January 1995

Price Sensitivity in Employee Health Care Choices: The Utility of Out-Of-Pocket Costs and Risk Aversion

Michael C. Sturman
Cornell University, mcs5@cornell.edu

John W. Boudreau
Cornell University

Price Sensitivity in Employee Health Care Choices: The Utility of Out-Of-Pocket Costs and Risk Aversion

Abstract
Using data from both company records and an insurance provider, the authors develop a direct measure of out-of-pocket costs incurred by employees choosing a health care plan. Previous studies have used characteristics of medical plans and demographic variables as proxies for OPC. By better specifying the consequences of the health care choice, the authors show how the demand for health plans is kinked in a manner consistent with risk aversion. The results suggest that using the proposed OPC measure can help practitioners and researchers better understand and predict the pattern of employee health care benefit choices.

Keywords
price, sensitivity, employ, health, benefit, security, cost, risk, utility, plan, OPC, care

Comments

CAHRS
Center for Advanced Human Resource Studies

CAHRS / Cornell University
187 Ives Hall
Ithaca, NY 14853-3901 USA
Tel. 607 255-9358
www.ilr.cornell.edu/CAHRS/

WORKING PAPER SERIES

Price Sensitivity in Employee Health Care Choices: The Utility of Out-of-Pocket Costs and Risk Aversion

Michael C. Sturman
John W. Boudreau

Working Paper 9 5 – 1 7

ilr School of Industrial and Labor Relations
Advancing the World of Work
CORNELL UNIVERSITY

Price Sensitivity In Employee Health Care Choices: The Utility of Out-Of-Pocket Costs and Risk Aversion

Michael C. Sturman and John W. Boudreau
Center for Advanced Human Resource Studies
School of Industrial and Labor Relations
Cornell University
Ithaca, New York 14853-3901

Working Paper 95-17

Abstract[1]

Using data from both company records and an insurance provider, the authors develop a direct measure of out-of-pocket costs incurred by employees choosing a health care plan. Previous studies have used characteristics of medical plans and demographic variables as proxies for OPC. By better specifying the consequences of the health care choice, the authors show how the demand for health plans is kinked in a manner consistent with risk aversion. The results suggest that using the proposed OPC measure can help practitioners and researchers better understand and predict the pattern of employee health care benefit choices.

[1] This research was in part supported by funds from the Center for Advanced Human Resource Studies. The authors thank Melissa Barringer, Olivia Mitchell, and Theresa Welbourne for their assistance and suggestions.

Flexible benefit plans, which offer employees choices among the benefits they receive from their employer, have enjoyed increasing popularity and expanding attention from scholars. Such plans are attractive to employers because they can reduce costs. Employers can contribute a fixed amount of money to pay for a basic level of employee benefits, and employees contribute additional funds if they desire expanded coverage (Employee Benefit Research Institute 1991; Davis, Giles & Feild 1988). Flexible benefits are also attractive because employees when offered choice might select benefits that best meet their individual needs, and thus experience greater satisfaction, motivation and organizational loyalty (Beam & McFadden 1988; DeCenzo & Holoviak 1990; Rosenbloom & Hallman 1981). To gain the advantages of flexible benefits, employees must be capable and motivated to make choices that benefit them. So, it is important for researchers and practitioners to understand the reasons behind choices.

Employers can provide choices for a large array of employee benefits (e.g., vacations, flexible hours, etc.), but health care benefits deserve special attention. Containing health care costs is the primary reason cited by companies for implementing flexible benefits plans (EBRI 1991), health care benefits are the most common benefit included in flexible benefit plans (EBRI 1991 1993), health care choices are frequently provided for employees even if other choices are not implemented (Hewitt 1994), and health care benefit satisfaction is a highly significant predictor of overall benefits satisfaction (Danehower & Lust 1995). Understanding health care benefit choices is particularly important to understanding employee benefit choices in general. Moreover, investigating health care benefit choices offers a unique opportunity to test labor economic and other behavioral theories, which can potentially help policy makers better predict employee choices and better design benefit plans to support employee and organizational goals.

Given their increasing importance, it is not surprising that recent research has examined the patterns of health care benefit choices (Barringer & Mitchell 1994; Feldman, Finch, Dowd & Cassou 1989; Holmer 1984; Short & Taylor 1989; Welch 1986). This research has used the theory of expected utility maximization (EUM) and has focused on how cost-related health care plan elements affect employee choices. This work has provided valuable insights into the sensitivity of employee choices to these cost-related elements. However, all prior research has used indirect measures of the true cost of benefit choices to employees, and thus has not fully specified individual utility functions. The present study introduces a more complete measure of the cost or "price" of health-care benefit choices: "out-of-pocket costs" (OPC).

Expected Utility Maximization Theory

EUM theory predicts that individuals make choices in ways that attempt to maximize their expected future utility (Friedman & Savage 1948). EUM suggests employees choose health-care benefits to maximize their expected future utility and that individual utility functions partly reflect anticipated future medical costs (Feldstein 1988; Friedman 1974; Holmer 1984; Barringer & Mitchell 1994). Specifically, employees may calculate potential future medical costs for each health care option and then chose the least-cost alternative (Friedman 1974; Marquis & Holmer 1986).

