NBER WORKING PAPER SERIES

PURE PRICE EFFECTS OF NONWAGE COMPENSATION

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Working Paper No. 1630

NATIONAL BUREAU OF ECONOMIC RESEARCH
1050 Massachusetts Avenue
Cambridge, MA 02138
June 1985

The National Science Foundation graciously supported the research presented in this paper through grant SES-8409720. Jonathan Leonard, Chris Maxwell and David Reishus have been generous with constructive comments. Only I am responsible for the content. The research reported here is part of the NBER's research program in Labor Studies and project in Government Budget. Any opinions expressed are those of the author and not those of the National Bureau of Economic Research.

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ABSTRACT

This paper discusses the pure static price effects which are engendered by tax preferences for nonwage compensation. Section II demonstrates that, because of these price effects, optimal consumption bundles will contain larger quantities of the goods included in nonwage compensation, and smaller quantities of other goods, than they would in the absence of tax preferences. In the presence of preferences, the cost of a compensation package to an employer usually differs from its value to an employee.

Under proportional taxation, compensation packages which contain optimal quantities of nonwage compensation may be between 4% and 13% less expensive than cash compensation sufficient to purchase, at retail, consumption bundles providing similar utility. This difference represents a substantial savings to employers. It is largely attributable to reductions in tax payments, and may represent substantial foregone tax revenues. Optimal provision of nonwage compensation confers greater advantages under progressive taxation, advantages which increase with the degree of progressivity.

These considerations are important in the analysis of any issue to which employee 'income' or employer costs are relevant. As examples, Section III demonstrates that conventional definitions of income unavoidably generate incorrect conclusions with regard to evaluations of welfare distribution, tax progressivity, and returns to human capital.

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Nonwage compensation, in all its forms, has become a substantial component of employee income, employer labor costs and national income in the years since World War II. In consequence, compensation for labor services is now more complex than is the price of any other commodity.

This paper addresses these complications in a simple, static context. Within that context, it explores the most important incentive to nonwage compensation: price effects which arise out of income tax exemptions on consumption goods received as compensation in kind. It demonstrates these effects through the contrasts between optimal consumption packages under personal provision, and optimal compensation packages under employer provision of the goods which comprise 'fringe benefits'.

Income tax exemptions insure that optimal employer provision of benefit goods is always less expensive than optimal personal provision. In simulations with proportional tax schemes and reasonable utility parameters, the costs of optimal consumption packages exceed the costs of optimal compensation packages of the same utility value by 4% to 13%. These advantages derive largely from implicit tax subsidies to employers offering nonwage compensation, which may represent large sacrifices in income tax revenue. They may be compounded by changes in consumption composition which further reduce employer expenditures on employee compensation.

The differences between employer and personal provision, or between levels of employer provision, distort all interpersonal comparisons which require accurate measures of individual welfare. For example, distributions of employer compensation costs and earnings under employer provision overstate the attenuation in distributions of employee utility. Distributions of disposable earnings -- net of income tax payments -- understate utility distributions. Taxation of earnings results in actual tax progressivity which exceeds nominal progressivity. Differences in compensation costs and earnings overstate returns to human capital, while differences in disposable earnings understate them.

I. Nonwage Compensation in the American Economy

> When a benefit program is paid for by the company, I do not think most employees think of it as a trade-off with their paycheck. And, while I recognize that, ultimately, there is no free lunch -- and there is a total limit on compensation dollars -- I am not really sure that we are looking at it in that context either. (Harold P. Kneen, Jr., Director of Employment Benefits, International Business Machines Inc., quoted in Conference Board)

> Total employer costs for fringe benefits cannot be equated with total income of the employee because a number of benefits, such as pensions, provide the worker with no immediate additional income. Other benefits, such as supplemental unemployment benefits, provide economic security against a circumstance which may never materialize. (Oswald and Smyth)

Modern compensation packages contain many nonwage components in addition to wage or salary payments. The economic implications of these 'fringe benefits' are subject to much greater misunderstanding than are the traditional cash components.

In principle, the marginal dollar of expenditure on nonwage compensation ought to elicit the same labor effort as does the marginal dollar of expenditure on cash compensation (Triplett). If this relationship is not enforced, compensation dollars will be expended inefficiently. Kneen suggests that employers fail to recognize the costs associated with haphazard compensation practices.

Nonwage compensation is comprised of goods -- insurance and savings programs among them -- which would be bought with disposable income if they were not included as part of the compensation package. Cash income is preserved when they are provided by the employer. Oswald and Smyth demonstrate that employees fail to recognize the contribution of nonwage compensation to real income. [1]

This confusion is not limited to those who provide and those who receive. The United States Congress and the Internal Revenue Service -- those who tax -- continually redraw distinctions between those components of compensation which constitute 'income' for tax purposes, and those which do not (AICPA). Economists -- those who measure -- have neglected the nonwage components of total compensation in their analyses of labor and consumption markets. [2]

Nonwage components of compensation are now sufficiently important

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[1] Oswald and Smyth appear to assert that employer expenditures are greater than the value an employee receives. Section II of this paper demonstrates that a well-chosen compensation package is worth more to its recipients than the employer expenditure it represents.

[2] Duncan and Woodbury are recent exceptions. Atrostic includes both wages and nonpecuniary benefits among the costs of leisure.

that such confusion is costly.[3] The value of nonwage compensation in the American economy of 1982 is estimated at $510 billion. This total represents approximately 21% of national income. Nonwage compensation comprised 29.1% of expenditures for employee compensation among firms surveyed by the Chamber of Commerce in that year.

Despite the magnitude of nonwage compensation payments in a modern economy, employers, employees and economists are understandably uncertain about the roles they play. Their role varies substantially between individual firms. Among firms surveyed by the Chamber of Commerce in 1982, four percent reported expenditures for nonwage compensation equivalent to less than 18% of payroll. Nearly four percent reported expenditures equal to 60% or more of payroll. Almost all firms offer life insurance coverage. Eighty-six percent of firms offer paid vacations. Just half of firms, 53%, offer dental insurance. Only 26% offer contributions to employee thrift plans.

The variety of modern compensation packages is matched by the multiplicity of goals they attempt to achieve. They may include provisions for human capital investments, work incentives, career development, risk-sharing, insurance, saving and current consumption, as well as the exchange of cash for output. These packages are constructed to satisfy an array of requirements established by competitive pressures, social obligations and legal responsibilities. They create a complicated, sometimes contradictory array of incentives which cannot be analyzed in

[3] The statistics quoted in this paragraph and the next are derived from the Chamber of Commerce, 1984.

its entirety within the confines of this paper. [4]

The discussion below explores the simple economic responses elicited by the most important characteristic of nonwage compensation components. Most forms of nonwage compensation are not taxed as income. The employer can provide benefit goods to his employees with pre-tax dollars. The employee would have to expend post-tax dollars if he purchased them himself. Employers can therefore 'buy' benefit goods for their employees at a 'price' which is lower than that charged of individual employees in retail exchanges. The employer 'price' of benefit goods may be further reduced through bulk discounts offered by vendors who value the transactional economies employers can provide. This price advantage is the principle reason for which goods are offered, and accepted, as compensation.

This paper discusses the pure static price effects which are engendered by tax preferences for nonwage compensation. [5] Section II demonstrates that these price effects have three major implications: In general, the cost of a compensation package to an employer is not the same as its value to an employee. Individuals with identical utility functions and identical levels of utility will choose different consumption bundles if one receives some compensation in kind while the other receives compensation in only cash. Individuals whose marginal rates of

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[4] This analysis abstracts from all questions of risk-sharing or dynamic optimization.

