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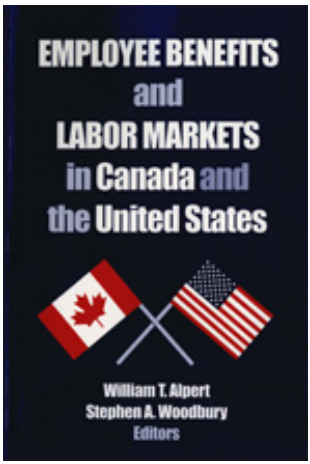
An Economic Model of Employee Benefits and Labor Supply



Paul Fronstin
Employee Benefit Research Institute

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2 An Economic Model of Employee Benefits and Labor Supply

An Application of the Almost Ideal Demand System

Paul Fronstin
Employee Benefit Research Institute

Employee benefits that are voluntarily provided by employers have become a major source of income for workers in the United States. In 1960, employee benefits accounted for 8 percent of total compensation, with pensions and health insurance accounting for 3.4 percent. By 1993, employee benefits accounted for 18 percent of total compensation, or $673.6 billion, with pensions and health insurance accounting for 10.3 percent (Employee Benefit Research Institute 1995). Among firms most likely to offer employee benefits, the percentage is even higher. The U.S. Chamber of Commerce (1995) found that the average payment for pension plans and health insurance was 17.6 percent of payroll in 1994.

Pension plans are one of the most popular employee benefits provided by employers. According to Table 1, 60 percent of all wage and salary workers in 1993 were employed by an employer that sponsored a pension plan. While 79 percent of wage and salary workers participated in the pension plan when their employer sponsored a plan, only 47 percent of all wage and salary workers participated in a pension plan because some employers did not offer a pension plan, some workers did not qualify to participate in a pension plan, and some workers voluntarily choose not to participate. Of those participating in a pension plan, 54 percent were included in a defined-benefit plan, while 62 percent were included in a defined-contribution plan. Almost 25 percent participated in both defined-benefit and defined-contribution plans.

Employer sponsorship and employee participation in a pension plan varies across demographic variables and job characteristics. Table 1 indicates that older workers are more likely to work for an employer

Table 1 Employer Sponsorship and Employee Participation in Pension Plans

Variable	Sponsorship rate	Participation rate	Sponsored participation rate	Of those participating		
				Defined benefit	Defined contribution	Not determinable
Total	0.60	0.47	0.79	0.54	0.62	0.14
Age						
18–24	0.43	0.16	0.38	0.37	0.59	0.18
25–34	0.59	0.44	0.73	0.49	0 65	0.14
35–44	0.64	0.55	0.86	0.57	0.62	0.13
45–54	0.65	0.59	0.90	0.57	0 61	0.13
55–64	0.59	0.52	0.88	0.59	0.58	0.14
Marital status						
Married	0.62	0.52	0.84	0.55	0.63	0.13
Widowed	0.58	0.49	0.84	0.53	0.57	0.19
Divorced	0.63	0.52	0.83	0.57	0 59	0.14
Separated	0.56	0.44	0.78	0.50	0.53	0.19
Never married	0.52	0 32	0.62	0.49	0.61	0.15
Race						
White	0.61	0.49	0.80	0.55	0.64	0.13
Black	0.62	0.47	0.75	0.51	0.50	0.20

Hispanic	0.43	0.31	0.73	0.50	0.51	0.21
Other	0.55	0.41	0.75	0.52	0.63	0.15
Education						
Some school	0.36	0.25	0.69	0 45	0.48	0.21
High school	0.58	0.45	0.77	0.53	0.59	0.15
College	0.71	0.59	0.82	0.55	0.70	0.10
Graduate school	0.79	0.70	0.88	0.63	0.66	0.10
Gender						
Male	0.59	0.49	0.83	0.55	0.64	0.13
Female	0.62	0.45	0.74	0.54	0.59	0.14
Number of children						
0	0.64	0.52	0.82	0.55	0 63	0.13
1	0.60	0.48	0.80	0.55	0.61	0.14
2	0.60	0.47	0.79	0.53	0.62	0.14
3 or more	0.52	0.38	0.73	0.53	0.60	0.15
Union contract						
Covered	0.90	0.82	0.91	0.68	0.47	0.13
Not covered	0.54	0.41	0.75	0.49	0.68	0.14
Occupation						
White collar	0.68	0.54	0.80	0.55	0.66	0.12

Table 1 (continued)

Variable	Sponsorship rate	Participation rate	Sponsored participation rate	Of those participating		
				Defined benefit	Defined contribution	Not determinable
Blue collar	0.42	0.28	0.67	0.55	0.45	0.19
Service collar	0.52	0.42	0.81	0.52	0.56	0.15
Firm size						
1–24	0.17	0.14	0.82	0.35	0.62	0.15
25–49	0.43	0.32	0.75	0.42	0.60	0.15
50–99	0.59	0.46	0.77	0.44	0.63	0.12
100–249	0.70	0.55	0.79	0.48	0.59	0.13
250 or more	0.87	0.70	0.80	0.59	0.63	0.13
Industry						
Agriculture, forestry, & fishing	0 15	0.13	0.84	0.52	0.67	0.15
Mining	0.75	0.69	0.93	0.52	0.75	0.13
Construction	0.35	0.31	0.88	0.56	0.49	0.15
Manufacturing	0.75	0.64	0.85	0.54	0.68	0.13
Transportation, communications, & utilities	0.73	0.63	0.86	0.59	0.66	0.14
Wholesale trade	0.57	0.48	0.84	0 43	0.71	0.14

Retail trade	0.41	0.25	0.61	0.37	0.63	0.17
Finance, insurance, & real estate	0.71	0.57	0.80	0.52	0.75	0.14
Personal services	0.23	0.13	0.57	0.43	0.49	0.21
Business & repair services	0.33	0.25	0.74	0.36	0.82	0.10
Entertainment services	0.38	0.24	0.62	0.55	0.63	0.14
Professional & related services	0.71	0.54	0.76	0.56	0.54	0.13
Public administration	0.93	0.85	0.91	0.71	0.51	0.13
Hours of work						
Part-time	0.41	0.15	0.37	0.48	0.54	0.15
Full-time	0.63	0.53	0.84	0.55	0.62	0.14

SOURCE: Employee Benefits Supplement to the 1993 Current Population Survey.

that sponsors a pension plan, more likely to participate in that pension plan, and more likely to have a defined-benefit plan than younger workers. Not surprisingly, differences in sponsorship and participation also occur across family type, race, education, gender, unionization, occupation, firm size, industry, and hours of work.

Health insurance is another employee benefit that many employers offer to workers. According to Table 2, 74 percent of wage and salary workers were employed by an employer that sponsored a health insurance plan in 1993, and 58 percent of all workers participated in a health insurance plan. Of the 79 percent that participated in their employer's health insurance plan, 40 percent have coverage only for themselves, while 60 percent also have coverage for a family member.[1] Table 2 also shows the probability of participating in a health insurance plan and the type of plan for various demographic variables and work-related attributes.

Theoretically, workers demand employee benefits from their employer for numerous reasons. First, preferential tax treatment of employee benefits reduces the price of the benefits to both employers and employees and is thus expected to increase the demand for employee benefits. However, the evidence regarding the effect of preferential tax treatment on employee benefits is mixed. Using cross-sectional data, Alpert (1983), Clain and Leppel (1989), and Woodbury and Bettinger (1991) found positive effects of preferential tax treatment on the demand for employee benefits. However, Turner (1987) found that employees do not demand a greater number of tax-preferred employee benefits when taxes increase. In addition, Vroman and Anderson (1984) and Alpert (1987) did not find significant positive tax effects on employee benefit growth when using time-series analysis. Second, group purchasing results in lower prices for health insurance than an individual would obtain in the marketplace. Third, the existence of economies of scale in the provision of employee benefits makes it more efficient (less costly) to provide savings vehicles for retirement and health insurance through the workplace (Mitchell and Andrews 1981).