No prior study has measured anticipated OPC and its relationship to health care decisions. Rather, studies have used characteristics of health care plans and proxies for health care demand to ascertain the relationship between price and health care choice. Research has shown that plan characteristics, such as premium, deductible, and co-payment, affect health care choice decisions (Barringer & Mitchell 1994; Feldman et al. 1989; Holmer 1984; Marquis & Holmer 1986; McGuire 1981; Short & Taylor 1989; Welch 1986). However, price elasticity estimates from these studies have varied greatly. Studies have estimated health care need through aggregations of medical expense data from similar demographic groups (Friedman 1974; Marquis & Holmer 1984) or through proxies of employee health care demands (Barringer & Mitchell 1994; Feldman et al. 1989; McGuire 1981). A better specification of individual utility functions would require measuring each employee's anticipated out-of-pocket costs for each health care option to predict employee health care choices, as expressed in the following equation.

$$Pr(Choice_{i.p}) = f(OPC_{i,p} + e) \qquad (1)$$

where:

$Pr(Choice_{i,p})$ = Probability of individual i choosing Plan p

$OPC_{i,p}$ = Out-of-Pocket Costs of Plan p for individual i.

e = the error term, e = N(0,1)

Estimating Total Out-of-Pocket Costs

Studies have shown that individual health care choices are sensitive to individual plan characteristics, but this does not necessarily imply sensitivity to OPC. Total OPC depends on relationships among many health-care plan components, including the insurance premium, the co-payment, out-of-pocket caps, and the deductible, but prior research has typically focused on only one or two of these components. Total OPC also depends on the individual's use of medical care. For example, for an employee requiring dialysis, a high-premium plan that provides generous coverage for dialysis procedures may well produce lower OPC than a lower-premium plan that requires significant cost-sharing for dialysis treatments. Conversely, for employees who do not require dialysis, the high-premium plan may have the highest OPC, because these employees would be paying a high premium for coverage they never use. Thus, a complete examination of health-care plan "prices" requires integrating medical care use with the cost-related plan components.

Research has used demographic variables to approximate demand for health care. McGuire (1981) used personal and socioeconomic characteristics-salary, sex, age, race, job status and education-to control for some demand effects. Similarly, Barringer and Mitchell (1994) used demographic factors, including sex, age, and marital status. Prior studies have found some significant relationships between demographic variables and choice (Barringer & Mitchell 1994; Feldman et al. 1989; Holmer 1984; McGuire 1981; Short & Taylor 1989), but the link between medical expenses and choice in a flexible benefits environment has not been directly tested. Thus, past research has been based on the following model:

$$\Pr(\text{Choice}_{i,p}) = f(\text{Demographics}_i + \text{Plan Payments}_p + e) \qquad (2)$$

One limitation of this model is that demographic variables may reflect factors other than medical expenses, such as risk aversion. For example, older employees may choose more comprehensive coverage because it reduces risk, not because of expected higher medical costs. Another limitation is the imperfect relationship between demographics and medical expenses. A few studies do show some statistically significant relationships between demographics and medical costs. Women were found to use more medical services than men (Sindelar 1982), and married people had less need for formal medical care (Taubman & Rosen 1982). However, in a longitudinal study of 35,000 people in the Netherlands, van Vliet (1992) regressed health care expenditures on age, sex, coverage of family-doctor care,

treatment in hospital, and location of subject. The R2 of this regression was .021. Van Vliet did not include some potentially important variables (i.e., number of children), nor did he perform transformations to normalize skewed distributions which, but the results suggest that medical expenses are only imperfectly associated with demographic factors. Comparing Equations 1 and 2 reveals the implicit assumption that the combination of demographics and plan payments provide a proxy for OPC. In the present study, we will test this assumption directly.

Hypotheses

Based on prior research and the limited available empirical data, we propose the following hypotheses:

H1: Being female will be positively associated with medical expenses.

H2: Marriage will be negatively associated with medical expenses.

H3: Number of children will be positively associated with medical expenses.

H4: Age will be positively associated with medical expenses.

H5: The combination of demographic characteristics will be significantly related to total medical expenses.

Previous research has also suggested relationships between plan characteristics and OPC. Specifically, using plan characteristics such as premium and deductible to test price sensitivity implies that choosing a high-premium plan or high-deductible plan would be positively associated with OPC. However, if employees are sensitive to total costs, then we must consider the plan characteristics in conjunction with one another. When employees must choose between benefit alternatives, the relative OPC advantage of each alternative will best reflect the cost tradeoff. Individual and plan characteristics may predict plan choices when used alone, but their predictive value should be reduced when the OPC advantage of each plan choice is added to the model. Thus, we propose:

H6: The OPC advantage of each plan alternative will be significantly positively correlated with the probability of choosing that plan.

H7: The OPC advantage of each plan alternative will be more strongly associated with choice than will the vector of demographics and plan characteristics.

H8: The OPC advantage of each plan alternative will be significant and will mediate the effects of plan characteristics on employee choices.

As mentioned earlier, research has hypothesized that demographics are linked to the expected level of medical expenses; however, researchers have also noted that some demographic characteristics (e.g., age, sex, marital status, number of children) may be associated with different health-care related preferences (Barringer & Mitchell 1994; Feldman et al. 1989). Therefore,

H9: Demographic variables will be related to plan choice, even after controlling for the OPC advantage of each plan.

Actual OPC can only be measured retrospectively. One calculates the OPC that employees incurred after making their benefits choices and accumulating medical expenses. Obviously, this measure of OPC does not necessarily capture the anticipated OPC facing each employee at the time they made their choices, which is the most appropriate variable in EUM theory. Future medical costs are uncertain, and we have little evidence suggesting whether employees can accurately predict them. Additionally, a moral hazard effect may be present. Employees may change their medical expenditures depending on their plan selection. OPC may therefore be endogenous to plan choice, and thus price minimization may be a reflection of more than simply being able to predict future expenditures. Nonetheless, even a retrospective OPC measure is informative because it provides a better specification of individual utility values under "best possible" assumptions. If OPC proves to predict prior employee choices, this will suggest that employees behave as if they could predict their future medical expenses or were aware of price and altered their behavior to take advantage of their health care plan selection.

Risk and Benefit Plan Choices

Though the focus of recent research has been on the effects of price or costs on employee benefit choices, it is obvious that the concept of "utility" in EUM theory encompasses more than simply cost. "Individuals must ...choose among alternatives that differ, among other things, in the degree of risk to which the individual will be subject. The clearest examples are provided by insurance and gambling (Friedman & Savage 1948: 279)." Thus, expected cost is probably a significant, but not exclusive consideration when employees choose benefits. Risk may also play a role (Feldstein 1988).

