paper. The basic model assumptions used in these examples are outlined in Chapters 4 and 5. Appendix C includes details of the optimization solutions illustrated in these examples. The notation is summarized on the table of notation in Appendix D.

For this illustration, let the production function be described as follows:

TABLE A1

Production Function

	$\pi(a_1 = 1)$	$\pi(a_2 = 3)$	$\pi(a_3 = 6)$	$\pi(a_4 = 9)$	$x_i(a, \theta)$
θ_1	.2	.4	.6	.8	1000
θ_2	.8	.6	.4	.2	200
$\bar{B}(a_i)$	360	520	680	840	

In addition, assume the agent's utility function, reservation price and tax rate are as follows:

$$H(w,a) = \sqrt{l_i} - a_i$$

$$\overline{H} = 10$$

$$t^A = 40\% \qquad \text{(A.1)}$$

where $l_i = (1 - t^A)s_i$ and $i = 1,\ldots,n$.

Solutions to the problem of maximizing the principal's wealth under various scenarios follow.

A.1 First Best Solution

In a first best situation the principal can determine the agent's reward based on his observed action choice. The problem becomes determining the action level that provides the principal with the maximum net wealth, $\overline{B}(a) - \overline{C}(a)$, assuming the agent is paid his reservation price. Thus,

$$\sqrt{l_i} - a_i = \overline{H} = 10;$$

and

$$s_i = \frac{(10 + a_i)^2}{(1 - t^A)}. \qquad \text{(A.2)}$$

Therefore, the first best cost to implement a_1 is as follows:

$$\overline{C}_{FB}(a_1) = \frac{(10+1)^2}{(1-.40)} = 202. \qquad \text{(A.3)}$$

The results for the first best cost for the remaining three effort levels are summarized in Table A2.

The next step is to determine the principal's benefit at each effort level. For example, referring to Table A1, the benefit for effort level a_1 is as follows:

$$\bar{B}(a_1) = \sum_{i=1}^{n=2} \pi_i(a_1)x_i = (.2)(1{,}000) + (.8)(200) = 360. \qquad (A.4)$$

The final step is to determine the effort level that provides the principal with the maximum net benefit. The following summary indicates that effort level a_3 provides the first best solution to the principal.

TABLE A2

First Best Solution

No Tax Sheltering of Benefits

	$\pi(a_1 = 1)$	$\pi(a_2 = 3)$	$\pi(\mathbf{a_3 = 6})$	$\pi(a_4 = 9)$
$\bar{B}(a_i)$	360	520	**680**	840
$\bar{C}_{FB}(a_i)$	202	282	**427**	602
$\bar{B}(a_i) - \bar{C}_{FB}(a_i)$	158	238	**253**	238

↑

A.2 Second Best Solution

To determine the second best solution, the first step is to calculate the least cost incentive scheme that will implement each possible effort level in the

agent's feasible set. For example, the incentive scheme to implement a_2 can be solved by the following mathematical programming model:

Choose an incentive scheme $s = s_1,\ldots,s_n$, to

$$\text{Minimize} \quad \sum_{i=1}^{n=2} \pi_i(a_2)s_i \tag{A.5}$$

$$\text{subject to} \quad \sum_{i=1}^{n=2} \pi_i(a_2)H(I_i,a_2) \geq \bar{H} \tag{A.6}$$

$$\sum_{i=1}^{n=2} \pi_i(a_2)H(I_i,a_2) \geq \sum_{i=1}^{n=2} \pi_i(a_1)H(I_i,a_1) \tag{A.7}$$

$$\sum_{i=1}^{n=2} \pi_i(a_2)H(I_i,a_2) \geq \sum_{i=1}^{n=2} \pi_i(a_3)H(I_i,a_3) \tag{A.8}$$

$$\sum_{i=1}^{n=2} \pi_i(a_2)H(I_i,a_2) \geq \sum_{i=1}^{n=2} \pi_i(a_4)H(I_i,a_4) \tag{A.9}$$

where $I_i = \left(1-t^A\right)s_i$, $i = 1,\ldots,n$. Expression (A.6) represents the agent's reservation price. Expressions (A.7), (A.8), and (A.9) represent the incentive compatibility constraints.