Employers have sound reasons for providing employee benefits. Many workers have strong preferences for employee benefits. As a result, competition in the labor market will force firms to provide employee benefits. Firms that do not offer the wage/benefit packages that workers desire can experience higher turnover rates as well as dif-

Table 2 Employer Sponsorship and Employee Participation in Health Plans, by Type of Plan

Variable	Sponsorship rate	Participation rate	Sponsored participation rate	Of those participating	
				Single coverage	Family coverage
Total	0.74	0.58	0.79	0.40	0.60
Age					
18–24	0.62	0 34	0.55	0.75	0.25
25–34	0.76	0 60	0.79	0.45	0.55
35–44	0.77	0.63	0.82	0.30	0.70
45–54	0.76	0.64	0.85	0.34	0.66
55–64	0.71	0.59	0.84	0.39	0.61
Marital Status					
Married	0.75	0.59	0.79	0.20	0.80
Widowed	0.71	0.59	0.84	0.69	0.31
Divorced	0.77	0.69	0.89	0 62	0.38
Separated	0.73	0.58	0.79	0.46	0.54
Never married	0.69	0.52	0.75	0.89	0.11
Race					
White	0.75	0.59	0.79	0.39	0.61
Black	0.76	0.62	0.81	0.44	0.56

Table 2 (continued)

Variable	Sponsorship rate	Participation rate	Sponsored participation rate	Of those participating	
				Single coverage	Family coverage
Hispanic	0.60	0.47	0.77	0.41	0.59
Other	0.73	0.58	0.79	0.45	0.55
Education					
Some school	0.53	0.39	0.73	0.41	0.59
High school	0.73	0.57	0.78	0.39	0.61
College	0.82	0.68	0.82	0.43	0.57
Graduate school	0.87	0.76	0.87	0.35	0.65
Gender					
Male	0.73	0.63	0.86	0.33	0.67
Female	0.74	0.53	0.72	0.49	0.51
Number of children					
0	0.77	0.64	0.83	0.54	0.46
1	0.75	0.60	0.81	0.39	0.61
2	0.74	0.56	0.77	0.27	0.73
3 or more	0.68	0.50	0.74	0.31	0.69
Union contract					
Covered	0.95	0.86	0.90	0.31	0.69

Not covered	0.70	0.53	0.76	0.42	0.58
Occupation					
White collar	0.81	0.64	0.79	0.41	0.59
Blue collar	0.56	0.37	0.66	0.47	0.53
Service collar	0.67	0.57	0.84	0.34	0.66
Firm size					
1–24	0.35	0.27	0.76	0.45	0.55
25–49	0.76	0.55	0.72	0.47	0.53
50–99	0.84	0.64	0 77	0.44	0.56
100–249	0.87	0.68	0.78	0.44	0.56
250 or more	0.94	0.77	0.82	0.36	0.64
Industry					
Agriculture, forestry, & fishing	0.30	0.24	0.80	0.36	0.64
Mining	0.91	0.85	0.93	0.16	0.84
Construction	0.50	0.41	0 83	0.32	0.68
Manufacturing	0.89	0.79	0.89	0.33	0.67
Transportation, communications, & utilities	0.85	0.75	0.88	0.29	0.71
Wholesale trade	0.79	0.68	0.86	0.38	0.62
Retail trade	0.60	0.38	0.63	0.49	0.51

Table 2 (continued)

Variable	Sponsorship rate	Participation rate	Sponsored participation rate	Of those participating	
				Single coverage	Family coverage
Finance, insurance, & real estate	0.82	0.66	0.80	0.42	0.58
Personal services	0.36	0.25	0.70	0 54	0.46
Business & repair services	0.55	0.41	0.75	0.49	0.51
Entertainment services	0.56	0.37	0.66	0.54	0.46
Professional & related services	0.82	0.61	0.74	0.45	0.55
Public administration	0.97	0.85	0.88	0.38	0.62
Hours of work					
Part-time	0.51	0.16	0.32	0.49	0.51
Full-time	0.78	0.66	0.85	0.39	0.61

SOURCE: Employee Benefits Supplement to the 1993 Current Population Survey.

ficulties recruiting workers. Virtually all studies on labor mobility conclude that pension plans significantly reduce turnover rates (Bartel and Borjas 1977; Gustman 1990; Ippolito 1986; McCormick and Hughes 1984; Mitchell 1982; Mitchell 1983).[2] Employers also have an economic incentive to offer pension plans to reduce their hiring and training costs. If an employer's objective is to increase job tenure among workers, employers have an added incentive to increase their investment in training, which will increase the overall productivity of their work force. In addition, health insurance plans may improve the health and productivity of workers, potentially lowering the firm's rate of absenteeism. Along the same lines, the provision of child care facilities can also reduce the incidence of absenteeism.[3]

While previous research has contributed to our understanding of employee benefits, many studies have not fully utilized theoretical or econometric techniques in developing a framework for studying employee benefits and their role in the labor market. In addition, data problems have led some authors to make conclusions that conflict with economic theory. For example, Smith and Ehrenberg (1983) attempted to estimate the trade-off between wages and employee benefits but failed to find a trade-off because of data problems. In fact, most studies using micro-level data find a positive relationship between wages and employee benefits, mostly because they do not have adequate data and can not control for all of the variables that affect employee benefits. However, studies using more aggregated data have found a trade-off (Woodbury 1983; Woodbury and Huang 1991).

One reason for the various shortcomings in the employee benefits literature may be model misspecification. Traditionally, in the simple static model of labor supply, labor-force participation decisions are assumed to be a function of hourly wages, nonwage income, and personal characteristics. However, what ultimately matters to workers is the total compensation they receive per unit of time worked, along with the quality of basic working conditions. In this paper, the simple static model of labor supply is extended to include the demand for employee benefits. Unlike previous work, which has focused on specific aspects of employee benefits, the model presented in this paper is flexible enough to take into account all types of employee benefits. A unique feature of the model is that labor supply is estimated jointly with the

demand for employee benefits, using Seemingly Unrelated Regression Equations with a correction for selectivity bias.

The chapter is organized into sections that develop the theoretical model, present the empirical model, describe the data set and the construction of the variables, discuss the empirical results, and provide a summary.

THEORETICAL MODEL

We assume that an individual receives earned income, Y, for time worked, and has unearned income, Y_n. Earned income and unearned income are used to purchase market goods and services, G, such that:

$$Y + Y_n = p_g G, \tag{1}$$

where p_g represents the market price of goods and services.

Earned income is equal to the individuals potential hourly wage rate[4] (p_w) (net of taxes) multiplied by the number of hours worked (H) minus the employer's and employee's contribution to employee benefits:

$$Y = p_w H - p_z B\,, \tag{2}$$

where Y equals $wH(1 - t)$, p_w is equal to $w(1 - t) + B/H$, t represents the marginal tax rate, p_z represents the shadow price of employee benefits,[5] and B represents the quantity of employee benefits consumed by the employee. In Eq. 2, Y represents after-tax, take-home income that the worker can freely spend to purchase market goods and services and/or employee benefits. Employee contributions to employee benefits are subtracted from potential take-home income because these contributions come out of the workers potential take-home wage in order to take advantage of lower prices via economies of scale, group purchase, and the preferential tax treatment.

Firms hire additional workers until the workers marginal revenue product is equal to the workers total compensation rate, where total compensation is equal to the sum of wages and the monetary value of

employee benefits. We assume that employers are indifferent to the composition of total compensation, but adjustments are not costless. As a result, workers face a trade-off between wages and employee benefits (assuming total compensation is constant across workers with equal human capital).

Substituting Eq. 2 into Eq. 1 gives us:

$$p_w H - p_z B + Y_n = p_g G. \tag{3}$$

Individuals are also subject to a time constraint:

$$T = L + H, \tag{4}$$

where T represents total available time and L represents leisure time.[6] Solving Eq. 4 for H, and substituting into Eq. 3 yields the following full-income budget constraint:

$$p_w T + Y_n = p_w L + p_z B + p_g G. \tag{5}$$

From Eq. 5, an individual can consume leisure time (L), employee benefits (B), and other market goods and services (G).

Dual to an individual's utility maximization objective is an objective to minimize expenditures on consumption of goods and services. Formally, the individual's dual problem is to choose L, B, and G so as to minimize total expenditures (E).

$$E = p_w L + p_z B + p_g G, \tag{6}$$

subject to the constraint on utility (U_0) that

$$U_0 = U(L, B, G). \tag{7}$$

The optimal amounts of L, B, and G chosen will depend on the respective prices and required utility. Consumer behavior is summarized by the expenditure function, which shows the minimal expenditures necessary to achieve a given level of utility for a particular set of prices.