Theoretical and empirical research suggests that risk aversion associates with health care insurance choices (Barringer & Mitchell 1994; Feldstein 1988; Friedman 1974; Friedman & Savage 1948; Marquis & Holmer 1984; Short & Taylor 1989). Risk aversion may be helpful in explaining a common, but somewhat anomalous finding in prior benefits research. Several studies (Barringer & Mitchell 1994; Holmer 1984) have found that employees with higher incomes seem inclined to choose a high-coverage FFS plan over an HMO or lower-premium FFS (Barringer & Mitchell 1994), and price-elasticity is negatively related to family income (Holmer 1984). The effect of income on choices remains, even after controlling for factors that reflect the likelihood that the employee will incur high medical expenses (e.g., age, number of children, marriage, etc.). Why would high-income individuals choose high-premium, high-protection plans? Perhaps the answer is risk aversion.

Evidence from decision theory shows that individuals exhibit significantly greater preferences for options that are framed as insurance premiums paid to avoid an uncertain future loss, than when the insurance premiums are framed as certain losses, even though the expected values of the options are the same (Bazerman 1994: 63-66). Applying these findings to health-care benefit choice, individuals might be expected to prefer benefit options offering protection against the high out-of-pocket expenses associated with serious medical problems, even when the probability of incurring such problems is low. If the desire for such protection is partially independent of the desire to minimize OPC, one would expect employees with greater disposable income to purchase "high-premium, high-protection" choices more frequently, because they can afford to indulge their preference for risk minimization, even when the expected OPC of the risk-protective choice is actually higher than the OPC of a lower-premium plan. Individuals may think, "I know I will probably never use it, but I'd like to be fully protected."

While the potential role of risk aversion in benefit choices has been noted before, prior research has not tested it directly. One problem has been that the same variables that are used as proxies for health care demand and benefit-plan costs (e.g., demographics, premium, and co-payments) also associate with individual risk aversion and the actual risk facing each individual. If a more direct measure of OPC is available, it may capture the "price" factors more completely, thus allowing the risk effects to be estimated more precisely.

Thus, including OPC as a predictor of benefits choices may better control for the cost-related elements of benefits choices, and thus allow a more precise examination of risk. Of course, risk aversion is only one of the non-cost utility attributes, and many are even more difficult to measure. Employees may prefer plans because they can continue to see their favorite physician or avoid paperwork. They may choose solely by duplicating the choices of co-workers whom they respect without explicitly considering costs or other factors. Such decision attributes are likely to be highly individual-specific, and not as easily observed as costs or risk. Still, because price and risk figure prominently in theories of benefit choice, it is useful to investigate them, recognizing that even this model will still be incomplete.

If the anticipated costs of health-care benefit options are roughly the same, individuals may choose based on the relative risk protection of the choices. Employees may consider risk protection separately from OPC. If so, then when employees anticipate roughly equal OPC levels for competing benefit plan alternatives, they will opt for the choice that provides the greater perceived protection against serious medical calamities. Thus, benefit choices would be more sensitive to OPC for benefit options that afford less protection against serious medical calamities, and vice versa. Figure 1 shows the functional form of this anticipated relationship.

Figure 1
Hypothesized Relationship Between Regret and Plan choice

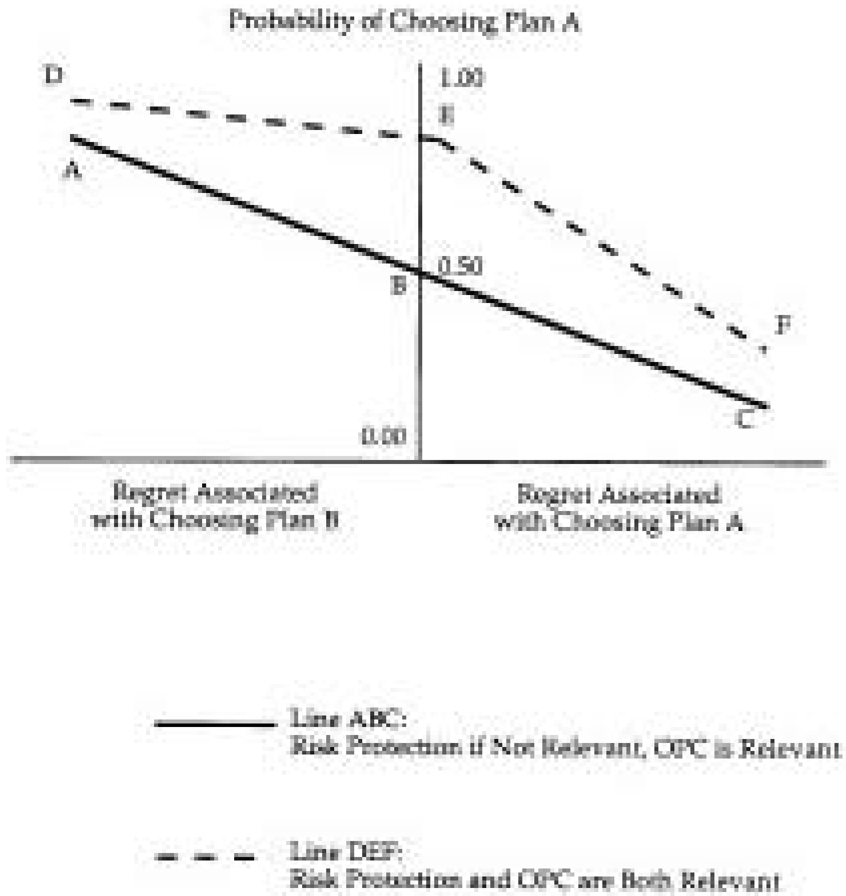


Figure 1 depicts a hypothetical situation involving two benefit plans. We assume that Plan A carries a higher premium, but also provides superior protection against the costs of serious medical calamities, while Plan B carries a lower premium, but provides less protection against the costs of serious medical calamities. The vertical axis depicts the probability of choosing the high-premium plan (Plan A). To allow the choice functions for both plans to be mapped on the same graph, the horizontal axis represents a variable called "Regret." Regret captures the OPC advantage of one plan choice versus another. It is simply the financial consequence of making a non-cost-optimal choice. For any individual with known medical costs, it is possible to calculate what their OPC would be for each health plan option. For each option, and for each individual, Regret is defined as the difference between the OPC of that option, less the OPC of the lowest-cost alternative. Thus, Regret is zero if a particular option is the lowest-cost alternative. If an option is not the lowest-cost alternative, Regret is positive, and Regret increases as the difference between the OPC of a particular choice and the OPC of the lowest-cost choice increases. In the two-option case, Regret represents the "cost" of choosing one option over the other.