To simplify the solution to this optimization problem where the agent's utility is $\sqrt{I_i} - a_i$, the radical is eliminated by allowing $\sqrt{I_i} = V_i$. Thus, $s_i = \dfrac{V_i^2}{1-t^A}$ and the constraints can now be written as linear equations. For example, the implementation program for a_2 can be described as follows:

$$\text{Minimize} \quad \sum_{i=1}^{n=2} \pi_i(a_2)s_i = \sum_{i=1}^{2} \pi_i(a_2)\frac{V_i^2}{1-t^A} = \frac{.4V_1^2}{.6} + \frac{.6V_2^2}{.6} \tag{A.10}$$

subject to $.4V_1 + .6V_2 - 3 = 10$[27] (A.11)

$$.4V_1 + .6V_2 - 3 \geq .2V_1 + .8V_2 - 1 \quad \text{(A.12)}$$

$$.4V_1 + .6V_2 - 3 \geq .6V_1 + .4V_2 - 6 \quad \text{(A.13)}$$

$$.4V_1 + .6V_2 - 3 \geq .8V_1 + .2V_2 - 9. \quad \text{(A.14)}$$

The solution to the above optimization problem is $V_1 = 19$ and $V_2 = 9$. Thus, substituting into expression (A.10) yields a second best cost to the principal of 322. Comparing the results in Table A3, the principal would implement action level a_2.[28]

TABLE A3

Second Best Solution

No Tax Sheltering of Benefits

	$\pi(a_1 = 1)$	$\pi(\mathbf{a_2 = 3})$	$\pi(a_3 = 6)$	$\pi(a_4 = 9)$
$\overline{B}(a_i)$	360	**520**	680	840
$\overline{C}_{SB}(a_i)$	202	**322**	517	662
$\overline{B}(a_i) - \overline{C}_{SB}(a_i)$	158	**198**	163	178

↑

Now, assume the agent desires a certain level of benefits and is willing to purchase these benefits with after tax dollars. The agent's after tax wages can be represented by $I_i = D_i + b_i$, where $i = 1,\ldots,n$. For this illustration, assume the

---

27 The second best solution is achieved at the agent's reservation price. For proof of this see Grossman and Hart (1983), page 16.

28 Solutions were determined using Solver in Excel. See Appendix C for details of all solutions.

agent allocates 20% of after tax dollars to benefits.[29] Thus, $b_i = .20(D_i + b_i)$. The agent allocates his net wages between discretionary income and benefits is as follows:

TABLE A4

Second Best Solution-No Tax Sheltering of Benefits

Agent's Allocation Between Discretionary Income and Benefits

	$\pi(a_1 = 1)$	$\pi(\mathbf{a_2 = 3})$	$\pi(a_3 = 6)$	$\pi(a_4 = 9)$
D_i	97	**154**	248	318
b_i	24	**39**	62	79
$D_i + b_i$	121	**194**	310	397
$\frac{D_i + b_i}{1 - t^A}$	202	**322**	517	662

A.3 Second Best Solution Assuming Tax Sheltering of Benefits

Now, assume the principal can tax shelter the agent's desired level of benefits. Again, assume the agent wishes to allocate 20% of his after tax wages to purchase benefits. Thus, $D_i = .8I_i$ and the cost to the principal now becomes

$$s_i = \frac{.8I_i}{1 - t^A} + .20I_i. \qquad \text{(A.15)}$$

[29] Refer to Internal Revenue Code Section 415 for the limitations on benefits under qualified plans. Twenty percent is within these limitations.

Again, assume $\sqrt{I_i} = V_i$ for simplification. Then, $s_i = \frac{.8V_i^2}{1-t^A} + .2V_i^2$ and the implementation program for a_2, can be described as follows:[30]

Minimize

$$\sum_{i=1}^{2} \pi(a_2)\left(\frac{.8V_i^2}{1-t^A} + .2V_i^2\right) = .4\left(\frac{.8V_1^2}{1-t^A} + .2V_1^2\right) + .6\left(\frac{.8V_2^2}{1-t^A} + .2V_2^2\right) \qquad (A.16)$$

subject to $\quad .4V_1 + .6V_2 - 3 = 10 \qquad (A.17)$

$$.4V_1 + .6V_2 - 3 \geq .2V_1 + .8V_2 - 1 \qquad (A.18)$$

$$.4V_1 + .6V_2 - 3 \geq .6V_1 + .4V_2 - 6 \qquad (A.19)$$

$$.4V_1 + .6V_2 - 3 \geq .8V_1 + .2V_2 - 9. \qquad (A.20)$$

When tax sheltering of benefits is permitted, the principal will implement action level a_4 instead of action level a_2 to achieve a second best solution. Table A5 summarizes these results.

---

30 Refer to Appendix C for solutions to all feasible action choices.

TABLE A5

Second Best Solution

Tax Sheltering of Benefits

	$\pi(a_1 = 1)$	$\pi(a_2 = 3)$	$\pi(a_3 = 6)$	$\pi(\mathbf{a_4 = 9})$
$\bar{B}(a_i)$	360	520	680	**840**
$\bar{C}_{TSB}(a_i)$	186	296	475	**609**
$\bar{B}(a_i) - \bar{C}_{TSB}(a_i)$	174	224	205	**231**

↑

A shift to a new second best solution occurs as a result of the tax sheltering of benefits. In comparing Table A3 to Table A5, the principal's cost decreases. However, the agent's allocation between discretionary income and benefits remains the same as shown in Table A4 and A6.