The consumers equilibrium condition is given by

$$E(p_g, p_w, p_z; U) = p_w T + Y_n \tag{8}$$

where $p_w T + Y_n$ represents full income. It is assumed that the expenditure function is linearly homogeneous and concave in prices.

ECONOMETRIC SPECIFICATION

Ever since Stone's (1954) system of demand equations, which were derived explicitly from economic theory, alternative specifications and functional forms of the consumers utility function have been proposed, the most popular being the linear model (Stone 1954), the Rotterdam model[7] (Theil 1965), and the translog model (Berndt and Christensen 1972). To avoid placing prior restrictions on the individuals utility function, a flexible approximation to the consumers' expenditure function is utilized in this study. The resulting expenditure function yields an easily estimatable system of consumer demand equations from which price and income elasticities can be derived. The consumer expenditure function is represented as follows:

$$\log E(\boldsymbol{p}, u) = a(\boldsymbol{p}) + ub(\boldsymbol{p}), \tag{9}$$

where u lies between 0 (subsistence) and 1 (bliss) and $\boldsymbol{p}$ represents a vector of prices. The expenditure function is linearly homogeneous, concave in factor prices, and $a(\boldsymbol{p})$ and $b(\boldsymbol{p})$ can be regarded as the costs of subsistence and bliss, respectively. In order to let the consumer expenditure function be flexible, $a(\boldsymbol{p})$ and $b(\boldsymbol{p})$ are set as follows:

$$a(\boldsymbol{p}) = a_0 + \Sigma_t a_t \log \boldsymbol{p}_t + 1/2 \Sigma_t \Sigma_J c_{tj} \log \boldsymbol{p}_t \log \boldsymbol{p}_J \tag{10}$$

$$b(\boldsymbol{p}) = b_0 \Pi_i \boldsymbol{p}_i^{b_t} \tag{11}$$

Deaton and Muellbauer (1980) pointed out that the choice of functional form for the above functions is partly due to the need for a flexible functional form; however, their main justification is that the resulting system of demand equations has desirable properties. In fact,

substitution of Eqs. 10 and 11 into Eq. 9 yields an expenditure function that is flexible and easily estimatable. The resulting system of demand equations is known as the Almost Ideal Demand System (AIDS). The AIDS system gives an estimate of the direct or indirect utility function yielding estimates of the structure of the workers' preferences for leisure, labor supply, employee benefits, and market goods and services. Own-price, cross-price, and income elasticities are easily derived from the AIDS model.

The expenditure function used in this study is shown as follows:

$$\log E(\boldsymbol{p}_t, U) = a_0 + \sum_t a_t \log \boldsymbol{p}_t + 1/2 \sum_t \sum_J c_{tj} \log \boldsymbol{p}_t \log \boldsymbol{p}_J + U b_0 \prod_t \boldsymbol{p}_t^{b_t} \tag{12}$$

where the subscript i, j equal g, w, and z.

The expenditure function can be logarithmically differentiated, yielding the expenditure shares associated with leisure, employee benefits, and market goods and services,

$$S_w = a_w + \sum_J b_{wj} (\log \boldsymbol{p}_J) + b_w (\log m / p^*) \tag{13a}$$

$$S_z = a_z + \sum_J b_{zj} (\log \boldsymbol{p}_J) + b_z (\log m / p^*) \tag{13b}$$

$$S_g = a_g + \sum_J b_{gj} (\log \boldsymbol{p}_J) + b_g (\log m / p^*) \tag{13c}$$

where $b_{tj} = \frac{1}{2}(c_{ij} + c_{jt})$, and the subscript $j = w, z$, and g. The share of total compensation spent on each good is a function of the natural log of prices and an income term, $\log(m/p^*)$, where p^* represents a price index.[8]

Economic theory requires the demand system to exhibit three properties: adding-up, homogeneity, and symmetry. Adding-up implies that the sum of the share equations equal one. We impose this condition by restricting the parameters in our system of equations as follows:

$$\sum_t a_t = 1, \sum_t b_{tw} = 0, \sum_t b_{iz} = 0, \sum_t b_{tg} = 0, \sum_t b_t = 0. \tag{14}$$

In order for the demand system to be homogeneous of degree zero in prices and income, the following within-equation restrictions are imposed:

$$\Sigma_J b_{wJ} = 0, \Sigma_J b_{zJ} = 0, \Sigma_J b_{gJ} = 0. \tag{15}$$

Additionally, symmetry is imposed by setting the cross-substitution effects equal, such that $b_{ij} = b_{ji}$.

After imposing the adding-up, homogeneity, and symmetry conditions, and appending a vector of demographic variables and normally distributed error terms, the system of demand equations is written as follows:

$$S_w = a_w + b_{wg}(\log p_g / p_w) + b_{wz}(\log p_z / p_w) + b_w(\log m / p^*) + \gamma_{1t} X_t + u_{1i} \tag{16a}$$

$$S_z = a_z + b_{zg}(\log p_g / p_z) + b_{wz}(\log p_w / p_z) + b_z(\log m / p^*) + \gamma_{2t} Y_t + u_{2t} \tag{16b}$$

$$S_g = a_g + b_{zg}(\log p_z / p_g) + b_{wg}(\log p_w / p_g) + b_g(\log m / p^*) + \gamma_{3t} Z_t + u_{3t} \tag{16c}$$

Our data allow us to estimate the system only for workers with employee benefits and, thus, needs to be adjusted for selectivity bias. The method to correct for selectivity bias when the subsample is selected based on two choices can be found in Maddala (1983, p. 368).[9]

Suppose labor supply and employee benefits are imperfectly observed such that:

$$S_w = S_w^* + u_w \tag{17a}$$

$$S_z = S_z^* + u_z \tag{17b}$$

Suppose, further, that there are latent variables:

$$y_1^* = X_1\tau_1 + \varepsilon_1 \tag{18a}$$

$$y_2^* = X_2\tau_2 + \varepsilon_2 \tag{18b}$$

such that the individual works if and only if $y_1^* \geq 0$ and receives employee benefits if $y_2^* \geq 0$. If the us and εs are joint normally distributed,

$$\begin{pmatrix} u \\ \varepsilon \end{pmatrix} \sim \left(\begin{pmatrix} 0 \\ 0 \end{pmatrix}, \begin{pmatrix} \Sigma_{11} & \Sigma_{12} \\ \Sigma_{21} & \Sigma_{22} \end{pmatrix} \right) \tag{19}$$

then the selectivity bias has the form

$$E\left(u \middle| \begin{matrix} \varepsilon_1 > -X_1\tau_1 \\ \varepsilon_2 > -X_2\tau_2 \end{matrix} \right) = \left(\sum_{11} \right)^{-1} \sum_{12} E \begin{pmatrix} \varepsilon_1 \mid \varepsilon_1 > -X_1\tau_1 \\ \varepsilon_2 \mid \varepsilon_2 > -X_2\tau_2 \end{pmatrix} \tag{20}$$

where

$$F(-X_1\tau_1, -X_2\tau_2) E\left(\varepsilon_1 \middle| \begin{matrix} \varepsilon_1 > -X_1\tau_1 \\ \varepsilon_2 > -X_2\tau_2 \end{matrix} \right) = \phi(c_i)[1 - \Phi(c_j^*)] + \rho\phi(c_j)[1 - \Phi(c_i^*)] \tag{21}$$

and

$c_i = -x_i\,\tau_i$,
ρ is the correlation between e_1 and ε_2,
$c_i^* = (c_i - \rho c_j)/(1-\rho^2)(1-\rho^2)^{1/2}$, $i = 1,2$
ϕ represents the standard normal density function,
Φ represents the cumulative distribution function, and
F is the bivariate normal distribution function.

The parameters τ_1, τ_2, and part of Σ_{22} can be estimated up to scale using a bivariate probit model. The model is estimated with sample selection because only workers are assumed to receive employee bene-

fits. The selectivity equations include a comprehensive set of economic and demographic variables likely to influence the decision to work and receive employee benefits.