[5] Differences across employers in bulk purchase discounts create price effects which duplicate those of tax preferences. Inter-employer differences in these discounts are discussed more fully in Zax.

substitution are identical whenever their consumption bundles have identical composition, but who receive different 'incomes', will choose consumption bundles of differing composition if the rate of income taxation depends upon the level of taxable income.

These implications are important in the analysis of any issue to which employee 'income' or employer costs are relevant. Conventional definitions of income unavoidably generate incorrect conclusions in many important interpersonal comparisons. Section III demonstrates that evaluations of income distribution, progressivity of taxation, and returns to human capital depend critically upon the measure of income on which they are based.

II. Optimal Compensation Packages

Individuals obtain benefit goods in two distinct 'markets'. Under employer provision, they receive nonwage compensation from their employers in partial exchange for labor. Under personal provision, they purchase benefit goods from retail vendors out of disposable income. [6]

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[6] Employer and personal provision are mutually exclusive alternatives in the analysis presented here. In addition, employees are not permitted to resell benefit goods received as part of compensation. In practice, many individuals supplement benefit goods provided by their employers with further retail purchases. This behavior is discussed further in Zax.

The analysis in this section derives optimal compensation packages in the case of employer provision, and optimal consumption bundles in the case of personal provision, with both proportional and progressive taxation. It demonstrates that employer provision can always attain a given level of utility at less total expense under proportional taxation than can personal provision. The advantage to employer provision is increased under progressive taxation. However, employers can only realize these advantages if they know the utility functions of their employees. Compensation packages which are ineptly composed can cost the employer more than would cash compensation of identical value to the employee.

A. Fundamental Concepts

Several concepts of income and consumption are essential to the relationships between benefits provision, consumption value and compensation cost. The definitions themselves demonstrate several important characteristics of optimal compensation packages.

Non-benefit goods are represented by the index good x. This good is also the numeraire good; its retail price is unity. However, it is taxed at the rate of t. In compensation packages, x represents post-tax wage compensation, or disposable earnings. Pre-tax wage compensation, or earnings, are $x(1+t)$. In consumption bundles, x represents post-tax nonbenefit consumption, and $x(1+t)$ represents pre-tax nonbenefit consumption.

Benefit goods are represented by the index b. This composite good has a retail price of p. In compensation packages, b represents nonwage compensation. Employers receive discounts for bulk purchases of benefit goods, represented by d. They purchase these goods with pre-income-tax dollars, at an effective price of (1-d)p. In consumption bundles, b reprsents benefit consumption. Employees must purchase benefit goods with cash, at an effective price of (1+t)p.

Employee utility is given by U(b,x). It is a function of the composite nonbenefit good -- disposable earnings -- and the composite benefit good. Employee cost of any arbitrary consumption bundle (b^*,x^*) is the expenditure necessary to purchase it at retail. It is given by:

$$C_1 = (1+t)pb^* + (1+t)x^* \quad (1)$$

U^* is the utility value of consumption bundle (b^*,x^*), [7]

$$U^* = U(b^*,x^*).$$

Employee value of any consumption bundle is equal to Y^*,the minimum level of income necessary to attain the utility level of this bundle

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[7] The analyses in this paper assume that employee utility levels are fixed at U^* as a result of competition in the labor market. Analyses at constant utility levels allow comparisons to be made conveniently in monetary terms.

through personal provision:

$$Y^* = E[(1+t)p, (1+t); U^*],$$

where E represents the expenditure function (Varian). If the employee chooses his or her consumption bundle inefficiently, its cost will exceed its value. By definition,

$$Y^* \leq C_1.$$

A consumption bundle is efficient under personal provision if equality holds.

The employer expenditure for compensation package (b^*,x^*) is the expenditure the employer must incur in order to provide that package to his or her employees. It is given as:

$$C_2 = (1-d)pb^* + (1+t)x^*$$

This definition and that of C_1 in equation 1 prove that

$$C_2 < C_1.$$

Any bundle of benefit and nonbenefit goods can be more cheaply purchased by the employer than by an employee.

Employer value of any compensation package is equal to the minimum level of expenditure the employer must incur in order to provide his or her employee with the utility level represented by that package. It is given as:

$$\tilde{Y} = E[(1-d)p,\ (1+t);\ U^*]$$

If a compensation package is inefficiently composed, its cost to the employer will be greater than necessary to provide employees with U^*. By definition,

$$\tilde{Y} \le C_2$$

As with personal provision, a compensation package is efficient under employer provision if equality holds.

C_1, C_2, Y^* and $\tilde{Y}$ are displayed graphically in Figure 1. The point at which a budget line intersects the x, or wage axis, represents the dollar value of all (b,x) combinations which lie on that line. Budget lines with steep slopes represent the possibilities of employer provision; relatively small quantities of wages can be exchanged for relatively large quantities of nonwage compensation. Budget lines with flat slopes represent the possibilities of personal provision; relatively large quantities of nonbenefit goods must be sacrificed for relatively small quantities of benefit goods.

Figure 1 also identifies four bundles of benefit and nonbenefit goods, each providing the same level of utility, U^*. The budget lines on which point 1 lies demonstrate that employer cost for any bundle is less than employee cost. The employer budget line always intersects the x axis at a point to the left of the intersection of that axis and the employee budget line. This bundle also demonstrates inefficient allocation in either employer or personal provision.

Employee value is represented by the consumption bundle at point 2. At the prices of personal provision, it is the least expensive consumption bundle which provides utility U^*. Employer value is represented by the compensation package at point 3. At the prices of employer provision, it is the least expensive combination of benefit and nonbenefit goods which provides utility U^*. In comparison, the bundle at point 2 is relatively intensive in nonbenefit goods. The bundle at point 3 is relatively intensive in benefit goods.

This figure demonstrates concisely the most significant aspect of employer benefits provision. The absolute price of disposable earnings is the same to employers and employees. However, the absolute price of benefit goods to employers is less than that to employees. In consequence, employer value is always less than employee value: [8]

$$\tilde{Y} < Y^*$$

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[8] The expenditure function increases in all prices (Varian). This conclusion is a simple application of that theorem.

Any given level of utility can be attained through employer provision at less expense then through personal provision.

Tax advantages and bulk discounts for benefit goods provide employers with opportunities to reduce labor costs by offering consumption goods as compensation, in addition to cash wages. The employer who wishes to take advantage of this opportunity must offer a compensation package for which employee value Y^* exceeds employer expenditure C_2. The optimal compensation package maximizes this excess. [9]

Compensation packages which fulfill these conditions always exist. However, there is no guarantee that employers will, in practice, be able to identify them. The employer must know employee preferences precisely in order to allocate compensation expenditures efficiently. In the absence of such knowledge, employer expenditure is likely to exceed employer value. [10] If the employer's choice of compensation packages is especially infelicitous -- point 4 in figure 1 is an example -- employer expenditure can exceed employee value:

$$C_2 > Y^*$$

In this circumstance, employees value their compensation package at less

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[9] With utility fixed at U^*, this is equivalent to minimizing employer expenditure.

[10] Empirical studies tentatively suggest that employers, and even union representatives, can not accurately predict employee compensation preferences (Brosnan, Lawler and Levin, Nealey, Nealey and Goodale)

than its cost to the employer.[11] Personal provision of benefit goods would be less expensive to the employer than is inept employer provision.

The relationships in Figure 1 demonstrate the general problems of compensation composition. Employees are not indifferent between different compensation bundles which represent identical levels of employer cost -- the bundles which define an employer's budget line are on different indifference curves. Consumption bundles of identical utility value represent different levels of expenditure under employer and under personal provision -- bundles on a single indifference curve are drawn from different budget lines.