TABLE A6

Second Best Solution-Tax Sheltering of Benefits

Agent's Allocation Between Discretionary Income and Benefits

	$\pi(a_1 = 1)$	$\pi(a_2 = 3)$	$\pi(a_3 = 6)$	$\pi(\mathbf{a_4 = 9})$
D_i	97	154	248	**318**
b_i	24	39	62	**79**
$D_i + b_i$	121	194	310	**397**
$\frac{D_i}{1-t^A} + b_i$	186	296	475	**609**

The sufficient condition for a shift to a higher effort level as a result of the tax sheltering of benefits identified in this study is satisfied as follows:

$$t^A \rangle \frac{\Delta C_0 - \Delta B}{\Delta C_0 - \Delta B + \Delta b} \tag{A.21}$$

where

$$\Delta C_0 = \overline{C}_{SB}(a_4) - \overline{C}_{SB}(a_2) = 662 - 322 = 340;$$

$$\Delta B = \overline{B}(a_4) - \overline{B}(a_4) = 840 - 520 = 320;$$

$$\Delta b = \sum_{i=1}^{n} \pi_i(a_4)(b_4) - \sum_{i=1}^{n} \pi_i(a_2)(b_2) = 79 - 39 = 40.$$

Thus

$$.4 \rangle \frac{340 - 320}{340 - 320 + 40}$$

or

$$.4 \rangle \frac{20}{60} \tag{A.22}$$

A.4. Impact on Government Revenue

Proposition 5 proves that government revenue can increase as a result of the tax sheltering of benefits if a shift to a higher effort level occurs and if $t^P \rangle \frac{t^A\left(\overline{b}_1 - \Delta D\right)}{t^A \overline{b}_1 + \left(\Delta B - \Delta C_1\right)\left(1 - t^A\right)}$. The following shows that this sufficient condition is satisfied:

$$t^P \rangle \frac{t^A\left(\bar{b}_1 - \Delta D\right)}{t^A \bar{b}_1 + \left(\Delta B - \Delta C_1\right)\left(1 - t^A\right)} \tag{A.23}$$

Thus,

$$t^P \rangle \frac{(.4)(39) - (.4)(318 - 154)}{(.4)(39) + (.6)(840 - 520) - (.6)(609 - 296)}$$

or

$$t^P \rangle \frac{-50}{19.8} \text{ or } t^P \rangle -2.5 \tag{A.24}$$

Since $1 \rangle t^P \rangle 0$, this condition is met.

Now, if the principal's tax rate is assumed to be 30%, government revenue with and without tax sheltering as defined in Section 5.4 would be as follows:

$$\bar{R}(P_1) = .30[840 - 609] + .40[530] = 281$$

and

$$\bar{R}(P_0) = .30[520 - 322] + .40[322] = 188$$

Thus, government revenue is enhanced as a result of the tax sheltering of benefits.

A.4. Impact of an Increase in the Agent's Tax Rate

Now, if the agent's tax rate is increased from 40% to 42% the second best solution shifts to a lower effort level as follows:

TABLE A7

Second Best Solution

Tax Shelter of Benefits – Tax Rate Increase

	$\pi(a_1 = 1)$	$\pi(\mathbf{a_2 = 3})$	$\pi(a_3 = 6)$	$\pi(a_4 = 9)$
$\bar{B}(a_i)$	360	**520**	680	840
$\bar{C}_{T'SB}(a_i)$	191	**305**	490	627
$\bar{B}(a_i) - \bar{C}_{T'SB}(a_i)$	169	**215**	190	213

↑

Thus, an increase in the agent's tax rate can erase the cost savings derived from the tax sheltering of benefits.

APPENDIX B

NUMERICAL ILLUSTRATION OF PURCHASE ADVANTAGE AND ADMINISTRATIVE COSTS

The following is a numerical illustration of the analyses assuming a purchase advantage and administrative costs. Table B1 presents data with and without the tax sheltering of benefits for three hypothetical tax rates for the agent, 20%, 40% and 60%.