Once the selectivity bias has been taken into account, the expenditure share equations can be written as follows:

$$S_w = a_w + b_{wg}(\log p_g/p_w) + b_{wz}(\log p_z/p_w) + b_w(\log m/p^*) + \gamma_{1t}X_t + F_w[E(u_{1t} \mid H = 1, B = 1)] + \xi_{1t} \quad (22a)$$

$$S_z = a_z + b_{zg}(\log p_g/p_z) + b_{wz}(\log p_w/p_z) + b_z(\log m/p^*) + \gamma_{2t}Y_t + F_z[E(u_{2t} \mid H = 1, B = 1)] + \xi 2_t \quad (22b)$$

$$S_g = a_g + b_{zg}(\log p_z/p_g) + b_{wg}(\log p_w/p_g) + b_g(\log m/p^*) + \gamma_{3t}Z_t + F_g[E(u_{3t} \mid H = 1, B = 1)] + \xi_{3t} \quad (22c)$$

where $H = 1$ if the individual participates in the labor force, $B = 1$ if the individual receives employee benefits, F_t are parameters, and ξ_t represent error terms that have zero means conditional on both the individuals decision to work and receive employee benefits.

The system of share equations can be estimated using Zellner's two-step (or iterative) Feasible Generalized Least Squares procedure or maximum likelihood, which is suitable for constrained, singular systems. One share equation is deleted from the system of equations to avoid singularity, because the share equations sum to 1. The choice of which equation to delete is arbitrary and has no effect on the empirical results. Data limitations motivate the deletion of the market goods and services equation; however, we capture the market goods share from our estimation. Also, the price of market goods and services, p_g, is normalized to 1 to further simplify the system.

The estimates of the demand system are used to compute the own-price, cross-price, and income elasticities of demand. Confidence intervals are constructed for the elasticities by computing the large-sample variance of each elasticity (see Kmenta 1986, p. 486).

DATA

The data for this study come from the April 1993 Current Population Survey (CPS). This survey included an employee-benefits supplement in which detailed questions were asked on employer-provided pension plans and health insurance plans. With respect to employer-provided pension plans, respondents to the supplemental questions were asked if their employer or union sponsored a pension plan for anyone in their company and whether they were included in the plan. Detailed questions were also asked about the type of plan. From the survey, we can determine whether the individual was included in a defined-benefit plan or a defined-contribution plan and the type of defined-contribution plan (i.e., profit sharing, employee stock ownership plan, 401k plan, salary reduction plan, etc.). An additional set of questions was asked about any salary reduction plans (i.e. 401k, 403b, etc.), the amount the individual contributed to the plan, and the amount of the contribution that the employer matched.

Salary reduction pension plan data is highly suitable to our model because it allows individuals to make choices about their level of contributions to the pension plan. Unlike a defined-benefit plan where a worker's retirement benefit is determined by an equation, usually based on age, years of service, and final pay—an equation that the worker has little control over—a defined-contribution plan with a salary reduction component allows a worker more flexibility at the margin in determining their degree of participation in the plan. Workers are allowed to determine how much they want to contribute to the plan on a pre-tax basis, and many plans allow workers to change their level of contributions on a regular basis (i.e., once a month) so that workers are not constrained to their choice of contribution level for a long period of time. This flexibility is highly desirable when trying to model workers' preferences for pension benefits.

While the CPS also includes data on health insurance plans, the data are not detailed enough to yield information about the cost of the plan. Respondents to the survey were asked about employer sponsorship of a health insurance plan, their participation, and whether the plan also covered family members. The survey does not ask whether the worker has a choice of health insurance options or the relative cost

of those options. In this survey, a worker with three options would be treated the same as a worker with only one option. In addition, the cost of health insurance is not as optimal as pension plan contributions for the model presented in this chapter because workers can not typically switch health insurance plans on a regular basis, assuming they even have a choice of health insurance plans. Open enrollment, where available, is usually limited to once per year.

The sample used in this paper is limited to the noninstitutionalized civilian population between the ages of 18 and 64. Active duty military personnel and the self-employed are not included in the sample, resulting in a sample of 37,975 working and nonworking males and 42,875 working and nonworking females. This sample is used to provide estimates of the bivariate probit model, which is used to correct the system of demand equations for selectivity bias. The system of demand equations is corrected for selectivity bias because it is only estimated with data on workers participating in a salary reduction pension plan. This results in a selected sample of 2,129 males and 1,544 females. Sample means and variable definitions are provided in Table 3.

From the CPS, the following variables are needed to estimate the system of demand equations:

1) Share of Leisure Time, S_w:

The share of leisure time is measured as the percentage of full-income spent on the consumption of leisure. This is computed as

$$S_w = (p_w L) / (p_w T + Y_n)$$

Total available time, T, is assumed to be equal to 5,840 hours, which is the total time available in a given year, given time for sleep. Nonwage income, Y_n, is measured as total personal unearned income.

2) Share of Pension Plan Contributions, S_z:

The share of pension plan contributions is computed as follows:

$$S_z = (p_z B) / (p_w T + Y_n)$$

The shadow price of pension plan contributions is measured using the workers' marginal tax rate, as discussed in the next section. The

amount of pension plan contributions, B, is calculated as the annual employee contribution to the salary reduction pension plan and does not include any match provided by the employer.

3) Price of Pension Plan Contributions, P_z:

The worker's marginal tax rate is used as a proxy for the shadow price of the pension plan. As mentioned above, this variable has been used extensively in previous research. It should be noted, however, that the use of the marginal tax rate has two potential shortcomings. First, the marginal tax rate is correlated with income. Higher income workers are in higher marginal tax rates. While this may present a problem in this study because real total compensation is used as an explanatory variable, price and income should have independent effects on the share equations. Second, the possibility exists that a worker will lower their marginal tax rate by increasing their contributions to their pension plan. However, a worker's ability to contribute to a pension plan on a pre-tax basis is limited by constraints set by the Internal Revenue Service, which minimizes the severity of this problem. In 1993, workers could not contribute more than $9,200 to a 401k plan and $9,500 to a 403b plan on a pre-tax basis.

Assumptions about an individual's tax-filing status are made from the various demographic characteristics provided in the CPS. Each individual's tax-filing status is based on their marital status and the number of dependent children. It is assumed that all married and separated individuals file a joint tax return. Widowed, divorced, and never married individuals are assumed to file as heads of household if they have dependent children, otherwise they are assumed to file as single taxpayers. Standard deductions and personal exemptions from taxable income are based on the number of dependents in the family.

The marginal tax rate is computed from both federal and state income tax forms. Local taxes, where applicable, and the social security payroll tax are not included in the marginal tax rate. Given limitations on geographic region in the CPS, it is impossible to calculate local income tax rates. In addition, previous research has shown that estimates of the demand for employee benefits are commonly unaffected by the inclusion of the Social Security payroll tax (Woodbury and Hamermesh 1992; Woodbury and Bettinger 1991).

Table 3 Sample Means and Variable Definitions

Variable	Definition	Males	Females
S_w	leisure share	0.59	0.63
S_z	benefit share	0.01	0.01
S_g	goods and services share	0.40	0.37
p_w	price of leisure	16.02	11.91
p_z	price of benefits	0.21	0.21
m/P^*	real total compensation	9827.97	6859.48
AGE	age	40.82	40.59
AGESQ	age squared	1761.98	1748.35
MARRIED	=1 if married	0.79	0.63
WIDOWED	=1 if widowed	0.01	0.03
DIVORCED	=1 if divorced	0.08	0.15
SEPARATE	=1 if separated	0.01	0.02
SINGLE	=1 if never married	0.12	0.16
OWNKIDS	number of own children under age 18	1.34	1.11
EDUC1	=1 if some school	0.02	0.02
EDUC2	=1 if high school graduate	0.51	0.62
EDUC3	=1 if college graduate	0.28	0.24
EDUC4	=1 if completed graduate school	0.18	0.12
WHITE	=1 if white, non-Hispanic	0.91	0.88
BLACK	=1 if black, non-Hispanic	0.03	0.06
HISPANIC	=1 if Hispanic	0.03	0.03
OTHRACE	=1 if other race	0.03	0.04
UNION	=1 if union worker	0.21	0.19
FULLTIME	=1 if full-time worker	0.99	0.94
WHITECOL	=1 if white collar	0.67	0.87
BLUECOL	=1 if blue collar	0.28	0.09
SERVCOL	=1 if service collar	0.05	0.04
FS1	=1 if 1–24 employees	0.06	0.08
FS2	=1 if 25–49 employees	0.03	0.03
FS3	=1 if 50–99 employees	0.06	0.04

Variable	Definition	Males	Females
FS4	=1 if 100–249 employees	0.07	0.07
FS5	=1 if 250 or more employees	0.78	0.78
MATCH	=1 if employer matches contribution	0.65	0.59
F_w	Selectivity term in leisure equation	0 20	0.15
F_z	Selectivity term in benefit equation	0.21	0.16

4) Price of Leisure Time, p_w:

The price of leisure time (the after tax hourly wage rate) is measured using observed data from the CPS. The hourly wage rate was calculated based on usual hours of work per week, weeks worked per year, and annual earnings. In some cases where weeks worked per year was missing, the mean (51.5) was substituted.