Algebraic formulations reiterate these relationships. Optimal consumption bundles under personal provision minimize the monetary income which must be earned -- Y^* -- in order to support the given level of utility -- U^*. They solve the following problem:

$$\begin{aligned} &\text{Minimize } Y^* = (1+t)pb + (1+t)x \\ &\text{subject to } U(b,x)=U^* \end{aligned} \tag{2}$$

The following first order condition determines optimal bundle composition:

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[11] Both extremes of the indifference curve represent compensation packages which merit this disdain. They are over-intensive in either wage or nonwage compensation.

$$\frac{U_1}{U_2} = p,$$

where U_1 and U_2 respectively represent the marginal utilities of b and x.

Optimal compensation packages under employer provision maximize employer profits -- π -- while insuring employees the required utility level. If the number of employees is n, the production function is f(n), and output is the numeraire good, then optimal packages solve the following problem:

$$\text{Maximize } \pi = f(n) - n\,[(1-d)pb + (1+t)x]$$
$$\text{subject to } U(b,x)=U^{*} \qquad (3)$$

The following first order condition determines optimal package composition in this case:

$$\frac{U_1}{U_2} = \frac{(1-d)p}{1+t} < p\ .$$

Benefits are relatively cheaper to the employer than they are to the employee. Optimal compensation packages will be relatively more intensive in benefit goods than will be optimal consumption bundles under personal provision at any given level of utility.

In general, employers can offer employees a given utility level with lower expenditures if they distribute benefit goods along with wages than if they offer only wages with which employees purchase their own benefits. This economy is available because employers can purchase benefit goods at lower prices than can employees. Optimal compensation packages under employer provision substitute relatively inexpensive benefits for relatively expensive wages, in comparison to optimal consumption bundles under personal provision which represent the same utility value. The subsection which follows develops these results further in the context of a specific utility function.

B. Optimal Compensation With Cobb-Douglas Utility

Equations 2 and 3 can be solved explicitly with respect to a specific functional form for the employee's utility function. A Cobb-Douglas representation of U(b,x) conveniently demonstrates most of the important points:

$$U(b,x) = b^{\alpha}x^{1-\alpha}. \tag{4}$$

The exponent, α, represents relative tastes for benefit and nonbenefit goods. It also represents the optimal share of benefit goods in compensation or consumption expenditures.

With this specification, solutions to equations 2 and 3 suggest that the optimal compensation package under employer provision can be 4% to 14% less expensive than the optimal consumption bundle under personal provision which provides the same level of utility. This economy is largely attributable to substantial tax subsidies under proportional taxation. These subsidies are larger under progressive taxation, because maximum tax rates under employer provision are endogenous.

1. Proportional Taxation

Under proportional taxation, employees convey a fixed proportion of their taxable income to the government, regardless of its magnitude. [12] Differences in the definitions of taxable income between personal and employer provision are responsible for differences between optimal consumption bundles in the first case, and optimal compensation packages in the latter. The optimal consumption bundle is more intensive in nonbenefit goods and more expensive than is the optimal compensation pack ge, given a constant level of utility.

The optimal consumption bundle under personal provision solves equations 2 and 4 at $U(b,x)= U^*$, where U^* is fixed. The solution consists of an

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[12] In practice, the tax rate is usually defined as a function of taxable income. In this study, the tax rate is defined as a function of post-tax consumption, for illustrative convenience. These two definitions are equivalent, as taxable income is identically equal to the sum of post-tax income and tax payments.

optimal level of benefit consumption, b^*, and an optimal level of non-benefit consumption, x^* in terms of the fixed utility level:

$$b^* = U^* \left[\frac{p(1-\alpha)}{\alpha}\right]^{\alpha-1} \tag{5}$$

$$x^* = U^* \left[\frac{p(1-\alpha)}{\alpha}\right]^{\alpha} \tag{6}$$

Together, b^* and x^* are represented by point 2 in Figure 1. Employee value, or the income required to purchase this consumption bundle, is given by:

$$Y^* = U^* \left[\frac{p(1-\alpha)}{\alpha}\right]^{\alpha} \left[\frac{1+t}{1-\alpha}\right] \tag{7}$$

The optimal compensation package under employer provision solves equations 3 and 4 at $U(b,x)= U^*$. The solution consists of optimal benefit and nonbenefit consumption levels $\tilde{b}$ and $\tilde{x}$ in terms of U^*:

$$\tilde{b} = U^* \left[\frac{p(1-\alpha)}{\alpha}\right]^{\alpha-1} \left[\frac{1-d}{1+t}\right]^{\alpha-1} \tag{8}$$

$$\tilde{x} = U^* \left[\frac{p(1-\alpha)}{\alpha}\right]^{\alpha} \left[\frac{1-d}{1+t}\right]^{\alpha} \tag{9}$$

Together, $\tilde{b}$ and $\tilde{x}$ are represented by point 3 in Figure 1.

$$\tilde{Y} = U^* \left[\frac{p(1-\alpha)}{\alpha}\right]^{\alpha} \left[\frac{1+t}{1-\alpha}\right] \left[\frac{1-d}{1+t}\right]^{\alpha}$$

$$= Y^* \left[\frac{1-d}{1+t}\right]^{\alpha} . \qquad (10)$$

Equations 5 and 8 prove that

$$b^* < \tilde{b} ,$$

Nonwage compensation under optimal employer provision is greater than benefit consumption under optimal personal provision. Equations 6 and 9 prove that

$$x^* > \tilde{x} ,$$

Non-benefit consumption is greater under optimal personal provision than is wage compensation under optimal employer provision. Equation 10 proves that

$$Y^* > \tilde{Y} ,$$

employee value is greater than employer value.

Explicit solutions for optimal income and consumption quantities also reaffirm that disposable earnings and earnings under employer provision understate employer value, which itself understates employee value:

$$\tilde{x} < \tilde{x}(1+t) < \tilde{Y} < Y^* .$$

Earnings under employer provision underestimate the value to the employee of his compensation package by more than they underestimate the cost incurred by the employer in its provision. [13]

The difference between employee and employer value is given as:

$$Y^* - \tilde{Y} = Y^* [1 - (\frac{1-d}{1+t})^{\alpha}] > 0 .$$

This difference represents the total advantage accruing to employer

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[13] In addition, earnings under personal provision usually underestimate employer value:

$$x^*(1+t) < \tilde{Y} .$$

However, if employer discounts (d) or tax rates (t) are sufficiently large,

$$[\frac{1-d}{1+t}]^{\alpha} < 1-\alpha.$$

In this circumstance, benefits are so inexpensive to the employer that $\tilde{b}$ is enormous and $\tilde{x}$ is tiny. Employer costs are so reduced by the discount on benefit purchases that

$$\tilde{Y} < x^*(1+t) .$$

Total employer costs under employer provision are less than pre-tax nonbenefit consumption alone under personal provision. This circumstance requires unusually large values of t and d in this model; if α=.3, then it occurs only if d + .3t > .7 .

provision over personal provision as a result of its privileged tax protection. This advantage is considerable. If the employer's discount on benefit purchases is 10% (d=.1), the exponent of benefit consumption in the utility function is .3 (α=.3),[14] and the income tax rate is 20% (t=.2), then

$$\left[\frac{Y^* - \tilde{Y}}{Y^*}\right] \approx .083 \ . \qquad (11)$$

Employer value is 8.3% less than employee value.[15] Employer value is 10.4% less than employee value, if t=.3 .[16] This difference may be substantial. The model presented here is not designed to produce a

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[14] Unless otherwise specified, all numerical simulations use these parameter values. The value d=.1 is a reasonable average of the discounts presented in Fosu. Chamber of Commerce surveys of compensation practices -- the only private sector surveys which measure costs of paid time not worked -- demonstrate that the share of nonwage compensation in total compensation has been equal to approximately .3 for the last several years (Chamber of Commerce, 1984). This value is assigned to αbecause the optimal share of a good in consumption expenditures is equal to the exponent it carries in the Cobb-Douglas utility function.