In Figure 1, the zero point on the X-axis represents zero Regret for both options. Points to the left of zero represent situations in which choosing Plan A affords increasingly greater advantage in minimizing OPC (i.e., $Regret_A = 0$, $Regret_B > 0$). Points to the right of zero represent situations in which choosing Plan B affords increasingly greater advantage in minimizing OPC (i.e., $Regret_A > 0$, $Regret_B = 0$). Figure 1 depicts two potential "utility functions," reflecting different combinations of uncertainty and taste for risk protection. Consider the situation in which risk protection is irrelevant (Line ABC in Figure 1). Under these conditions, choices will be governed largely by cost differences, so one should see the probability of choosing Plan A increase as its OPC advantage increases to Point A in Figure 1, and vice versa as the OPC advantage of Plan B increases to Point C in Figure 1. The line intersects the vertical axis at .50 (Point B in Figure 1) because at zero Regret the two plans provide identical OPC and the choice is random.

Theory on the demand for health insurance, though, suggests that economic variables, plan characteristics, income, risk preferences, and the distribution of potential losses affect this demand (Feldstein 1988). When both OPC and risk protection are relevant utility attributes, the choice function will resemble Line DEF in Figure 1. The probability of choosing Plan A is still high when Plan A produces much lower OPC (Point D in Figure 1). However, as the OPC advantage of Plan A decreases to zero, the probability of choosing Plan A decreases only slightly, and the line intersects the zero point at a much higher level. This is because although Plan B becomes more attractive as one moves closer to the zero point, Plan A maintains an advantage due to its superior risk protection. In fact, we would expect the probability of choosing Plan A to remain high even when Plan B has a small OPC advantage (slightly to the right of the zero point), because risk-averse employees will accept a small OPC "penalty" to have the risk protection of Plan A. At some point, as the OPC advantage of Plan B becomes greater, we should see increased sensitivity to the OPC difference, and the choice function should drop more steeply as the Regret associated with choosing Plan A increases (beyond Point E in Figure 1). Of course the exact locations of Points D, E and F for any particular sample of employees cannot be precisely predicted. They will depend on the magnitude of the OPC differences between the plans, the risk aversion of the employees, and the accuracy with which employees can anticipate their future medical costs. Still, if the effect is reasonably strong, it should be possible to detect the non-linearity described above. Thus, H10: The choice function will resemble line DEF in Figure 1, more than it will resemble line ABC.

Setting and Sample

This study examines benefit choices among employees of a medium-sized manufacturing firm. The organization had two manufacturing plants, one of which offered a choice of medical plans and employed 309 people. This choice was introduced in 1991.

Prior to 1991, all employees were enrolled in a single medical plan, here called Plan A. In 1991, employees at this particular plant were offered a new choice, here called Plan B. From the company archival data base, information from 1992 was available on employee benefit choices, employee age, marital status, and number of children, for employees in the plant that offered the choice. In addition, matched data on medical procedure charges for each employee were collected from the insurance company that administered the health care plan. A total of 287 cases had complete data on all variables. The average age of the sample was 36 years, 63% were male, 82% were married, and employees had an average of 1.9 children (maximum of 7). A summary of the two health insurance plans offered appears in Table 1. The plans differ with regard to the treatment of hospitalization and in-hospital treatments, premiums, deductibles, and out-of-pocket caps.

Table 1
Summary of Health Care Plans

	Plan A			Plan B		
	EE Only	EE + 1 Dependent	EE + >1 Dependent	EE Only	EE + 1 Dependent	EE + >1 Dependent
Premium	$231.36	$461.28	$530.40	$79.56	$80.64	$170.52
Deductible	$100	$200	$200	$200	$400	$400
Co-Payment Rate on Non-Hospital Charges	20%	20%	20%	20%	20%	20%
Co-Payment Rate on Hospital-Related Charges	0%	0%	0%	20%	20%	20%
Out-of-Pocket Cap	$1100	$2200	$2200	$1200	$2400	$2400

Both plans covered non-hospital medical claims in the same way, in that the company paid 80% of such expenses beyond a deductible, and 100% once the out-of-pocket maximum had been reached. Plan A covered the full cost of up to 120 days of hospitalization and in-hospital treatments. Under Plan B, hospital claims were treated similarly to non-hospital medical claims, as described above. By paying the higher premium for Plan A, an employee purchased a lower deductible, plus protection against the chance of paying 20% of hospital-related costs beyond the deductible, up to the out-of-pocket maximum. In the most extreme case, if an employee only incurred hospital expenses and incurred enough to reach the out-of-pocket maximum under Plan B, Plan A would produce an OPC of $0, excluding the premium, while choosing Plan B would produce an OPC of $2400, excluding the premium. In sum, Plan A afforded more protection against the costs associated with serious medical conditions requiring lengthy hospitalization, but at a higher premium. For each employee, medical claims data, benefit plan characteristics, and choices were used to calculate total medical expenses and all OPC and Regret measures.

The similarities between the two choices provided a unique advantage for the present study. The plans differed only in their premium, deductible and payment schedule. Potentially confounding differences in access to providers, claims procedures, communication channels, etc. were controlled. Thus, observed choice patterns are more easily interpreted within the theoretical framework proposed here. In a very real sense, this situation offered a more controlled "field experiment" than prior research in which many of these factors were confounded with differences in cost-related plan elements. Moreover, the purity of the choice situation is not unusual (EBRI 1991 1993; Hewitt 1994; U.S. BLS 1990), so findings are likely to generalize to many other situations.