5) Real After-Tax Total Compensation, m:

The measure of real total compensation is obtained by summing after-tax annual earnings with annual pension plan contributions and dividing by the price index, p^*.

6) Price Index, p^*:

Using Stone's (1953) price index, some researchers have approximated p^* as:

$$\log p^* = S_w (\log p_w) + S_z (\log p_z) + S_g (\log p_g)$$

and have found this to be a good approximation of the price index (Anderson and Blundell 1983, 1984; Deaton and Muellbauer 1980; Kang 1983; and Woodbury and Huang 1991). We follow this approach to estimate the price index. When p_g is normalized to 1, the last term drops out.

7) Demographic Variables that Affect the Share of Leisure and the Share of Pension Plan Contributions:

A vector of demographic variables affecting both the share of leisure and the share of pension plan contributions includes controls for

the following: age, marital status, number of children, race, education, union status, occupation, industry, firm size, and geographic region.

Two variables are included to control for age: age (AGE) and age-squared (AGESQ). We expect age to have a nonlinear effect on the demand for leisure with the oldest workers having a greater demand for leisure as they transition out of the labor force. With respect to pension plan contributions, we expect age to always have a positive effect. As workers age, they will have less time to take advantage of compound interest, and they will also realize the need to start saving for retirement. Thus, they will make larger contributions to their pension plans.

A set of dummy variables on marital status (WIDOWED, DIVORCED, SEPARATE, SINGLE) are also included in both the leisure demand equation and the employee benefit demand equation (MARRIED is the base group). We expect to find differences in pension plan contributions between males and females and across marital status. Unmarried women are expected to be less likely to demand leisure time and more likely to contribute to pension plans than married women. Our expectations are based on previous research, which has shown that unmarried women are less likely to intend to retire early than married women because they have access to fewer resources than married women (Holtmann et al. 1994). The marital status of men, however, has not been shown to affect their plans to retire early. We expect similar results in this study. In addition, we expect the number of children (OWNKIDS) to have an effect on both the share of leisure and the share of pension plan contributions. Workers with more children are more likely to demand leisure time than workers without children in order to spend more time with their children. With respect to pension plan contributions, workers with children are expected to contribute less to their pension plan because of the additional expenses needed to raise children, all else being equal.

Race has been shown to be correlated with the probability that an individual works, therefore, we include a set of dummy variables (BLACK, HISPANIC, OTHRACE) to determine whether race plays a role in the share of leisure demanded (given that an individual is already working) and the share of pension plan contributions demanded (given that a worker participates in a salary reduction pension plan; WHITE is the base group).

Education variables (EDUC2, EDUC3, and EDUC4) are included in the model as well (EDUC1 is the base group). We expect more educated workers to demand less leisure time because of the implicit demands of a job that are correlated with education. In addition, we expect more educated workers to demand a greater share of their total income in the form of pension plan contributions. More educated workers are more likely to be able to evaluate and understand the advantages of contributing to their pension plan than less educated workers. More educated workers may also be more comfortable directing their asset allocation decisions.

With respect to employment characteristics, variables are included to control for union membership, occupation, industry, and firm size. We expect union membership (UNION) to increase a worker's demand for leisure because the union may be better able to negotiate a fixed work schedule. Our expectations of union membership on pension plan contributions are less clear. While unions may be better able to educate their members about the advantages of contributing to a pension plan, union members are typically more likely to have an employer-funded defined-benefit plan. Therefore, there may be no need to contribute to a defined-contribution pension plan in addition to the defined-benefit plan.

The set of dummy variables to control for occupation include a variable for white collar workers (the base group), a variable to control for blue collar workers (BLUECOL), and a variable to control for service collar workers (SERVCOL).[10] With respect to firm size, we expect workers employed in large firms to have a greater demand for pension plan contributions because large firms typically have better educational programs and materials concerning the advantages of contributing to a pension plan than a small firm. Dummy variables are included to control for firms with 1–24 workers (FS1=the base group), 25–49 workers (FS2), 50–99 workers (FS3), 100–249 workers (FS4), and 250 or more workers (FS5).

8) Demographic Variables which Affect Only Pension Plan Contributions:

Two additional employment related variables are only included in the share of pension plan contributions equation. A dummy variable is include to control for whether the worker was employed part time or

full time (FULLTIME), and a dummy variable was included to control for whether the employer offered a match to the workers' contributions to the pension plan (MATCH). The direction of the effect of the employer match is unclear because of two potential offsetting effects. On one hand, we expect the presence of an employer match to have a positive effect on a worker's contribution to a pension plan. If an employer offers a dollar-for-dollar match, a worker may contribute more to the plan because the opportunity cost of not contributing is higher when the match is forgone. Alternatively, the availability of an employer match may result in a worker contributing less to the plan if the match acts as a substitute for the worker's own contributions.[11]

RESULTS

Bivariate Probit Model

Table 4 contains the results from the bivariate probit model used to estimate selectivity corrected estimates of the model on leisure demand and employee benefits demand. As mentioned previously, the bivariate probit model is estimated with sample selection because we assume that only workers will receive employee benefits. The results of the bivariate probit model are worth briefly mentioning. Separate equations are estimated for males and females. A likelihood-ratio test for equality of coefficients in the male and female equations rejects the hypothesis that the two equations are the same.

With respect to the labor supply equation, we find that the probability of working is positively related to age until an individual reaches age 55, at which point the probability of working decreases as compared with the aged 18–24 base group. These results are consistent for both males and females.

The effects of marital status on the probability of working are not consistent for males and females. Married males are more likely to be working than their unmarried counterparts. Divorced, separated, and never married women, however, are more likely to be working than married or widowed women, suggesting that unmarried women have

fewer resources than married women, and thus have a greater incentive to participate in the labor force.

The effect of education is consistent for males and females: there is a higher probability of participating in the labor force the more education an individual attains. Race is also generally consistent for males and females, with nonwhites less likely to be participating in the labor force than whites, with the exception of Hispanic males. In addition, the more children an individual has, the less likely they are to be participating in the labor force. This is an interesting result because most individuals with children would be expected to need the resources that can be derived from working. It is not surprising, however, that the effect is over three times larger for females than it is for males because single parent families headed by women are more likely to qualify for public assistance.

Given that an individual is working, we find the following results with respect to participation in a salary reduction pension plan. For both males and females, age effects are strongest for younger workers, implying that older workers are more likely to have a defined benefit plan or less likely to have any type of pension plan. Marital status appears to play an important role in the probability of whether a worker participates in a salary reduction pension plan, with different effects for males and females. Unmarried males are less likely than married and widowed males to be participating in a salary reduction pension plan. Divorced women, on the other hand, are more likely to be participating in a salary reduction pension plan than all other women, This result suggests that divorced women may have lost their rights to their husbands' pension benefits and must accumulate their own resources for retirement.

Education has a strong linear effect on the probability that a worker participates in a salary reduction pension plan. Race has a strong negative effect, with nonwhites having a lower probability of participating in a salary reduction pension plan than whites. Number of children also has a negative effect on the probability of participating in a salary reduction pension plan.