[15] Smeeding's empirical analysis of the differences between employer cost and employee value suggests an estimate of this difference at 6.3% . His estimate and that presented here are not entirely comparable, as he ignores consumption expenditure reallocations induced by tax exemptions for nonwage compensation.

[16] These estimates are representative of those which obtain for a wide range of reasonable parameter values. In general, the advantages of employer provision increase with tax rates, bulk discounts and preferences for benefit goods. If t=.2, strong preferences for benefit goods (α=.4) and large employer discounts (d=.15) increase the difference above to 12.9%. In contrast, reduced preferences for benefit goods (α=.2) and reduced employer discounts (d=.05) limit this difference to 4.6%, at the same tax rate.

precise estimate of this reduction.[17] However, the magnitudes it suggests are noteworthy. National income accounts for the United States give employer expenditures for employee compensation in 1984 as $2.173 trillion (Bureau of Economic Analysis). If this is taken as employer value, equation 11 with t=.2 implies that employee value exceeds it by $180.4 billion.

The difference between employee and employer value is comprised of the difference in retail payments under personal and employer provision and the difference in tax payments:

$$Y^* - \tilde{Y} = [(x^*-\tilde{x}) + p(b^*-\tilde{b}(1-d))]$$

$$+ [tpb^* + t(x^*-\tilde{x})] \qquad (12)$$

Retail costs of consumption packages are usually greater under personal than under employer provision, but need not be. The 'composition' effect of tax privileges on nonwage compensation is given as:

$$(x^*-\tilde{x}) + p(b^*-\tilde{b}(1-d)) =$$

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[17] This model analyzes individual compensation packages. Its use in the estimation of national economic activity entails many assumptions about aggregation which should not be casually invoked. In addition, welfare levels are taken as constant in the model and in all succeeding calculations. These calculations ignore the general equilibrium effects of tax privileges for nonwage compensation on equilibrium welfare levels in general, and on employment and output levels, in particular.

$$U^* \left[\frac{p(1-\alpha)}{\alpha}\right]^{\alpha} \left[\frac{1}{1-\alpha}\right] \left[1 - \left(\frac{1-d}{1+t}\right)^{\alpha} (1+\alpha t)\right]$$

Simulations demonstrate that, with Cobb-Douglas utility, this composition effect is positive unless d is very small and t is very large. Usually, increases in consumption of benefit goods under employer provision are small relative to reductions in wages and in the post-discount price of benefit goods.[18]

Tax payments under employer provision are always less than those under personal provision. The 'excise' effect of tax privileges is always positive:

$$tpb^* + t(x^*-\tilde{x}) = tU^* \left[\frac{p(1-\alpha)}{\alpha}\right]^{\alpha} \left[\frac{1}{1-\alpha}\right] \left[1 - \left(\frac{1-d}{1+t}\right)^{\alpha} (1-\alpha)\right] > 0 \tag{13}$$

Tax payments under employer provision are less than those under personal provision, both because benefit goods provided by the employer are not subject to taxation, and because optimal consumption bundles contain greater shares of benefit goods under employer provision.

Equation 11 demonstrates that employers are able to substantially

[18] Composition effects are rarely negative under Cobb-Douglas utility because this utility function restricts ordinary own-price elasticities of demand to equal -1 . Composition effects may be more regularly negative under utility functions which permit demand for benefits to be more elastic.

reduce expenditures for employee compensation if nonwage compensation is not subject to income tax. Equation 13 measures the size of the subsidy these tax privileges confer. This subsidy, as a proportion of the total difference between employee and employer value, is:

$$\frac{tpb^{*} + t(x^{*}-\tilde{x})}{Y^{*} - \tilde{Y}} =$$

$$\left[\frac{t}{1+t}\right] \left[\frac{\left[1 - \left(\frac{1-d}{1+t}\right)^{\alpha} (1-\alpha)\right]}{\left[1 - \left(\frac{1-d}{1+t}\right)^{\alpha}\right]}\right] \tag{14}$$

If the composition effect of tax privileges is negative, the reduction in government tax revenue actually exceeds the savings which accrue to employers. Positive composition effects reinforce the subsidy under most values for Cobb-Douglas parameters. With α=.3, d=.1 and t=.2, the tax subsidy contributes 72.1% of the difference between employee and employer value. If t=.3, that contribution rises to 82.4%.

This subsidy may represent a significant reduction in tax receipts. As an example, the excess of employee value over employer value estimated by equation 11 with t=.2, the parameter values on which this estimate is based, and equation 14 imply that income tax revenues foregone in 1984 through tax exemptions for nonwage compensation amounted to approximately $130.0 billion. This subsidy estimate is more than twice as large as explicit Medicare subsidies for health care ($57.5 billion), and nearly half as large as actual federal income tax revenue ($296.2 billion) in 1984 (Economic Report of the President, Table B-71). As a further example, implicit tax subsidies to homeownership in 1966 were approximately $7 billion, in contemporary dollars (Aaron). With $\alpha=.2$,[19] d=.1 and t=.2, equations 11 and 14 imply that implicit tax subsidies to employment through exemption of nonwage compensation amounted to $17.9 billion.

Tax privileges for nonwage compensation have two separable effects; they alter the composition of consumption bundles, and they subsidize employment costs for employers. Alternative taxation policies could, in principle, achieve either of these effects without invoking the other. Subsidization, if that is the primary purpose, can be achieved through lump-sum payments to employers of $Y^* - \tilde{Y}$, without altering the prices of benefit goods relative to nonbenefit goods.

If the primary purpose of policy is to induce greater consumption of benefit goods, relative to nonbenefit goods, tax exemptions for nonwage compensation and lump-sum taxes can be combined so as to avoid any net subsidy to employers, or any net change in tax revenue. With exemptions for nonwage compensation, lump-sum taxes equal to $S_1\tilde{Y}$,

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[19] Companies surveyed by the Chamber of Commerce in 1967 reported the average share of nonwage compensation in total compensation to be 22.9% (Chamber of Commerce, 1981).

$$S_1 = \left[\left(\frac{1+t}{1-d}\right)^{\alpha} - 1\right] ,$$

equate employer expenditures on employee compensation under exemptions to expenditures in their absence. This surcharge is equal to 9.0% of employer value, given t=.2 and the values for d and α used as examples throughout this paper. It is equal to 11.7% if t=.3 .

Lump-sum taxes equal to $S_2\tilde{Y}$,

$$S_2 = \left[\frac{t}{1+t}\right] \left[\left(\frac{1+t}{1-d}\right)^{\alpha} - (1-\alpha)\right] ,$$

provide total tax revenues equal to those which would be collected under personal provision, in the absence of exemptions. This surcharge is equal to 6.5% if t=.2, to 9.6% if t=.3 . [20]

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[20] The difference between constant expenditure and constant revenue surcharges,

$$S_1 - S_2 = \left[\frac{1}{1+t}\right] \left[\left(\frac{1+t}{1-d}\right)^{\alpha} - (1+\alpha t)\right]$$

is equal to zero only where parameter values are such that the composition effect of tax privileges for nonwage compensation is zero.