Results

Table 2 contains the correlation matrix for all variables used in this study. The first five rows/columns reflect the demographic characteristics. The sixth row reflects the natural logarithm of the total medical expenses incurred by the employee. The seventh row reflects the employee's choice (Plan A =1; Plan B = 0). The next two rows reflect the actual OPC and Regret incurred by the employee. Rows 10 through 13 report the OPC that would have been incurred if the employee chose Plan A, the OPC if choosing Plan B, the Regret if choosing Plan A, and the Regret if choosing Plan B. Row 14 is the premium of the chosen plan, and row 15 reflects the deductible of the chosen plan. The remaining four rows reflect the premiums and deductibles that would have been incurred if choosing each plan.

Table 2
Correlations

Variable	Mean	SD	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1. Sex	0.37	0.48	1.00																		
2. Marital Status	0.82	0.38	-0.06	1.00																	
3. # Children	1.85	1.54	0.03	0.45	1.00																
4. Age	35.7	9.08	-0.06	0.25	0.08	1.00															
5. Age^2	1357	725	-0.04	0.21	0.01	0.99	1.00														
6. ln Total Med Ex	6.49	2.39	0.07	0.34	0.28	0.08	0.08	1.00													
7. Choice	0.78	0.41	-0.11	0.04	0.05	0.01	0.02	0.25	1.00												
8. OPC	870	561	0.04	0.36	0.31	0.11	0.10	0.76	0.23	1.00											
9. Regret	93	126	-0.06	0.11	-0.05	0.03	0.03	-0.31	0.34	0.02	1.00										
10. OPC_A	920	546	0.06	0.40	0.31	0.11	0.11	0.72	0.07	0.98	-0.06	1.00									
11. OPC_B	930	756	0.00	0.32	0.32	0.04	0.04	0.81	0.22	0.87	-0.28	0.85	1.00								
12. $Regret_A$	143	130	0.00	0.16	-0.07	0.03	0.02	-0.53	-0.39	-0.18	0.59	-0.08	-0.45	1.00							
13. $Regret_B$	153	321	-0.08	0.14	0.19	-0.08	-0.07	0.48	0.23	0.32	-0.32	0.28	0.72	-0.51	1.00						
14. Premium	405	168	-0.12	0.49	0.38	0.12	0.10	0.38	0.83	0.41	0.33	0.28	0.37	-0.28	0.29	1.00					
15. Deductible	255	88	0.08	0.42	0.21	0.10	0.07	-0.03	-0.84	0.00	-0.24	0.16	-0.02	0.43	-0.14	-0.48	1.00				
16. $Premium_A$	477	106	-0.04	0.89	0.61	0.19	0.14	0.37	0.04	0.41	0.09	0.43	0.36	0.12	0.16	0.55	0.46	1.00			
17. $Deductible_A$	185	36	-0.04	0.90	0.50	0.24	0.20	0.36	0.04	0.41	0.12	0.43	0.34	0.16	0.14	0.53	0.48	0.98	1.00		
18. $Premium_B$	145	41	-0.02	0.65	0.73	0.01	-0.05	0.31	0.03	0.33	-0.02	0.34	0.33	-0.03	0.19	0.47	0.32	0.82	0.68	1.00	
19. $Deductible_B$	370	72	-0.04	0.90	0.50	0.24	0.20	0.36	0.04	0.41	0.12	0.43	0.34	0.16	0.14	0.53	0.48	0.98	1.00	0.68	1.00

N = 287.

Sex: male = 0, female = 1; Marital Status, single = 0, married = 1; Choice, Plan B = 0, Plan A = 1

Correlations greater than .10 are significant at p<0.1, correlations greater than .12 are significant at p<.05, and correlations greater than .15 are significant at p<.01

Before discussing the specific hypotheses, certain correlation patterns should be explained. There are a large number of quite large correlations that might at first cause concern about multicollinearity. However, many of these correlations are simply a function of the way benefits are constructed, or of the OPC calculation. For example, marital status and number of children (columns 2 and 3) are highly correlated with all variables in rows 14 through 19, which reflect the cost elements of the benefit choices. This is expected, as the premiums and deductibles explicitly differ with the number of dependents. Total medical expenses (column 6) shows high correlations with measures of OPC, Regret and plan cost characteristics, which is generally expected due to the direct relationship between plan cost elements and these cost-related measures. OPC (column 8) correlates with measures of costs and Regret because it is functionally calculated from these components.

The correlations between OPC, OPC_A, and OPC_B should be noted. Because the plans reimbursed non-hospital related medical expense equally, for many employees the OPC of each plan only differed with regard to the premium. Thus, for many cases the two values covary perfectly. This explains the large correlation between the OPC values associated with each plan. Because actual OPC is equal to the OPC of the chosen plan, and because most employees chose Plan A, OPC and OPCA are almost perfectly correlated. However, because the OPC advantage of a plan (i.e., Regret) is a function of the difference in OPC values, Regret does not have this level of correlation with the OPC values. Because Regret will be used in the subsequent analyses, we remove the danger of collinearity problems that we might face had we used incurred OPC.

Finally, variables in rows 10 through 19 exhibit significant associations because they reflect costs or cost advantages of the benefit plans. It is interesting to note, however, that in most cases the correlations are much smaller than 1.0, suggesting that there are non-trivial relationships between cost-related plan characteristics and the actual costs experienced by employees. We now explore these relationships within the framework of the hypotheses.

Predicting Costs

The first four hypotheses can be examined using the correlations in columns one through six, in Table 2. Contrary to Hl and H4, being female and being older were not associated with higher medical expenses (Row 6). Apparently, in this sample, gender and age were imperfect univariate proxies for medical costs. Also, contrary to H2, being married was positively correlated with medical expenses. Hypothesis H3 was supported: having more children was positively related to medical expenses.