With respect to characteristics associated with the labor market, we find statistically significant effects for union membership, hours of work, occupation, and firm size. Union membership is found to decrease the probability that a worker participates in a salary reduction

Table 4 Bivariate Probit Model Estimates for Labor Supply Equation and Employee Benefit Equation

	Male		Female	
	Employee benefit equation	Labor supply equation	Employee benefit equation	Labor supply equation
Constant	–3.646***	–0.491***	–3.457***	–0.878***
	(0.120)	(0.031)	(0.095)	(0.031)
AGE2	0.470***	0.116***	0.445***	0.106***
	(0.059)	(0.023)	(0.056)	(0.023)
AGE3	0.520***	0.121***	0.516***	0.170***
	(0.060)	(0.026)	(0.057)	(0.025)
AGE4	0.496***	0.078***	0.532***	0.138***
	(0.062)	(0.028)	(0.059)	(0.026)
AGE5	0.284***	–0.187***	0.271***	–0.223***
	(0.068)	(0.031)	(0.067)	(0.030)
WIDOWED	–0.128	–0.326***	0.061	–0.027
	(0.157)	(0.084)	(0.076)	(0.039)
DIVORCED	–0.108***	–0.141***	0.087**	0.182***
	(0.041)	(0.026)	(0.035)	(0.021)
SEPARATE	–0.262***	–0.130***	–0.072	0.067*
	(0.091)	(0 047)	(0.076)	(0.038)
SINGLE	–0.273***	–0.168***	0.024	0.109***
	(0.035)	(0.019)	(0.034)	(0.019)
EDUC2	0.434***	0.195***	0.505***	0.364***
	(0.052)	(0.020)	(0.061)	(0.021)
EDUC3	0.681***	0.270***	0.646***	0.477***
	(0.060)	(0.025)	(0.067)	(0.026)
EDUC4	0.698***	0.316***	0.636***	0 511***
	(0.062)	(0.030)	(0.072)	(0.033)
BLACK	–0.408***	–0.140***	–0.346***	–0.085***
	(0.056)	(0.024)	(0.049)	(0.022)
HISPANIC	–0.193***	0.009	–0.265***	–0.070***
	(0.058)	(0.026)	(0.064)	(0.027)
OTHRACE	–0.238***	–0.170***	–0.074	–0.091***
	(0.059)	(0.032)	(0.061)	(0.031)
OWNKIDS	–0.025***	–0.017***	–0.093***	–0.068***
	(0.009)	(0.005)	(0.010)	(0.005)

	Male		Female	
	Employee benefit equation	Labor supply equation	Employee benefit equation	Labor supply equation
UNION	–0.152***	–	–0.145***	–
	(0.028)		(0.030)	
FULLTIME	0.672***	–	0.443***	–
	(0.088)		(0.041)	
SERVCOL	–0.299***	–	–0.431***	–
	(0.049)		(0.053)	
BLUECOL	–0.121***	–	–0.057	–
	(0.027)		(0.040)	
FS2	0.592***	–	0.373***	–
	(0.059)		(0.069)	
FS3	0.909***	–	0.626***	–
	(0.051)		(0.060)	
FS4	0.883***	–	0.669***	–
	(0.049)		(0.053)	
FS5	1.109***	–	0.900***	–
	(0.037)		(0.035)	
ρ	0.963***		0.987	
	(0.202)		(9.563)	
n	37,975		42,875	
log L	–29,179.1		–29,340.5	

NOTE: Age dummies represent the following categories: AGE1 =1 if aged 18–24 (base group), AGE2 =1 if aged 25–34, AGE3 =1 if aged 35–44, AGE4 =1 if aged 45–54, and AGE5 =1 if aged 55–64. All other variables are defined in Table 3. Standard errors in parentheses.

***significant at the 1% level.

**significant at the 5% level.

*significant at the 10% level.

pension plan. Because of collective bargaining agreements, union members are more likely to have a defined-benefit plan funded by the employer. Full-time workers are more likely than part-time workers and white collar workers are more likely than blue collar and service collar workers to participate in salary reduction plans. In addition, workers employed in large firms are more likely to participate in salary reduction pension plans than workers in small firms. These results are generally consistent for both males and females.

Finally, the correlation coefficient between the labor supply equation and the salary reduction pension plan equation, ρ, is statistically significant for males but not for females.

AIDS Model Results

Table 5 contains the estimated coefficients from the AIDS model. The adjusted R^2 for males and females is 0.89 and 0.90, respectively, for the leisure share equation, and 0.40 for both males and females for the salary reduction pension plan equation.

The parameters on the price and income variables are significant in most cases for both males and females. However, the estimated own-price, cross-price, and income elasticities presented in Table 6, give us a better understanding of the effects in the model. Therefore, we first discuss the results of the demographic and labor-market variables and then discuss the estimated elasticities.

Returning to the results in Table 5, we find consistent nonlinear effects of age on the share of leisure time for both males and females. At first, an increase in age reduces the demand for leisure time (increases time spent at work) and eventually increases the demand for leisure time. Predictions from the model indicate that males will start to increase their demand for leisure time at age 52.75, while females will increase their demand for leisure time at age 47.25. With respect to pension plan contributions, we find significant positive effects of age for males, but insignificant effects for females.

As mentioned previously, we expect marital status to have different effects for males and females on the share of leisure and the share of pension plan contributions. For males, we find that separated and never married males demand a greater share of leisure than married, widowed, and divorced males. For females, we find that all nonmar-

ried females demand a smaller share of leisure than their married female counterparts. With respect to pension plan contributions, marital status has no effect for males (with the exception of a small negative effect for separated males). Divorced females, on the other hand, have a significantly lower share demand for pension plan contributions than all other females. This may suggest that given their budget constraints, divorced females choose to spend less on pension plan contributions than other females. While we expected unmarried women to be spending a greater share of their income on pension plan contributions, the effect of marital status appears to be working through the probability of participating in the pension plan (the bivariate probit model), as opposed to the amount contributed once participation has been determined.

The number of children exerts consistent positive effects on leisure demand for both males and females. Both males and females appear to demand a greater share of leisure the more children they have. With respect to pension plan contributions, the number of children has a negative effect on the share of pension plan contributions for males and an insignificant effect for females.

Our results for race are in large part consistent for both males and females in both the leisure share equation and the pension plan contribution share equation. We find that nonwhites demand a greater share of their income in the form of leisure than whites. For males, there is no effect of race on pension plan contributions (any difference appears in the probability of participating model), while black females demand a greater share of pension plan contributions than females of other races.

With respect to education, we find consistent effects for males and females in the leisure share equation but not in the benefits share equation. We find that increasing levels of education result in a decreased demand for the share of leisure time, indicating that higher levels of education are associated with increasing shares of work time. Higher education levels result in a greater share demand of benefits for males, while education has no effect on the share demand of benefits for females.

With respect to the variables associated with the labor market, we find the following. Hours of work do not exert a significant effect on pension plan contributions for males, but do exert a negative effect for

Table 5 Estimated Coefficients of the Leisure Share and Benefit Share Equations

	Males	Females
a_w	2.001***	2.021***
	(0.021)	(0.024)
a_z	–0.011**	–0.002
	(0.005)	(0.005)
a_g	–0.990***	–1.019***
	(0.021)	(0.025)
b_{ww}	0.079***	0.080***
	(0.002)	(0.002)
b_{wg}	–0.079***	–0.080***
	(0.002)	(0.002)
b_{wz}	0.000	0.000
	(0.000)	(0.000)
b_{zz}	–0.003***	–0.003***
	(0.001)	(0.000)
b_{zg}	0.003***	0.003***
	(0.001)	(0.001)
b_{gg}	0.076***	0.077***
	(0.002)	(0.002)
b_w	–0.175***	–0.176***
	(0.001)	(0.002)
b_z	0.003***	0.003***
	(0.000)	(0.000)
b_g	0.171***	0.173***
	(0.001)	(0.002)

	Variables in leisure equation	Variables in benefits equation	Variables in leisure equation	Variables in benefits equation
AGE	–0.00211***	0.00037**	–0.00189***	–0.00014
	(0.00069)	(0.00015)	(0.00064)	(0.00013)
AGESQ	0.00002***	0.00000**	0.00002**	0.00000
	(0.00001)	(0.00000)	(0.00001)	(0.00000)