2. Progressive Taxation

Income tax exemptions for nonwage compensation create an incentive for employer provision which does not vary with the level of taxable income if taxation is proportional. Progressive taxation creates an incentive for employer provision which increases with the level of taxable income, with tax rates, and with the degree of progressivity. The excess of employee value over employer value is greater if taxation is progressive than if it is proportional.

Progressive tax schemes apply increasing rates of taxation to additional increments of taxable income. B_j defines these increments as the width, in dollars, of the jth tax bracket. The tax rate, t_j, applies to that part of income which falls in the jth bracket. The index i represents the highest bracket into which taxable income falls. Total tax payments (T) are given by:

$$T = \sum_{j=1}^{i} t_j \max \left(0, \min(x - \sum_{k=1}^{j-1} B_k, B_j\right)$$

where

$$t_j < t_{j+1}$$

for all j.

The budget constraint for an employee who purchases his or her own benefit goods out of post-tax earnings has slope equal to -p, the retail price for benefit goods, under progressive as well as under proportional taxation. Benefit and nonbenefit consumption levels, b^* and x^*, are determined by equations 5 and 6 in either regime. In contrast, progressive taxation changes the minimum level of pre-tax income from which these quantities can be purchased.

The required level of income under personal provision and progressive taxation, Y_p^*, is

$$Y_p^* = x^* + pb^* + \sum_{j=1}^{i^*-1} t_j B_j + t_{i^*} (x^* + pb^* - \sum_{j=1}^{i^*-1} B_j)$$

$$= U^* \left[\frac{p(1-\alpha)}{\alpha}\right]^{\alpha} \left[\frac{1+t_{i^*}}{1-\alpha}\right] - \sum_{j=1}^{i^*} B_j \, (t_{i^*} - t_j)$$

$$= Y^*(t_{i^*}) - \sum_{j=1}^{i^*} B_j \, (t_{i^*} - t_j) \ . \tag{15}$$

The bracket i^* is the highest bracket into which employee taxable income falls. It is defined implicitly by this condition:

$$\sum_{j=1}^{i^*-1} B_j < x^* + pb^* < \sum_{j=1}^{i^*} B_j$$

$Y^*(t_{i^*})$ is the solution to equation 7 at a proportional tax rate equal to the tax rate in bracket i^*. Employee value under progressive taxation is similar to that under proportional taxation, with an adjustment for tax payments below the rate of t_i* in brackets below i^*.

The budget constraint for an employer who provides employees with benefit goods as part of their compensation package is also linear under proportional taxation. Under progressive taxation, this budget constraint becomes piecewise linear. It is linear within a tax bracket, B_j, and continuous but not differentiable at the boundary between two brackets. The relative price of benefit goods decreases as j, the bracket index, increases.

Figure 2 portrays the budget constraint for employer provision under progressive taxation. The ith bracket begins at

$$\sum_{j=1}^{i-1} B_j, \text{ and ends at } \sum_{j=1}^{i} B_j \ .$$

The relative price of nonwage compensation decreases as taxable income exceeds one tax bracket and enters the next.

The compensation package at point 1 represents the employer value of utility level U_1. The package at point 2 represents employer value of utility level U_2. The budget constraints associated with these utility levels demonstrate the incentives to which employers are subject.

The optimal compensation package for utility level U_2 at the optimal price ratio for utility level U_1 is at point 3. However, wages at point 3 fall within a higher tax bracket than do wages at point 1. The actual relative price of nonwage compensation in that bracket is lower than in the bracket of point 1, so point 3 is inefficient. Point 2 is the actual optimum compensation package for U_2. It represents less taxable compensation than point 3, but more nonwage compensation. [21]

Composition of the optimal compensation package depends only on the marginal tax rate, that prevailing in the tax bracket which includes the value of taxable compensation. Equations 8 and 9, with the tax rate of that bracket, also represent the optimal levels of nonwage and wage compensation under progressive taxation.

As with employee value, employer value under progressive taxation ($\tilde{Y}_p$) differs from that under proportional taxation in order to reflect the difference in tax payments:

$$\tilde{Y}_p = \tilde{x} + (1-d)p\tilde{b} + \sum_{j=1}^{\tilde{i}-1} t_j B_j + t_{\tilde{i}} (\tilde{x} - \sum_{j=1}^{\tilde{i}-1} B_j)$$

---

[21] Alpert tests empirically the proposition that compensation packages are composed of wage and nonwage components in constant proportions. Triplett asserts that proportionality can not occur with progressive taxation except with unusual utility functions. Figure 2 confirms Triplett's statement: Under progressive taxation, the slope of the budget constraint is increasing along any ray from the origin. Optimal compensation packages cannot be composed of components in constant proportions if utility is homothetic.

$$= U^* \left[\frac{p(1-\alpha)}{\alpha}\right]^{\alpha} \left[\frac{1+t_{\tilde{i}}}{1-\alpha}\right] \left[\frac{1-d}{1+t_{\tilde{i}}}\right]^{\alpha} - \sum_{j=1}^{\tilde{i}} B_j \, (t_{\tilde{i}} - t_j)$$

$$= \tilde{Y}(t_{\tilde{i}}) - \sum_{j=1}^{\tilde{i}} B_j \, (t_{\tilde{i}} - t_j) \qquad (16)$$

The bracket $\tilde{i}$ is the highest bracket into which earnings, $\tilde{x}$, fall:

$$\sum_{j=1}^{\tilde{i}-1} B_j < \tilde{x} < \sum_{j=1}^{\tilde{i}} B_j$$

$\tilde{Y}(t_{\tilde{i}})$ is the employer cost of equation 10, calculated at the tax rate of bracket $\tilde{i}$.

Under specified tax rates and tax brackets, the solutions to equations 15 and 16 demonstrate that employee value exceeds employer value under progressive as well as under proportional taxation. [22] If tax rates are a linear function of the tax bracket, t_j=jt for all brackets j, then the difference between maximum tax rates under personal and under employer provision is:

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[22] Proofs for all mathematical statements in this section are available from the author.

$$t_{i^*} - t_{\tilde{i}} = i^* t - \tilde{i} t = t\,(i^* - \tilde{i}) \,.$$

This difference is nonnegative, as the maximum tax bracket achieved under personal provision is at least as high as that achieved under employee provision: [23]

$$i^* \geq \tilde{i} \,.$$

If, in addition,

$$B_j = B \text{ for all } j.$$

then

$$x^* + pb^* \geq (i^* - 1)B$$

and

$$\tilde{x} \leq \tilde{i}B \,.$$

23

At low levels of U^* and broad tax brackets, $x^* + b^*$ and $\tilde{x}$ may both qualify in the same tax bracket. Marginal tax rates would be identical under either employer or personal provision. In this case, the results derived under proportional taxation continue to apply. As U^* increases and the breadth of tax brackets decreases, the probability increases that private provision will place the employee in a higher tax bracket than will employer provision.

Further, if taxable earnings under personal and under employer provision fall into different tax brackets,

$$i^* > \tilde{i}$$

then

$$Y_p^* - \tilde{Y}_p > Y^*(t_{\tilde{i}}) - \tilde{Y}(t_{\tilde{i}}) > 0 ,$$

The difference between employee and employer value under progressive taxation exceeds the difference under proportional taxation. Progressive taxation increases the advantages to employer provision of nonwage compensation, by compounding tax exemptions analyzed in the previous section with reduced rates of taxation on earnings still subject to tax.