TABLE B1

Principal's Cost and Agent's Incentive

Agent's Tax Rates: 20%, 40%, and 60%

		PRINCIPAL'S COST (Before Agent's Tax)			AGENT'S INCENTIVE (After Agent's tax)		
SCENARIO	**TAX RATE**	**CASH WAGES**	**IN-KIND WAGES**	**TOTAL COST**	**DISCR. WAGES**	**DESIRE BENEF**	**TOTAL INCEN**
No Shelter	20%	125	0	125	80	20	100
Shelter	20%	100	20	120	80	20	100
No Shelter	40%	166	0	166	80	20	100
Shelter	40%	133	20	153	80	20	100
No Shelter	60%	250	0	250	80	20	100
Shelter	60%	200	20	220	80	20	100

B-1 Comparing No Tax Sheltering to Tax Sheltering

Table B1 summarizes the cost savings as a result of the tax sheltering of benefits. Assuming tax rates of 20%, 40%, and 60% the cost savings are $5, $13, and $30, respectively. Thus, the cost savings to the principal increase as the agent's tax rate rises. These results can be shown mathematical as follows:

Assuming 20% tax rate: $$\frac{t^A b_i}{1-t^A} = \frac{(.20)(20)}{(1-.20)} = 5;$$

Assuming a 40% tax rate: $$\frac{t^A b_i}{1-t^A} = \frac{(.40)(20)}{(1-.40)} = 13;$$

Assuming a 60% tax rate: $$\frac{t^A b_i}{1-t^A} = \frac{(.60)(20)}{(1-.60)} = 30.$$

B.2 Impact of a Purchase Advantage

Adding the assumption of a purchase advantage increases the cost savings to the principal by $(1-\rho_i)b_i$. For this illustration assume that the principal can purchase benefits for 90% of the agent's purchase price. Thus, ρ_i equals .90. Cost savings to the principal as a result of tax sheltering would now be:

Assuming 20% tax rate: $$\frac{t^A b_i}{1-t^A}+(1-\rho_i)b_i=\frac{(.20)(20)}{(1-.20)}+(1-.90)20=7$$

Assuming 40% tax rate: $$\frac{t^A b_i}{1-t^A}+(1-\rho_i)b_i=\frac{(.40)(20)}{(1-.40)}+(1-.90)20=15$$

Assuming 60% tax rate: $$\frac{t^A b_i}{1-t^A}-(1-\rho_i)b_i=\frac{(.60)(20)}{(1-.60)}-(1-.90)20=32.$$

B.3 Impact of Administrative Costs

If administrative costs incurred to provide tax-sheltered benefits exceeded the cost savings of $7 in the example using a 20% tax rate, the principal would be worse off if benefits were provided. Similarly if administrative expenses exceed $15 with a 40% tax rate and $32 with a 60% tax rate, the principal would be worse off.

APPENDIX C

MATHEMATICAL SOLUTIONS TO ILLUSTRATIONS IN APPENDIX A

This appendix includes the solution models for the principal's cost shown on Tables A3, A5, and A7. The solutions were obtained with the aid of Excel, Solver.

NO TAX SHELTERING OF BENEFITS TO IMPLEMENT a_1

where $a_1 = 1,\ a_2 = 3,\ a_3 = 6,\ a_4 = 9,$

and $t^A = 40\%$

Minimize

$$\sum_{i=1}^{n} \pi_i(a_1)s_i = \sum_{i=1}^{n=2} \pi_i(a_1)\frac{V_i^2}{1-t^A} = \frac{.2V_1^2}{1-.4} + \frac{.8V_2^2}{1-.4}$$

Subject to

$$.2V_1 + .8V_2 - 1 = 10$$

$$.2V_1 + .8V_2 - 1 \geq .4V_1 + .6V_2 - 3$$

$$.2V_1 + .8V_2 - 1 \geq .6V_1 + .4V_2 - 6$$

$$.2V_1 + .8V_2 - 1 \geq .8V_1 + .2V_2 - 9.$$

Solution

$$\frac{.2V_1^2}{1-.40} + \frac{.8V_2^2}{1-.40} = \frac{.2(11)^2}{.6} + \frac{.8(11)^2}{.6} = 201.7$$

NO TAX SHELTERING OF BENEFITS TO IMPLEMENT a_2

where $a_1 = 1,\ a_2 = 3,\ a_3 = 6,\ a_4 = 9,$

and $t^A = 40\%$

Minimize

$$\sum_{i=1}^{n} \pi_i(a_2) s_i = \sum_{i=1}^{n=2} \pi_i(a_2) \frac{V_i^2}{1 - t^A} = \frac{.4V_1^2}{1-.4} + \frac{.6V_2^2}{1-.4}$$