The test of H5 largely contradicts van Vliet's (1992) findings and provides greater support for the initial hypotheses. The results of the regression of total medical expenses on sex, marital status, number of children, age, and age^2 are shown in Table 3. The model explains significantly more variance in medical expense (R^2 = .16; Adj. R^2 = .14) than were reported in van Vliet's (1992) study.[2] Additionally, marital status, number of children, age, and age^2 were all significant predictors (in the predicted directions), thus providing support for H2, H3, and H4. As predicted, married people have lower medical expenses, but only after controlling for the effects of number of children and age. Thus, contrary to the findings from the correlation analyses reported above, H2 is supported. Second, if the age-squared term was not used, then the age variable does not appear significant. In sum, some demographic variables had significant relationships with medical expenses; however, a significant portion of medical expenses remains unexplained.

Table 3
Medical Expenses as a Function of Demographic Characteristics

Variable	β (t-value)
Sex	-0.17
(0 = Male; 1 = Female)	(1.26)
Marital Status	-0.83***
(0 = Single; 1 = Married)	(4.19)
#Children	0.34***
	(3.25)
Age	-0.21 **
	(2.12)
Age^2	0.0027**
	(2.17)
F-Statistic	10.36***
R^2	.16
Adjusted R^2	.14

Note: Dependent variable is log of total medical expenses
*p<.10;**p<.05;***p<.01

Correlations in Table 2 show that the premium of the chosen plan was significantly related to incurred OPC and positively related to Regret. However, the deductible was not related to OPC. Deductible was negatively related to Regret. In other words, those who chose

[2] A possible explanation for the discrepancy between these results and van Vliet's (1992) findings is that the natural logarithm was used to transform the medical expense data to make the distribution more normal. Had this transformation not been performed, the R^2 would have been only .03 and only the variable number of children would have appeared related to total medical expenses.

Plan B, which had a larger deductible, ended up with lower levels of Regret on average. For many employees, the premium advantage of Plan B was greater than the deductible disadvantage. This suggests that interdependencies between the plan characteristics are important when exploring choice.

Predicting Choice

Hypothesis H6 proposed that the likelihood of employees choosing a particular plan would be significantly positively correlated with the OPC advantage of that choice. As shown in Figure 1 and discussed earlier, Regret captures the relative OPC advantage of each plan. Recall that $Regret_A$ equals zero when choosing Plan A produces the lowest OPC, and increases as the OPC advantage of Plan B increases. The converse relationship holds for Regret.

Table 2 supports H6 in that the correlation between choosing Plan A (Column 7) is significant and negative for $Regret_A$ (-0.39), and significant and positive for $Regret_B$ (0.23). Interestingly, H6 is only partially supported when one examines only the OPC of each plan, rather than their relative OPC advantage. Table 2 shows that the correlations between the probability of choosing Plan A and OPC_A and OPC_B were 0.07 and 0.22, respectively. The correlation between OPC_A and choosing Plan A was not statistically significant. However, the correlation between OPC_B and choosing Plan A was significant and positive as predicted, suggesting that as Plan B became more costly, employees were significantly more likely to choose Plan A. This finding is consistent with the pattern proposed in Figure 1, and reinforces the value of using OPC, and the relative OPC advantage of competing choices, to measure benefit plan costs.

Model 1 in Table 4 regresses plan choice on demographic characteristics and the premiums associated with Plan A and Plan B.[3] Contrary to prior research, the model does not significantly predict the probability of choosing Plan A, the high-premium plan (x^2 = 8.24; df = 7; n.s.). Plan premiums were not related to choosing the high-premium plan.[4] Of the demographic variables, sex was significantly related to choice, and age and age2 were marginally related to choice. In the absence of an alternative measure of plan costs, this finding might lead to the conclusion that employees were not sensitive to premiums or deductibles. An alternative

[3] In this two-choice situation, the Premium and Deductible are collinear. So, we used the Premium as the plan characteristic in the regressions, because it has been used most often in prior research.

[4] Results were also no different when the regression was run using the variables A-Premium and A-Deductible, the variables B-Premium and B-Deductible, or the differences (A-Premium minus B-Premium), and (A-Deductible minus B-Deductible).

interpretation is that individual plan characteristics affect choice as they interact with other plan characteristics and individual health care needs. Using OPC will allow us to examine this more thoroughly.

Table 4

Determinants of Health Plan Choice: Logit Models

(Probability of Selecting Health Care Plan A as Reference Category)

	Model 1	Model 2	Model 3
Sex	0.33**	-	0.35**
(0 = Male; 1 = Female)	(2.18)		(2.11)
Married	-0.17	-	-0.37
(0 = Single; 1 = Married)	(0.40)		(0.73)
Number of Children	0.23	-	0.17
	(1.41)	(0.96)	
	(1.42)		
Age	-0.22*	-	0.13
	(1.71)		(0.99)
Age^2	0.0028*	-	0.0016
	(1.69)		(0.93)
Plan A Premium	-0.00091	-	0.0040
	(0.22)		(0.79)
Plan B Premium	-0.0024	-	-0.015
	(0.31)		(1.65)*
$Regret_A$	-	-0.0058***	-0.0081 ***
		(4.35)	(4.85)
$Regret_B$	-	0.0029	0.0014
		(1.63)	(0.94)
-Log Likelihood	146.93	126.97	121.29
Pseduo R^2	.03	.16	.20

*p<.10;**p<.05; ***p<.01

Note: N = 287. Reduced model has a -Log Likelihood of 151.05. Models 2 and 3 are more predictive than the reduced model and Model 1. Models 3 is not more predictive than Model 2.

Model 2 in Table 4 begins to test the predictive power of OPC. A logistic regression was used to model plan choice (Plan A = 1) on the OPC advantage of each plan (i.e., $Regret_A$ and $Regret_B$). $Regret_A$ is highly significant ($p < .0001$) and in the predicted direction. Consistent with Hypothesis H8, the probability of Choosing Plan A decreases as $Regret_A$ increases. $Regret_B$ is a marginally significant predictor of plan choice ($t=1.63$; $p = .1032$), which somewhat supports hypothesis H8 and is consistent with the pattern of line DEF in Figure 1.