	Males		Females	
	Variables in leisure equation	Variables in benefits equation	Variables in leisure equation	Variables in benefits equation
WIDOWED	–0.00403	–0.00301	–0.02579***	–0.00100
	(0.00915)	(0.00192)	(0.00391)	(0.00068)
DIVORCED	0.00389	–0.00084	–0.02310***	–0.00115***
	(0.00262)	(0.00056)	(0.00199)	(0.00036)
SEPARATE	0.01448**	–0.00247*	–0.01130***	–0.00102
	(0.00649)	(0.00137)	(0.00429)	(0.00074)
SINGLE	0.01155***	–0.00003	–0.00728***	–0.00027
	(0.00294)	(0.00065)	(0.00190)	(0.00033)
OWNKIDS	0.00282***	–0.00034***	0.00400***	0.00009
	(0.00057)	(0.00012)	(0.00081)	(0.00016)
BLACK	0.01321***	–0.00025	0.01865***	0.00145**
	(0.00468)	(0.00103)	(0.00336)	(0.00064)
HISPANIC	0.01065***	–0 00077	0.01020***	–0.00027
	(0.00401)	(0.00086)	(0.00412)	(0.00074)
OTHRACE	0.00974**	0.00031	0.01106***	0.00052
	(0.00442)	(0.00094)	(0.00373)	(0.00065)
EDUC2	–0.01816***	0.00180*	–0.00824*	–0.00089
	(0.00456)	(0.00099)	(0.00462)	(0.00083)
EDUC3	–0.02373***	0.00240*	–0.01340***	–0.00104
	(0.00597)	(0.00133)	(0.00520)	(0.00098)
EDUC4	–0.02240***	0.00327**	–0.01785***	–0.00087
	(0.00623)	(0.00139)	(0.00540)	(0.00102)
FULLTIME	–	0.00139	–	–0.00286***
		(0.00176)		(0.00075)
UNION	0.00621***	–0.00055	0.00521***	0.00113***
	(0.00210)	(0.00046)	(0.00198)	(0.00037)
BLUECOL	0.00608***	–0.00055	0.00264	0.00039
	(0.00205)	(0.00044)	(0.00264)	(0.00046)
SERVCOL	–0.00003	–0.00017	0.01222***	0.00062
	(0.00406)	(0.00088)	(0.00407)	(0.00074)

(continued)

Table 5 (continued)

	Males		Females	
	Variables in leisure equation	Variables in benefits equation	Variables in leisure equation	Variables in benefits equation
FS2	–0.01585***	0.00081	0.00162	–0.00021
	(0.00537)	(0.00117)	(0.00461)	(0.00080)
FS3	–0.01823***	0.00246*	–0.01401***	–0.00070
	(0.00608)	(0.00138)	(0.00439)	(0.00082)
FS4	–0.02029***	0.00274**	–0.00541	–0.00154**
	(0.00590)	(0.00135)	(0.00413)	(0.00079)
FS5	–0.02734***	0.00382**	–0.02113***	–0.00168*
	(0.00699)	(0.00162)	(0.00445)	(0.00094)
MATCH	–	0.00031	–	–0.00019
		(0.00030)		(0.00024)
Selectivity term	0.18142***	–0.02078**	0.18941***	0.01588**
	(0.03589)	(0.00821)	(0.02867)	(0.00646)
adjusted R^2	0.89	0.40	0.90	0.40
n	2,129	1,544		

NOTE: Estimation results from applying an iterative unweighted version of Zellner's seemingly unrelated regression equations. The dependent variables are the shares of total full income received as leisure consumption and employee benefit share. Asymptotic standard error shown in parentheses. Each equation includes a set of two-digit industry dummy variables, and eight region variables, in addition to the control variables shown.

Standard errors in parentheses.

***significant at the 1% level.

**significant at the 5% level.

*significant at the 10% level.

Table 6 Price and Income Elasticities

	Males		Females	
Uncompensated price elasticities				
η_{ww}	–0.691	(0.003)	–0.696	(0.003)
η_{zz}	–1.450	(0.072)	–1.547	(0.074)
η_{gg}	–0.984	(0.004)	–0.965	(0.005)
η_{wz}	0.002	(0 001)	0.002	(0.001)
η_{zw}	–0.261	(0.043)	–0.314	(0.050)
η_{wg}	0.572	(0.003)	0.555	(0.003)
η_{gw}	–0.445	(0.004)	–0.512	(0.005)
η_{zg}	0.266	(0.076)	0 334	(0.084)
η_{gz}	0.005	(0.002)	0.006	(0.002)
Compensated price elasticities				
η^*_{ww}	–0.278	(0.003)	–0.246	(0.003)
η^*_{zz}	–1.439	(0.072)	–1.538	(0.074)
η^*_{gg}	–0.409	(0.005)	–0.424	(0.005)
η^*_{wz}	0.008	(0.001)	0.006	(0.001)
η^*_{zw}	0.590	(0.048)	0.643	(0.054)
η^*_{wg}	0.270	(0.003)	0 240	(0.003)
η^*_{gw}	0.393	(0.004)	0.410	(0.005)
η^*_{zg}	0.850	(0.084)	0.895	(0.096)
η^*_{gz}	0 016	(0.002)	0.014	(0.002)
Income elasticities				
η_{wm}	0.703	(0.002)	0.718	(0.003)
η_{zm}	1.446	(0.043)	1.527	(0.059)
η_{gm}	1.424	(0.004)	1.472	(0.005)

NOTE: Elasticities computed from the parameter estimates displayed in Table 5. Standard error of each elasticity is in parentheses next to each elasticity. Standard errors are computed by taking a Taylor series approximation at the sample mean.

females. Union status significantly increases the demand for leisure for both males and females. It has no effect on pension plan contributions for males but has a positive, significant effect for females. Occupation also has no effect on pension plan contributions for both males and females. On the other hand, firm size plays an important role in pension plan contributions, but the results for males and females are mixed. We find that male workers employed in larger firms contribute a larger share of income to pension plans than workers in small firms, but the opposite is true for females. In addition, an employer match does not significantly affect a worker's pension plan contributions.

Finally, we find evidence of selectivity bias for males and females in both the leisure share equation and the pension plan contribution share equation. Note, however, that the signs on the selectivity correction term are inconsistent for males and females and may be due to the fact that the estimated correlation between the error terms in the bivariate probit model was insignificant for females.

Elasticities

The estimated coefficients shown in Table 5 are used to estimate uncompensated, compensated, and income elasticities. These elasticities, computed at the sample mean, along with each standard error (shown in parentheses next to the elasticity) are shown in Table 6. The uncompensated own-price elasticities are all statistically significant and of the correct sign. Our results suggest that a 10 percent increase in the wage rate would reduce the share of leisure by 6.91 percent for males and 6.96 percent for females. We find that a 10 percent increase in the price of a pension plan (that is, a 10 percent decrease in the marginal tax rate) results in a 14.5 percent decrease in the share of income contributed to a salary reduction pension plan for males and a 15.5 percent decrease for females, suggesting that pension plan contributions are very elastic with respect to a worker's marginal tax rate. We also find a nearly unitary own-price elasticity for other goods and services.

The uncompensated cross-price elasticities yield interesting results. We find no effect between the share of leisure time and the price of pension plans. However, we do find a negative effect between wages and pension plan contributions, suggesting that pension plan contributions and wages are gross substitutes. We find that a 10 per-

cent decrease in the wage rate results in a 2.61 percent increase in pension plan contributions for males and a 3.14 percent decrease for females. Both males and females behave as we would expect when facing an employer's wage–benefit trade-off curve. The other uncompensated cross-price elasticities suggest that pension plan contributions and other goods and services are gross complements, while the results are mixed for the share of leisure and other goods and services.

The income elasticities are all positive and significant, indicating that all of the goods are normal goods. The results suggest that the share of leisure is income inelastic, while the share of pension plan contributions and market goods and services are income elastic.

CONCLUSION

In this chapter, the simple static model of labor supply is extended to incorporate the demand for employee benefits. Traditionally, labor-supply models have ignored employee benefits, even though they have become a significant component of total compensation during the 20th century. The model presented in this paper incorporates the demand for employee benefits by assuming that the demand for employee benefits, the demand for leisure time, and the demand for market goods and services are determined simultaneously. Previous studies assumed that labor supply decisions were exogenous to the demand for employee benefits. In addition, previous studies have only modeled the separate components of employee benefits. The model presented in this paper is flexible enough to include all employee benefits.

Our results, determined using data from the April 1993 Current Population Survey, are consistent with economic theory. We find that the income elasticity of worker contributions to a pension plan is approximately 1.5, indicating that if worker income increased by 10 percent, contributions to a pension plan would increase by 15 percent. This result is consistent with previous findings. We also find that pension plan contributions are sensitive to a worker's marginal tax rate. This result is consistent with Woodbury and Huang (1991), who found that pension plan contributions would fall between 50 and 64 percent if their tax-preferred status was removed. We also find evidence of a

trade-off between wages and employee benefits and the magnitude of the effect is consistent with adjustments for a worker's marginal tax rate.

While a joint model of employee benefits and labor supply is presented in this paper, data limitations allowed us to estimate the model only for pension plan contributions. The model presented in this paper is flexible enough to incorporate all employee benefits. As more data on the composition and cost of employee benefits becomes available at the micro level, future research should be able to estimate more detailed models.