Subject to

$$.4V_1 + .6V_2 - 3 = 10$$

$$.4V_1 + .6V_2 - 3 \geq .2V_1 + .8V_2 - 1$$

$$.4V_1 + .6V_2 - 3 \geq .6V_1 + .4V_2 - 6$$

$$.4V_1 + .6V_2 - 3 \geq .8V_1 + .2V_2 - 9.$$

Solution

$$\frac{.4V_1^2}{.6} + \frac{.6V_2^2}{.6} = \frac{.4(19)^2}{.6} + \frac{.6(9)^2}{.6} = 321.7$$

NO TAX SHELTERING OF BENEFITS

TO IMPLEMENT a_3

where $a_1 = 1,\ a_2 = 3,\ a_3 = 6,\ a_4 = 9,$

and $t^A = 40\%$

Minimize

$$\sum_{i=1}^{n} \pi_i(a_3)s_i = \sum_{i=1}^{n=2} \pi_i(a_3)\frac{V_i^2}{1-t^A} = \frac{.6V_1^2}{1-.4} + \frac{.4V_2^2}{1-.4}$$

Subject to

$$.6V_1 + .4V_2 - 6 = 10$$

$$.6V_1 + .4V_2 - 6 \geq .2V_1 + .8V_2 - 1$$

$$.6V_1 + .4V_2 - 6 \geq .4V_1 + .6V_2 - 3$$

$$.6V_1 + .4V_2 - 6 \geq .8V_1 + .2V_2 - 9.$$

Solution

$$\frac{.6V_1^2}{.6} + \frac{.4V_2^2}{.6} = \frac{.6(22)^2}{.6} + \frac{.4(7)^2}{.6} = 516.7$$

NO TAX SHELTERING OF BENEFITS TO IMPLEMENT a_4

where $a_1 = 1,\ a_2 = 3,\ a_3 = 6,\ a_4 = 9,$

and $t^A = 40\%$

Minimize

$$\sum_{i=1}^{n} \pi_i(a_4) s_i = \sum_{i=1}^{n=2} \pi_i(a_4) \frac{V_i^2}{1-t^A} = \frac{.8V_1^2}{1-.4} + \frac{.2V_2^2}{1-.4}$$

Subject to

$$.8V_1 + .2V_2 - 9 = 10$$

$$.8V_1 + .2V_2 - 9 \geq .2V_1 + .8V_2 - 1$$

$$.8V_1 + .2V_2 - 9 \geq .4V_1 + .6V_2 - 3$$

$$.8V_1 + .2V_2 - 9 \geq .6V_1 + .4V_2 - 6.$$

Solution

$$\frac{.8V_1^2}{.6} + \frac{.2V_2^2}{.6} = \frac{.8(22)^2}{.6} + \frac{.2(7)^2}{.6} = 661.7$$

TAX SHELTERING OF BENEFITS TO IMPLEMENT a_1

where $a_1 = 1,\ a_2 = 3,\ a_3 = 6,\ a_4 = 9,$

and $t^A = 40\%$

Minimize $\sum_{i=1}^{n} \pi_i(a_1)s_i =$

$$\sum_{i=1}^{n=2} \pi(a_1)\left(\frac{.8V_i^2}{1-t^A} + .2V_i^2\right) = .2\left(\frac{.8V_1^2}{1-t^A} + .2V_1^2\right) + .8\left(\frac{.8V_2^2}{1-t^A} + .2V_2^2\right)$$

Subject to

$$.2V_1 + .8V_2 - 1 = 10$$

$$.2V_1 + .8V_2 - 1 \geq .4V_1 + .6V_2 - 3$$

$$.2V_1 + .8V_2 - 1 \geq .6V_1 + .4V_2 - 6$$

$$.2V_1 + .8V_2 - 1 \geq .8V_1 + .2V_2 - 9$$

Solution

$$.2\left(\frac{.8(11)^2}{.6} + .2(11)^2\right) + .8\left(\frac{.8(11)^2}{.6} + .2(11)^2\right) = 185.5$$

TAX SHELTERING OF BENEFITS TO IMPLEMENT a_2

where $a_1 = 1,\ a_2 = 3,\ a_3 = 6,\ a_4 = 9,$

and $t^A = 40\%$

Minimize $\sum_{i=1}^{n} \pi_i(a_2)s_i =$

$$\sum_{i=1}^{n=2} \pi(a_2)\left(\frac{.8V_i^2}{1-t^A} + .2V_i^2\right) = .4\left(\frac{.8V_1^2}{1-t^A} + .2V_1^2\right) + .6\left(\frac{.8V_2^2}{1-t^A} + .2V_2^2\right)$$