As in the case of proportional taxation, the difference between employee and employer value under progressive taxation is comprised of changes in the retail value of consumption and changes in tax payments:

$$Y_p^* - \tilde{Y}_p =$$

$$[(x^*-\tilde{x}) + p(b^*-(1-d)\tilde{b})]$$

$$+ \{[t_{i^*}(x^*+pb^*) - \sum_{j=1}^{i^*} B_j(t_{i^*}-t_j)] - [t_{\tilde{i}}\tilde{x} - \sum_{j=1}^{\tilde{i}} B_j(t_{\tilde{i}}-t_j)]\} .$$

(17)

The first term of equation 17 represents the difference between retail values of consumption. This composition effect is identical to that encountered under proportional taxation, as given in equation 12.

The second term of equation 17 represents the difference between tax payments under personal and employer provision. The components of this term are analogous to those of equation 12, but differ in that they include adjustments for tax progressivity. Under the assumptions given above, the difference between tax payments, ΔT_p, is bounded below;

$$\Delta T_p \geq (1/2)\ Bt\ [\ i^*(i^*-1) - \tilde{i}(\tilde{i}+1)]\ .$$

The lower bound for this difference depends on the brackets i^* and $\tilde{i}$ and on the difference between them. If $i^* = \tilde{i} + k$, where k indicates the extent of progressivity, then

$$\Delta T_p \geq (1/2)\ Bt\ [(2\tilde{i}+k)\ (k-1)] \geq 0.$$

ΔT_p represents the implicit tax subsidy allowed to employer provision of nonbenefit goods under progressive taxation. The lower bound for this subsidy increases with tax progressivity (with k), with the increment added to tax rates at each new bracket (with t) and with the minimum bracket attained under employer provision (with i).

The size of this tax subsidy, relative to the difference between employee and employer value, depends upon the exact relationship between taxable earnings and tax brackets. If the taxable components of income under either employer or personal provision are equal to the maximum levels in their respective brackets;

$$x^* + pb^* = i^*B \text{ and } \tilde{x} = \tilde{i}B,$$

then tax revenue under personal provision is given as:

$$\sum_{j=1}^{i^*} t_j B_j = (1/2)\ tBi^*\ (i^*+1) = (1/2)\ t(x^*+pb^*)\ (i^*+1)\ .$$

Tax revenue under employer provision is given as:

$$\sum_{j=1}^{\tilde{i}} t_j B_j = (1/2)\ tB\tilde{i}\ (\tilde{i}+1) = (1/2)\ t\tilde{x}\ (\tilde{i}+1)\ .$$

With these conditions, the loss of tax revenue represented by the difference between tax payments under personal and employer provision is equal to:

$$\Delta T_p = (1/2)\ tU^*\ [\frac{p(1-\alpha)}{\alpha}]^{\alpha}\ [\frac{1}{1-\alpha}]\ \{\ (\tilde{i}-1)\ [1-(\frac{1-d}{1+\tilde{i}t})^{\alpha}\ (1-\alpha)] + k\ \}\ >\ 0\ .$$

With the same conditions, equation 17 gives the savings accruing to an employer under employer provision as:

$$Y_p^* - \tilde{Y}_p =$$

$$U^* \left[\frac{p(1-\alpha)}{\alpha}\right]^{\alpha} \left[\frac{1}{1-\alpha}\right] \{[1-(\frac{1-d}{1+\tilde{i}t})^{\alpha}(1+\alpha\tilde{i}t)] + \frac{1}{2}t\,[(\tilde{i}-1)[1-(\frac{1-d}{1+\tilde{i}t})^{\alpha}(1-\alpha)]+k]\} .$$

This savings, as well as that between tax payments, increases with k, the progressivity of the tax system. Nevertheless, if the composition effect is not negative -- if the tax subsidy does not exceed net employer savings -- the subsidy provides an increasing share of employer savings as k increases. [24]

III. Applications

The analysis of Section II demonstrates that earnings and income measures differ systematically under personal and employer provision of benefit goods. The discussion in this section demonstrates that inappropriate income concepts give rise to incorrect analyses of welfare distribution, taxation equity and returns to human capital. It suggests that similar problems will arise in analyses of many other important

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[24] If d=.1, then the composition effect in this model is negative only if t≥.6 . In the context of progressive taxation, these values are extreme. The marginal tax rate in bracket j is jt. If the marginal tax rate in the American economy is approximately .4 (Stuart, for example), and that rate is achieved in the thirteenth or fourteenth tax bracket (Schedule X, Internal Revenue Service), then t is on the order of .05.

issues. Utility can not be accurately inferred on the basis of incomplete measures of either income or consumption. [25] This section explores problems which arise when compensation packages are efficient. The problems it reveals must be compounded unpredictably if they are not.

Truly progressive taxation schemes, such as that of Section II, are too cumbersome for application in this presentation. The analysis in this section is based upon a quasi-progressive tax scheme in which individual taxation is proportional. Higher proportional tax rates at higher levels of utility generate progessivity across individuals. Throughout this section,

$$j > i \text{ and } U_j^* > U_i^*.$$

The tax rate applied to individuals with utility of U_k^* is t_k, where $k=i,j$ and

$$t_j > t_i.$$

The conclusions drawn within this taxation scheme should obtain under truly progressive schemes, as well.

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[25] The interpersonal comparisons discussed in this section are conducted under the assumption of identical utility functions.

1. Distribution of Income and Taxation

The distribution of utilities among employees differs from the distributions of employee and employer value, earnings and disposable earnings under progressive or quasi-progressive taxation schemes, and under most utility functions. The effects of progressivity on tax payments ensure that the cost of compensation packages increases more rapidly than does the utility they provide. The composition effects of tax exemptions for nonwage compensation usually ensure that disposable earnings increase less rapidly than does the utility derived from the compensation packages of which they are a part. [26]

Solutions to equation 10 demonstrate the relationship between employer values at different levels of welfare:

$$\frac{\tilde{Y}_j}{\tilde{Y}_i} = \frac{U_j^*}{U_i^*} \left[\frac{1+t_j}{1+t_i}\right]^{1-\alpha} > \frac{U_j^*}{U_i} \tag{18}$$

Solutions to equation 7 demonstrate the same relationship under personal provision:

[26] This discussion compares employees at different levels of utility within either employer or personal provision. Comparisons between employees who differ in the manner by which they obtain benefit goods require more extensive analysis.

$$\frac{Y_j^*}{Y_i^*} = \frac{U_j^*}{U_i^*} \left[\frac{1+t_j}{1+t_i}\right] > \frac{U_j^*}{U_i^*} \qquad (19)$$

These relationships prove that the distribution of employee value is more attenuated than the distribution of employee utilities. The distribution of employer value is less attenuated than that of employee value because substitution of nonwage for wage compensation under employer provision reduces the growth in employer value with increases in utility. However, this distribution still overstates disparities in utility. The share of tax payments in both employee and employer value increases with utility under progressive and quasi-progressive taxation schemes. In consequence, value ratios exceed utility ratios. While this result is demonstrated using Cobb-Douglas utility, it should hold regardless of the utility function.

Under employer provision, distributions of earnings and disposable earnings provide upper and lower bounds for the underlying distribution of employee utilities. Disparities in disposable earnings underestimate disparities in utility because nonwage compensation substitutes increasingly for wages as utility increases. However, the growth of tax payments with utility is more rapid than the decline of wages. As a result, earnings disparities overestimate utility disparities. [27]

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[27] This last result is imposed by the Cobb-Douglas utility function, which forces the share of earnings in employer value to be constant. Utility functions which allow that share to decrease could generate earnings disparities which underestimate the extent of utility disparities. Empirically, Smeeding claims that the distribution of employer value is more attenuated than that of earnings.