Notes

The views expressed in this paper are those of the author and should not be construed as representing the opinions or policies of the Employee Benefit Research Institute or any sponsoring agencies.

1. Those workers with single coverage may not need family coverage if there are no dependents.
2. Some of the evidence attributes the lower turnover rates to nonportability and backloading of pensions. Other studies present evidence that pension-covered jobs offer higher levels of total compensation; hence, the compensation premium accounts for the lower turnover rate.
3. Unionization and the role of collective bargaining have also been shown to affect an employer's decision to offer employee benefits (Freeman 1981; Belman and Heywood 1991).
4. This is the maximum wage rate that the individual would earn, based on their human capital and other characteristics, when no employee benefits were received.
5. The parameter p_z represents the rate of exchange between wages and employee benefits on the boundary of the employee's choice set Competition will tend to bring p_z into equality both with the price at which workers would buy benefits in the market and with the employer's marginal cost of providing the benefits (see Atrostic [1982] and Triplett [1983]).
6. Leisure refers to hours not worked that are not paid for by the employer. Paid vacation, sick leave, and other paid time away from work are included in employee benefits. For the purposes of this study, time used for home production is included as leisure time.
7 In the Rotterdam model, the demand function is estimated in the logarithm of differentials instead of in levels of differentials.
8. The income term, $\log(m/p^*)$, can be derived using the following steps. For a utility maximizing individual, total expenditures is a function of utility and prices.

The expenditure function can be inverted to give utility as a function of income and prices. We can do this for the expenditure function given in Eq. 12 and substitute the result into the budget share Eq 13 to get the budget share equations as a function of income and prices.

9. See Michalopoulos et al. (1992) for an application of this method to child-care demand.
10. Service collar workers include those employed as private household service workers, protective service workers, and other service workers.
11. The size of the match would be a better measure of employer contributions to the plan than whether a match is available. Unfortunately, data on the size of the employer match was missing for nearly a third of the sample.

References

Alpert, William H. 1983. "Manufacturing Workers Private Wage Supplements: A Simultaneous Equations Approach." *Applied Economics* 15(3): 363–378.

_____. 1987. "An Analysis of Fringe Benefits Using Time-Series Data." *Applied Economics* 19(1):1–16.

Anderson, Gordon, and Richard Blundell. 1983. "Testing Restrictions in a Flexible Dynamic Demand System: An Application to Consumers' Expenditure in Canada." *Review of Economics Studies* 50(July): 397–410.

_____. 1984. "Consumer Non-Durables in the U.K.: A Dynamic Demand System." *Economic Journal* 94(Supplement): 35–44.

Atrostic, B.K. 1982. "The Demand for Leisure and Nonpecuniary Job Characteristics." *American Economic Review* 72(3): 428–440.

Bartel, Ann P., and George J. Borjas. 1977. "Middle-Age Job Mobility: Its Determinants and Consequences." In *Men in Their Preretirement Years*, Seymour Wolfbein, ed. Philadelphia: Temple University.

Belman, Dale, and John S. Heywood. 1991. "Direct and Indirect Effects of Unionization and Government Employment on Fringe Benefit Provision." *Journal of Labor Research* 12(2): 111–122.

Berndt, E., and L. Christensen. 1972. "The Translog Function and the Substitution of Equipment, Structures, and Labor in U.S. Manufacturing, 1929-1968." *Journal of Econometrics* 1: 81–114.

Clain, Suzanne H., and Karen Leppel. 1989. "Fringe Benefits and the Effect of Tax Reform." *Applied Economics* 21(5):681–685.

Deaton, Angus, and John Muellbauer. 1980. "An Almost Ideal Demand System." *American Economic Review* 70(3): 312–326.

Employee Benefit Research Institute. 1995. *EBRI Databook on Employee Benefits*, third ed. Washington, D.C.: Employee Benefit Research Institute.

Freeman, Richard. 1981. "The Effect of Unionism on Fringe Benefits." *Industrial and Labor Relations Review* 34(4): 489–509.

Gustman, Alan L. 1990. "Pension Portability and Labor Mobility: Evidence from the Survey of Income and Program Participation." SIPP Working Paper Series, No. 9015, U.S. Department of Commerce, Bureau of the Census.

Holtmann, A.G., S.G. Ullmann, P. Fronstin, and C.F. Longino, Jr. 1994. "The Early Retirement Plans of Women and Men: An Empirical Application." *Applied Economics* 26(6): 591–602.

Ippolito, Richard A. 1986. *Pensions, Economics, and Public Policy*, Homewood, Illinois: Irwin.

Kang, Suk. 1983. *Estimation of An Almost Ideal Demand System from Panel Data*. Ph.D. Dissertation. University of Wisconsin-Madison.

Kmenta, Jan. 1986. *Elements of Econometrics*, Second ed. New York: MacMillan Publishing Company.

Maddala, G.S. 1983. *Limited-Dependent Variables and Qualitative Variables in Econometrics*, Cambridge, Massachusetts: Cambridge University Press.

McCormick, Barry, and Gordon Hughes. 1984. "The Influence of Pensions on Job Mobility." *Journal of Public Economics* 23(February/March): 183–206.

Michalopoulos, Charles, Philip K. Robins, and Irwin Garfinkel. 1992. "A Structural Model of Labor Supply and Child Care Demand." *Journal of Human Resources* 27(1): 166–203.

Mitchell, Olivia S. 1982. "Fringe Benefits and Labor Mobility." *Journal of Human Resources* 17(2): 286–298.

_____. 1983. "Fringe Benefits and the Cost of Changing Jobs." *Industrial and Labor Relations Review* 37(1): 70–78.

Mitchell, Olivia S., and Emily S. Andrews. 1981. "Scale Economies in Private Multi-Employer Pension Systems." *Industrial and Labor Relations Review* 34(4): 522–530.

Smith Robert S., and Ronald G. Ehrenberg. 1983. "Estimating Wage-Fringe Trade-Offs: Some Data Problems." In *The Measurement of Labor Cost*, Jack E. Triplett, ed. National Bureau of Economic Research, Conference on Research in Income and Wealth, Studies in Income and Wealth, Vol. 48, Chicago: University of Chicago Press, pp. 1–60.

Stone, J.R.N. 1953. *The Measurement of Consumers' Expenditure and Behaviour in the United Kingdom, 1920–1938, Vol. 1*, Cambridge.

_____. 1954. "Linear Expenditure Systems and Demand Analysis: An Application to the Pattern of British Demand." *Economic Journal* 64(September): 511–527.

Theil, Henri. 1965. "The Information Approach to Demand Analysis." *Econometrica* 33(January): 67–87.

Triplett, Jack E. 1983. "Introduction: An Essay on Labor Cost." In *The Measurement of Labor Cost*, Jack E. Triplett, ed. National Bureau of Economic Research, Conference on Research in Income and Wealth, Studies in Income and Wealth, Vol. 48, Chicago: University of Chicago Press, pp. 1–60.

Turner, Robert W. 1987. "Taxes and the Number of Fringe Benefits Received." *Journal of Public Economics* 33(1): 41–57.

U.S. Chamber of Commerce. 1995. *Employee Benefits, 1995 Edition*. Washington, D.C.: U.S. Chamber of Commerce.

Vroman, Susan, and Gerard Anderson. 1984. "The Effect of Income Taxation on the Demand for Employer-Provided Health Insurance." *Applied Economics* 16(1): 33–43.

Woodbury, Stephen A. 1983. "Substitution Between Wage and Nonwage Benefits." *American Economic Review* 73(1): 166–182.

Woodbury, Stephen A., and Douglas R. Bettinger. 1991. "The Decline of Fringe Benefit Coverage in the 1980s." In *Structural Changes in U.S. Labor Markets in the 1980s: Causes and Consequences*, Randall W. Eberts and Erica Groshen, eds. Armonk, NY: M.E. Sharpe, pp. 101–134.

Woodbury, Stephen A., and Daniel S. Hamermesh. 1992. "Taxes, Fringe Benefits, and Faculty." *Review of Economics and Statistics* 74(May): 287–296.

Woodbury, Stephen A., and Wei-Jang Huang. 1991. *The Tax Treatment of Fringe Benefits*. Kalamazoo, Michigan: W.E. Upjohn Institute for Employment Research.