Subject to

$$.4V_1 + .6V_2 - 3 = 10$$

$$.4V_1 + .6V_2 - 3 \geq .2V_1 + .8V_2 - 1$$

$$.4V_1 + .6V_2 - 3 \geq .6V_1 + .4V_2 - 6$$

$$.4V_1 + .6V_2 - 3 \geq .8V_1 + .2V_2 - 9$$

Solution

$$.4\left(\frac{.8(19)^2}{.6} + .2(19)^2\right) + .6\left(\frac{.8(9)^2}{.6} + .2(9)^2\right) = 295.9$$

TAX SHELTERING OF BENEFITS TO IMPLEMENT a_3

where $a_1 = 1,\ a_2 = 3,\ a_3 = 6,\ a_4 = 9,$

and $t^A = 40\%$

Minimize $\sum_{i=1}^{n} \pi_i(a_3)s_i =$

$$\sum_{i=1}^{n=2} \pi(a_3)\left(\frac{.8V_i^2}{1-t^A} + .2V_i^2\right) = .6\left(\frac{.8V_1^2}{1-t^A} + .2V_1^2\right) + .4\left(\frac{.8V_2^2}{1-t^A} + .2V_2^2\right)$$

Subject to

$$.6V_1 + .4V_2 - 6 = 10$$

$$.6V_1 + .4V_2 - 6 \geq .2V_1 + .8V_2 - 1$$

$$.6V_1 + .4V_2 - 6 \geq .4V_1 + .6V_2 - 3$$

$$.6V_1 + .4V_2 - 6 \geq .8V_1 + .2V_2 - 9.$$

Solution

$$.6\left(\frac{.8(22)^2}{.6} + .2(22)^2\right) + .4\left(\frac{.8(7)^2}{.6} + .2(7)^2\right) = 475.3$$

TAX SHELTERING OF BENEFITS TO IMPLEMENT a_4

where $a_1 = 1,\ a_2 = 3,\ a_3 = 6,\ a_4 = 9,$

and $t^A = 40\%$

Minimize $\sum_{i=1}^{n} \pi_i(a_4)s_i =$

$$\sum_{i=1}^{n=2} \pi(a_4)\left(\frac{.8V_i^2}{1-t^A} + .2V_i^2\right) = .8\left(\frac{.8V_1^2}{1-t^A} + .2V_1^2\right) + .2\left(\frac{.8V_2^2}{1-t^A} + .2V_2^2\right)$$

Subject to

$$.8V_1 + .2V_2 - 9 = 10$$

$$.8V_1 + .2V_2 - 9 \geq .2V_1 + .8V_2 - 1$$

$$.8V_1 + .2V_2 - 9 \geq .4V_1 + .6V_2 - 3$$

$$.8V_1 + .2V_2 - 9 \geq .6V_1 + .4V_2 - 6.$$

Solution

$$.8\left(\frac{.8(22)^2}{.6} + .2(22)^2\right) + .2\left(\frac{.8(7)^2}{.6} + .2(7)^2\right) = 608.7$$

TAX SHELTERING OF BENEFITS TO IMPLEMENT a_1

where $a_1 = 1,\ a_2 = 3,\ a_3 = 6,\ a_4 = 9,$

and $t^A = 42\%$

Minimize $\sum_{i=1}^{n} \pi_i(a_1)s_i =$

$$\sum_{i=1}^{n=2} \pi(a_1)\left(\frac{.8V_i^2}{1-t^A} + .2V_i^2\right) = .2\left(\frac{.8V_1^2}{1-t^A} + .2V_1^2\right) + .8\left(\frac{.8V_2^2}{1-t^A} + .2V_2^2\right)$$

Subject to

$$.2V_1 + .8V_2 - 1 = 10$$

$$.2V_1 + .8V_2 - 1 \geq .4V_1 + .6V_2 - 3$$

$$.2V_1 + .8V_2 - 1 \geq .6V_1 + .4V_2 - 6$$

$$.2V_1 + .8V_2 - 1 \geq .8V_1 + .2V_2 - 9$$

Solution

$$.2\left(\frac{.8(11)^2}{.58} + .2(11)^2\right) + .8\left(\frac{.8(11)^2}{.58} + .2(11)^2\right) = 191.1$$

TAX SHELTERING OF BENEFITS TO IMPLEMENT a_2

where $a_1 = 1,\ a_2 = 3,\ a_3 = 6,\ a_4 = 9,$

and $t^A = 42\%$

Minimize $\sum_{i=1}^{n} \pi_i(a_2) s_i =$

$$\sum_{i=1}^{n=2} \pi(a_2)\left(\frac{.8V_i^2}{1-t^A} + .2V_i^2\right) = .4\left(\frac{.8V_1^2}{1-t^A} + .2V_1^2\right) + .6\left(\frac{.8V_2^2}{1-t^A} + .2V_2^2\right)$$