Solutions to equation 9 demonstrate these conclusions.

$$\frac{\tilde{x}_j}{\tilde{x}_i} = \frac{U_j^*}{U_i^*}\left[\frac{1+t_i}{1+t_j}\right]^{\alpha} < \frac{U_j^*}{U_i^*}$$

Therefore,

$$\frac{\tilde{x}_j}{\tilde{x}_i} < \frac{U_j^*}{U_i^*} < \frac{\tilde{x}_j}{\tilde{x}_i}\left[\frac{1+t_j}{1+t_i}\right] \qquad (20)$$

The distribution of employer-provided disposable income is more compressed than the distribution of utilities, while the distribution of earnings is more attenuated.

Of the income concepts discussed here, only disposable earnings under personal provision and Cobb-Douglas utility provide an accurate basis for interpersonal comparisons of welfare. The solution to equation 6 demonstrates that x^* is in fixed proportion to the level of utility: [28]

$$\frac{x_j^*}{x_i^*} = \frac{U_j^*}{U_i^*} \qquad (21)$$

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[28] The relative price of benefit to nonbenefit consumption is constant under personal provision, regardless of the taxation scheme. Therefore, the composition of consumption bundles does not vary with utility, and this result holds, for all homothetic utility functions.

The distribution of disposable earnings under personal provision reproduces faithfully the underlying distribution of employee utilities. The relationship in equation 21 also proves that disparities in pre-tax nonbenefit consumption under personal provision overstate utility disparities. Pre-tax expenditures on nonbenefit goods under personal provision are not proportional to utility because they are inflated by progressive tax payments.

In the examples of this section, nominal tax rates are specific to utility levels. Intended tax revenue is equal to $t_k U_k^*$ at any utility level U_k^*. If tax rates are applied to observable income measures rather than utility, actual tax progressivity almost always differs from nominal, intended progressivity. Equation 21, multiplied by the ratio t_j/t_i, demonstrates that actual progressivity is equal to nominal progressivity only where taxation is applied to nonbenefit consumption under personal provision.

Equations 18 through 20 demonstrate that other taxation schemes do not produce intended progressivity. Taxation of employer value, earnings, employee value or pre-tax nonbenefit consumption takes revenue disproportionately from employees with high levels of utility. In all these cases, actual progressivity is greater than nominal progressivity. Taxation of disposable earnings under employer provision takes revenue disproportionately from employees with low levels of utility. In this case, actual progressivity is less than nominal progressivity. [29]

2. Returns to Schooling

Accurate estimates of returns to schooling require accurate measures of returns. Standard empirical analyses rely on the relationship between schooling and earnings differentials to reveal the benefits of additional study (Mincer). Duncan attempts to include a measure of nonwage compensation, as well, but does not have access to adequate data. Theoretically, the concepts developed in Section II indicate that returns may be badly misestimated when compensation is misrepresented.

Human capital is denoted by H_K, where $K=i,j$ and $H_j > H_i$. Human capital level H_K supports utility level U_K for all values of K, where $U_j > U_i$ if $H_j > H_i$. True relative returns to human capital, measured in terms of utility, are:

$$R^* = [\frac{U_j^* - U_i^*}{U_i^*}][\frac{1}{H_j - H_i}]$$

---

29 The assumptions which obtain in this discussion assure exogenously the level of utility. In this context, these distortions are imposed upon the employer.

$$= \frac{1}{H_i} \left[\frac{k_1 - 1}{k_2 - 1}\right] \tag{22}$$

where $k_1 = U_j^*/U_i^*$ and $k_2 = H_j/H_i$.

If compensation packages contain both taxable wages and tax-exempt nonwage compensation in optimal proportions, the true returns of equation 22 cannot be estimated correctly by disposable earnings, earnings or employer value. Estimated returns based on differentials in disposable earnings are given by R_1:

$$R_1 = \left[\frac{\tilde{x}_j - \tilde{x}_i}{\tilde{x}_i}\right]\left[\frac{1}{H_j - H_i}\right] .$$

With the solution to equation 9,

$$= \frac{1}{H_i} \left[\frac{k_1 \left(\frac{1+t_i}{1+t_j}\right)^{\alpha} - 1}{k_2 - 1}\right] < R^* .$$

Under progressive or quasi-progressive taxation, increases in utility are accompanied by increases in disposable earnings which are less than proportionate. Disposable earnings differentials understate utility differentials (equation 20) and therefore underestimate true returns to schooling.

Estimated returns to schooling based on employer value,

$$R_2 = \left[\frac{\tilde{Y}_j - \tilde{Y}_i}{\tilde{Y}_i}\right]\left[\frac{1}{H_j - H_i}\right] ,$$

overestimate true returns to human capital. With the solution to equation 10,

$$= \frac{1}{H_i}\left[\frac{k_1\left(\frac{1+t_j}{1+t_i}\right)^{1-\alpha} - 1}{k_2 - 1}\right] > R^* .$$

Increases in utility require more than proportionate increases in employer value under progressive or quasi-progressive taxation schemes (equation 18). Employer value differentials overstate utility differentials and overestimate returns to human capital.

In this example, earnings differentials yield overestimates of returns to human capital which are identical to those produced by employer value differentials. This result is guaranteed by the Cobb-Douglas representation of utility, which forces proportionality between earnings and employer value at any level of compensation or taxation (equations 9 and 10). If employee utility functions require that optimal shares of earnings in employer value decrease as tax rates increase -- in effect, price elasticities greater than unity -- earnings differentials will not overestimate utility differentials as dramatically as do employer value differentials. However, earnings differentials will overestimate utility differentials by more than do value differentials if earnings shares increase with tax rates.

The differences between true and estimated returns to human capital may be substantial. For example, where t_i=.1, t_j=.2, =.3, and k_1=k_2=1.1, true returns are equal to:

$$R^* = \frac{1}{H_i} .$$

Estimated returns based on disposable earnings underestimate true returns by 28%:

$$R_1 = .717 \frac{1}{H_i} .$$

Estimated returns based on earnings or employer value overestimate true returns by 69%:

$$R_2 = 1.69 \frac{1}{H_i}$$

No measure of compensation under employer provision correctly estimates true returns to human capital. Measures of disposable earnings and earnings or employer cost give rise to estimates which bound the true value on either side, but which miss it by wide margins.

IV. Conclusion

This paper has explored the interactions between tax privileges, optimal consumption bundles and optimal compensation packages. If employers and employees understand these interactions, they can be manipulated to the benefit of both. In contrast, analysts must suffer from these interactions, whether or not they understand them.

Employers can reduce compensation costs without reducing employee utility by offering compensation packages which contain nonwage components when these components are exempt from income taxation. This opportunity is not a guarantee, however. Employers must know their employees' preferences in order to take advantage of these tax privileges. If they do not know them, they risk constructing a complicated compensation package which is more costly than it would be were it to include only wages.

Economists must usually choose between several imperfectly correlated measures of compensation and income when compensation packages include nonwage components. The correct measure is usually unavailable. For most labor demand problems, cost of the entire compensation package is probably the appropriate measure of compensation. For most consumption and labor supply problems, utility is the appropriate measure of income.

Many data sets measure only earnings. The analysis in this paper demonstrates that earnings differentials hardly ever provide accurate direct estimates of utility differentials. Here, they are proportional to compensation cost differentials only because utility is represented as a Cobb-Douglas function. Appropriate measures of income and compensation may be inferrable from earnings measures if the compensation package of which earnings are a part is efficient. If it is not, earnings cannot reliably estimate income, and analysis cannot reliably specify the bias.

Figure 1.