To test hypothesis H7, these two models were compared. A Chi-square test reveals that Model 2 is more predictive than Model 1 ($x2 = 39.92$; $df = 5$; $p < .0001$), thus supporting the predictions of hypothesis H9. Using Pseudo-R^2 values to illustrate, Model 1 has an R^2 of .03, while Model 2 has an R^2 of .16. These results further support H7.

Hypothesis H8 proposed that OPC captures the cost implications facing employees better than plan characteristics, and H9 proposed that demographic variables would still have an impact even after controlling for the effects of cost. If these hypotheses hold, the relationship between the Plan A premium and Plan B premium should not be significant after controlling for the linear effects of the OPC advantage of each choice; however, we expect demographics to be significant predictors of choice. Model 3 in Table 4 shows the estimated logistic regression of choosing Plan A on the various explanatory variables. The results provide mixed support for these hypotheses.

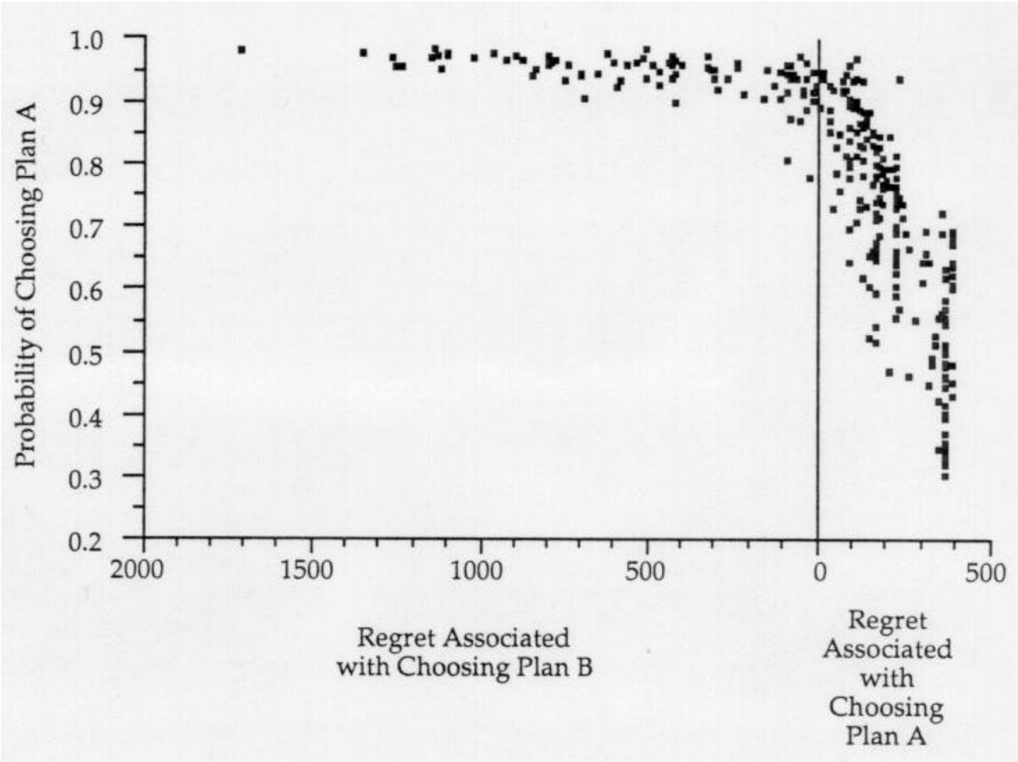
Model 3 shows that $Regret_A$ is a highly significant predictor of choice. The coefficient for $Regret_B$ is in the expected direction, but it is not significant. Overall, Model 3 is not more predictive than Model 2 ($x^2 = 11.35$; $df = 7$; n.s.).

The extent that Regret mediates the effects of plan premiums is unclear. Plan premiums were not significant predictors in Model 1, so interpreting the effect of controlling for the OPC advantage of each plan is questionable. Nonetheless, the OPC advantage of Plan A ($Regret_A$) remains significant.

The results from Model 3 support hypothesis H9. After controlling for the OPC advantage of each plan, sex was still a significant predictor of choice. Interestingly, sex is the only demographic variable that was significant in Model 3, yet was the only variable not significant for the prediction of medical expenses (Table 3).

To test hypothesis H10, we constructed the plot shown in Figure 2, which depicts the same relationships hypothesized in Figure 1. The plotted points in Figure 2 were constructed from the predicted probabilities of choosing Plan A as computed from Model 3. Thus, controlling for premium levels, demographic characteristics, and the OPC advantage of each plan, the non-linear pattern of predicted choice probabilities closely resembles line DEF in Figure 1. It appears that for this sample, price-elasticity depends on whether the price difference favors Plan A, which provides higher risk protection, or Plan B. When Plan A was the low-cost choices ($Regret_B$ greater than zero), price elasticity equaled -0.03. In contrast, when Plan B was the low-cost choice ($Regret_A$ greater than zero), price elasticity was -0.50.[5] Although the price elasticity values vary depending on where along the Regret function price-sensitivity is measured, these values do not differ greatly from the range of values reported in other studies (e.g., Barringer & Mitchell 1994; Holmer 1984; Marquis & Holmer 1986; Short & Taylor 1989). Choices appear to be more sensitive to OPC differences when the OPC difference favors the less protective Plan B. When the two plans are approximately equivalent in their cost implications, employees overwhelmingly seem to prefer the more protective plan.

Figure 2
Relationship Between Regret and Computed Probability of Plan Choice



[5] Elasticity of the probability of selecting health care plan A with respect to Regret equals B*X*(1-P), where P is the probability of choosing Plan A and is predicted here at the means of the independent variables for those with Regret greater than 0 for each price elasticity computation. For the first estimate, P equaled 0.96, and the average Regret (X) was 498. For the second estimate, P equaled 0.70, and average Regret (X) was 206.