Subject to

$$.4V_1 + .6V_2 - 3 = 10$$

$$.4V_1 + .6V_2 - 3 \geq .2V_1 + .8V_2 - 1$$

$$.4V_1 + .6V_2 - 3 \geq .6V_1 + .4V_2 - 6$$

$$.4V_1 + .6V_2 - 3 \geq .8V_1 + .2V_2 - 9$$

Solution

$$.4\left(\frac{.8(19)^2}{.58} + .2(19)^2\right) + .6\left(\frac{.8(9)^2}{.58} + .2(9)^2\right) = 304.8$$

TAX SHELTERING OF BENEFITS

TO IMPLEMENT a_3

where $a_1 = 1,\ a_2 = 3,\ a_3 = 6,\ a_4 = 9,$

and $t^A = 42\%$

Minimize $\sum_{i=1}^{n} \pi_i(a_3)s_i =$

$$\sum_{i=1}^{n=2} \pi(a_3)\left(\frac{.8V_i^2}{1-t^A} + .2V_i^2\right) = .6\left(\frac{.8V_1^2}{1-t^A} + .2V_1^2\right) + .4\left(\frac{.8V_2^2}{1-t^A} + .2V_2^2\right)$$

Subject to

$$.6V_1 + .4V_2 - 6 = 10$$

$$.6V_1 + .4V_2 - 6 \geq .2V_1 + .8V_2 - 1$$

$$.6V_1 + .4V_2 - 6 \geq .4V_1 + .6V_2 - 3$$

$$.6V_1 + .4V_2 - 6 \geq .8V_1 + .2V_2 - 9.$$

Solution

$$.6\left(\frac{.8(22)^2}{.58} + .2(22)^2\right) + .4\left(\frac{.8(7)^2}{.58} + .2(7)^2\right) = 489.6$$

TAX SHELTERING OF BENEFITS

TO IMPLEMENT a_4

where $a_1 = 1,\ a_2 = 3,\ a_3 = 6,\ a_4 = 9,$

and $t^A = 42\%$

Minimize $\sum_{i=1}^{n} \pi_i(a_4)s_i =$

$$\sum_{i=1}^{n=2} \pi(a_4)\left(\frac{.8V_i^2}{1-t^A} + .2V_i^2\right) = .8\left(\frac{.8V_1^2}{1-t^A} + .2V_1^2\right) + .2\left(\frac{.8V_2^2}{1-t^A} + .2V_2^2\right)$$

Subject to

$$.8V_1 + .2V_2 - 9 = 10$$

$$.8V_1 + .2V_2 - 9 \geq .2V_1 + .8V_2 - 1$$

$$.8V_1 + .2V_2 - 9 \geq .4V_1 + .6V_2 - 3$$

$$.8V_1 + .2V_2 - 9 \geq .6V_1 + .4V_2 - 6.$$

Solution

$$.8\left(\frac{.8(22)^2}{.58} + .2(22)^2\right) + .2\left(\frac{.8(7)^2}{.58} + .2(7)^2\right) = 627.0$$

APPENDIX D

TABLES I, II, III, and IV

TABLE I
TOP TEN REVENUE LOSERS
BUDGETED FOR FISCAL YEAR 1992

TAX PROVISION	$ BILLION
Net exclusion of employer pension contributions and earnings	51.2
Home mortgage interest deduction	40.5
Exclusion employer provided medical insurance premium & care	33.5
Step-up in basis of capital gains at death	26.8
Accelerated depreciation	26.1
Non business state and local tax deduction	20.4
Exclusion of OASI benefits retired workers	18.0
Charitable contributions deduction	16.8
Exclusion of interest on public purpose state and local debt	14.0
Capital gains deferral on home sales	13.9

SOURCE: U.S. Office of Management and Budget, The Budget for Fiscal Year 1992, 1991, Section XI, "Tax Expenditures," Part Three, Pg. 40.