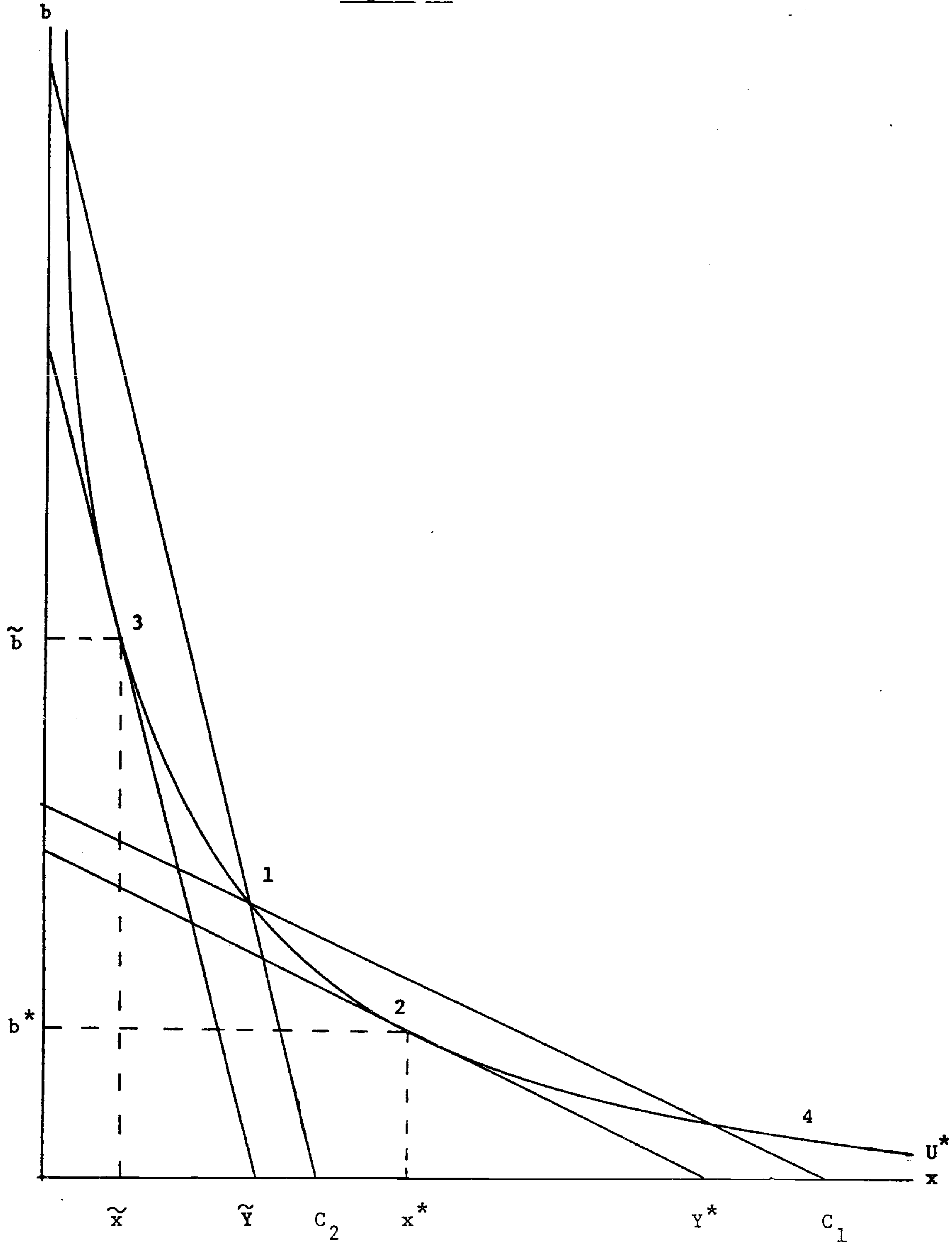
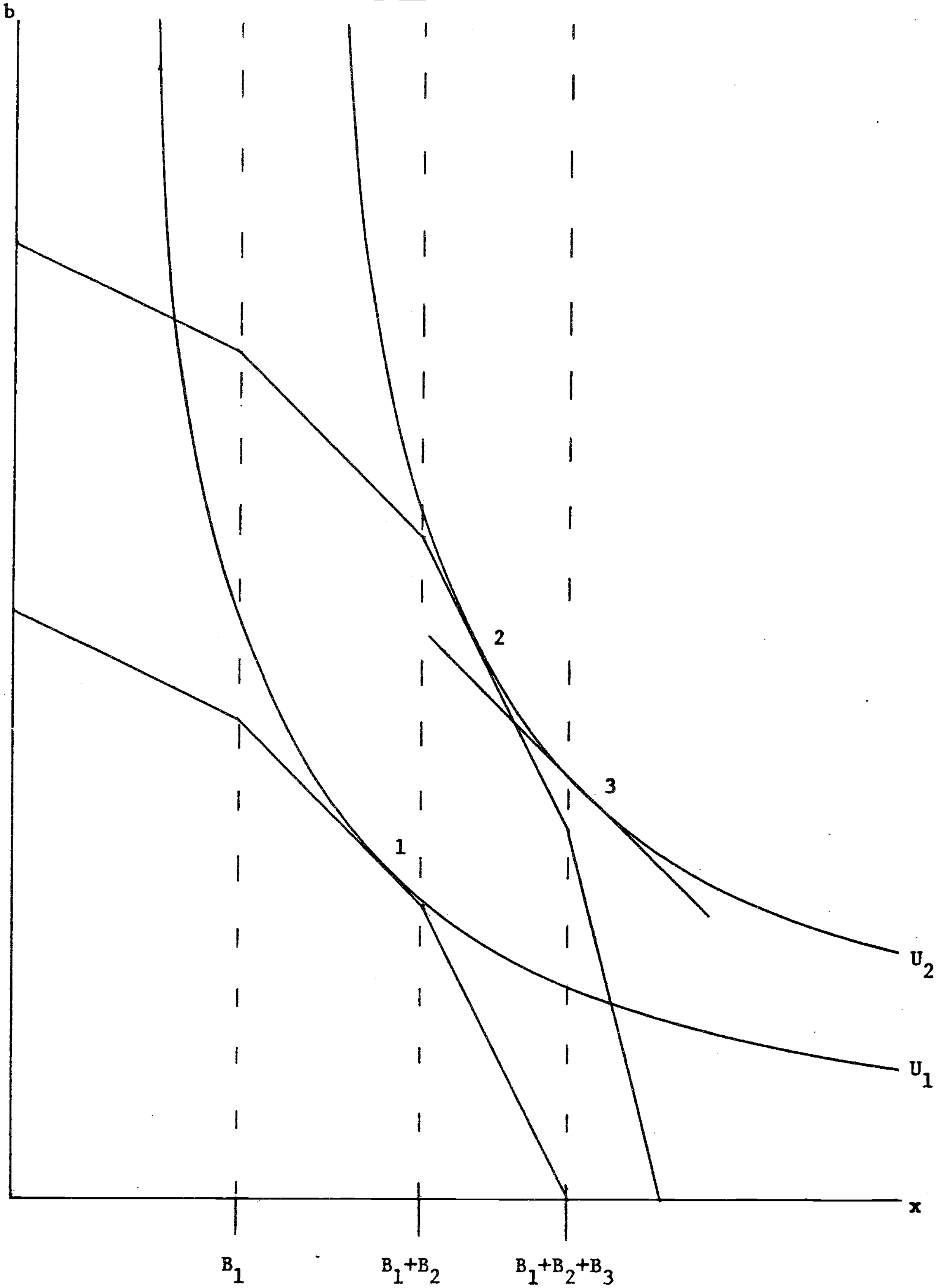


Figure 2.



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