TABLE II

LAWS IMPACTING BENEFITS ENACTED

FROM 1974 TO 1993

1. Employee Retirement Income Security Act of 1974 (ERISA)
2. Tax Reduction Act of 1975 (TRA '75)
3. Tax Reform Act of 1976 (TRA '76)
4. Tax Reduction and Simplification Act of 1977
5. Age Discrimination in Employment Amendments Act 1978 (ADEA)
6. Revenue Act of 1978
7. Technical Corrections Act of 1979
8. Multi-employer Pension Plan Amendments Act of 1980 (MEFFAA)
9. Economic Recovery Tax Act of 1981 (ERTA)
10. Tax Equity and Fiscal Responsibility Act of 1982 (TEFRA)
11. Social Security Amendments of 1983 (SSA)
12. Retirement Equity Act of 1980 (REA)
13. Deficit Reduction Act of 1984 (DEFRA)
14. Consolidated Omnibus Budget Reconciliation Act 1985 (COBRA)
15. Single Employer Pension Plan Amendments Act 1986 (SEPPAA)
16. Omnibus Budget Reconciliation Act of 1986 (OBRA '86)
17. Tax Reform Act of 1986 (TRA '86)
18. Omnibus Budget Reconciliation Act of 1987 (OBRA '87)
19. Retiree Benefits Bankruptcy Protection Act of 1988
20. Technical and Miscellaneous Revenue Act of 1988 (TAMRA)
21. Public Law 101-100; Repeal of Section 89
22. Medicare Catastrophic Coverage Repeal Act of 1989
23. Omnibus Budget Reconciliation Act of 1989 (OBA '89)
24. Older Workers Benefit Protection Act of 1990 (OWBPA)
25. Omnibus Budget Reconciliation Act of 1990 (OBRA '90)
26. Americans with Disabilities Act of 1990
27. Rural Telephone Cooperative Assoc. ERISA Amendments Act '91
28. Unemployment Compensation Amendments Act of 1992 (UCAA)
29. Omnibus Budget Reconciliation Act of 1993

Source: Irish, L.E., "Twenty Years of Employee Benefits," Tax Notes, November 12, 1992.

TABLE III SUMMARY OF NOTATION		
$G(\cdot)$	=	Principal's utility function
$H(\cdot\cdot)$	=	Agent's utility function
W	=	Wealth
a_i	=	Agent's effort level
θ_i	=	Random state of nature
$x_i(a,\theta)$	=	Individual payoff
$\pi_i(a)$	=	Probability of θ_i given a
s_i	=	Agent's share of outcome or Gross cost to Principal
$x_i - s_i$	=	Principal's share of outcome
$\overline{B}(a)$	=	Principal's expected benefit for action a
$\overline{C}(a)$	=	Principal's expected cost for action a
P_0	=	Tax policy without tax sheltering benefits
P_1	=	Tax policy with tax sheltering of benefits
t^A	=	Agent's marginal tax rate
$l_i(a)$	=	Agent's net payoff after tax for action a
D_i	=	Agent's discretionary income after tax and after benefits are purchased
w_i	=	Agent's cash wages before tax
b_i	=	Agent's desired level of benefits purchased by either agent or principal
$\rho_i b_i$	=	Principal's discounted cost for benefits
α	=	Principal's administrative costs

TABLE IV

1993 TAX RATE SCHEDULES

CORPORATIONS					
If 1993 taxable income is:		The tax is:			
Over—	*But not over—*				*Of excess over—*
0	50,000	0	+	15%	0
50,000	75,000	7,500	+	25%	50,000
75,000	100,000	13,750	+	34%	75,000
100,000	335,000	22,250	+	39%	100,000
335,000	10,000,000	113,900	+	34%	335,000
10,000,000	15,000,000	3,400,000	+	35%	10,000,000
15,000,000	18,333,333	5,150,000	+	38%	15,000,000
18,333,333	—	6,416,667	+	35%	18,333,333

1993 TAX RATE SCHEDULES

MARRIED FILING JOINT

If 1993 taxable income is:		The tax is:			
Over—	*But not over—*				*Of excess over—*
0	36,900	0	+	15%	0
36,900	89,150	5,535	+	28%	36,900
89,150	140,000	20,165	+	31%	89,150
140,000	250,000	35,929	+	36%	140,000
250,000	—	75,529	+	39.6%	250,000

VITA 2

Carolyn C. Patterson

Candidate for the Degree of

Doctor of Philosophy

Thesis: THE IMPACT OF THE TAX SHELTERING OF BENEFITS ON EMPLOYER-EMPLOYEE CONTRACTING

Major Field: Business Administration

Biographical:

Personal Data: Born in Montreal, Quebec, Canada, December 2, 1950, the daughter of Matthew J. Benoit and Elizabeth G. Benoit.

Education: Graduated from St. Thomas High School, Pointe Claire, Quebec, Canada, June 1967; received a Bachelor of Science Degree in Accounting from the University of Tulsa, December 1978; received a Masters of Science Degree in Taxation from the University of Tulsa, May 1989; completed requirements for the Doctor of Philosophy Degree at Oklahoma State University, May 1994.

Professional Experience: Manager, Arthur Andersen & Co., Tulsa, Oklahoma, December 1978 to August 1989; Instructor, School of Accounting, University of Tulsa, summer 1993.

Professional Designations: Certified Public Accountant, May 1979.

Professional Affiliations: American Accounting Association; American Institute of CPA's; Oklahoma Society of CPA's.