Discussion and Conclusions

This study proposed a more direct measure of benefit costs, OPC, to explain and predict employee health-care benefit choices. OPC and Regret were designed to better specify health care costs to allow a greater understanding of the role that price sensitivity plays in health-care benefit decisions. In the present sample of employees making actual benefit decisions, Regret was significantly related to employee choices, and provided additional explanatory power beyond an array of individual and plan characteristics typical of those used in prior research. The results were generally consistent with the hypotheses. Moreover, adding Regret proved to enhance not only predictions of employee choice, but controlled for cost-related factors in a way that permitted direct tests of propositions regarding risk aversion. The relationship between employee choices and Regret in Figures 1 and 2 suggests that such multi-dimensional utility functions may be typical, and OPC may prove useful in isolating them.

OPC has not previously been measured and incorporated into studies of benefits decisions. Thus, one contribution of the present study is to explain and draw attention to this measure. Though the data required to calculate OPC often reside in at least two organizations (in this case, the insurance administrator and the company), the construction of OPC is straightforward and informative. We hope that one result of this study will motivate others to apply these measurement techniques, and to refine and embellish the OPC measure. Other fruitful areas of future research include replicating these methods in more complex environments and relating the quality of employee decisions to outcomes such as benefits satisfaction. Additionally, future research could use this measure to more directly explore the moral hazard effect associated with health care choices in benefits decision making.

An interesting practical implication of the present findings involves the interaction between risk aversion and cost sensitivity. Changes in cost-related plan attributes may have very different effects, depending on the associated risk protection offered by the benefits choices. In the present study, for example, increases in plan premiums, co-payments or deductibles have relatively insignificant effects on plan choice for those employees falling to the left of the zero point in Figure 2. It is only when such changes position employees in the region to the right of the zero point that cost elasticity becomes a factor. For example, increasing the premium of Plan A by $100 would only reduce the probability of selecting Plan A by about 4% for those who previously had Regret_B between $101 and $200; however, for those who had Regret_B between $1 and 100, the premium increase would be expected to reduce the probability of selecting Plan A by 12%.

The present analysis suggests a more precise method of forecasting changes in employee benefit choices as a result of plan characteristic changes. This method explicitly considers not only the plan characteristics and the demographics of the employee population, but how those factors interact to produce OPC, and the role of risk protection. The present study suggests that research on employee benefit choices can be enhanced by using OPC to measure incurred OPC directly. We have provided an illustration showing how OPC can be applied to an actual situation. It is our hope that future research and practice will be more precise through the use of this new method.

References

Barringer, Melissa. W. & Olivia S. Mitchell. 1994. "Workers' Preferences Among Company-Provided Health Insurance Plans." Industrial and Labor Relations Review, Vol. 48, No. 1, pp. 141-52.

Bazerman, Max H. 1994. judgment in Managerial Decision Making. New York: John Wiley & Sons.

Beam, B. T. Jr., and J. J. McFadden. 1988. Employee Benefits. Illinois: Irwin.

Danehower, Carol, and John A. Lust. (1995, in press). "Understanding and Measuring Employee Benefit Satisfaction." Benefits Quarterly, forthcoming.

Davis, Kermit. R., William F. Giles, and Hubert S. Feild. 1988. "Opting for Benefits: Do Job-Hunting College Seniors Envision More Money or More Benefits? Personnel Administrator, Vol. 33, (August), pp. 62-66.

DeCenzo, D. A., and S. J. Holoviak. 1990. Employee Benefits. New Jersey: Prentice Hall.

Employee Benefit Research Institute. 1991. "Flexible Benefits Plans and Changing Demographics." EBRI Issue Brief, 113.

Employee Benefit Research Institute. 1993. "Flexible Benefits, Choice, and Work Force Diversity." EBRI Issue Brief, 139.

Feldman, Roger, Michael Finch, Bryan Dowd, and Steven Cassou. 1989. "The Demand For Employment-Based Health Insurance Plans." Journal of Human Resources, Vol. 24, No. 1, pp. 115-42.

Feldstein, Paul J. 1988. Health Care Economics, New York: John Wiley & Sons.

Friedman, Bernard. 1974. "Risk Aversion and Consumer Choice of Health Insurance Option." Review of Economics and Statistics, Vol. 56, No. 2, pp. 209-14.

Friedman, Milton, and L. J. Savage. 1948. "The Utility Analysis of Choices Involving Risk." Journal of Political Economy Vol. 56, No. 4, pp. 279-304.

Hewitt Associates. 1994. Salaried Employee Benefits Provided by Major U.S. Employers in 1993. Lincolnshire, IL: Hewitt Associates.

Holmer, Martin. 1984. "Tax Policy and the Demand for Health Insurance." Journal of Health Economics, Vol. 3, pp. 203-21.

Marquis, M. Susan, and Martin R. Holmer. 1986. "Choice Under Uncertainty and the Demand for Health Insurance." The Rand Corporation, N-2516-HHS.

McGuire, Thomas G. 1981. "Price and Membership in a Prepaid Group Medical Practice." Medical Care, Vol. 19, No. 2, pp. 172-83.

Rosenbloom, J. S., and G. V. Hallman. 1981. Employee Benefit Planning. New Jersey: Prentice-Hall.

Short, Pamela Farley, and Amy K. Taylor. 1989. "Premiums, Benefits, and Employee Choices of Health Insurance Options." Journal of Health Economics, Vol. 8, pp. 293-311.

Sindelar, Jody L. 1982. "Differential Use of Medical Care By Sex. Journal of Political Economy, Vol. 90, No. 5, pp. 1003-19.

Taubman, Paul J., and Sherwin Rosen. 1982. "Healthiness, Education, and Marital Status." In Victor R. Fuchs, ed., Economic Aspects of Health. Chicago: University of Chicago Press, pp. 121-40.

U. S. Department of Labor. Bureau of Labor Statistics. 1990. Employee Benefits in Medium and Large Firms, 1989. Washington, DC: GPO.

Van Vliet, Rene C. J. A. 1992. "Predictability of Individual Health Care Expenditures." Journal of Risk and Insurance. Vol. 59, No. 3, pp. 443-60.

Welch, W. P. 1986. "The Elasticity of Demand for Health Maintenance Organizations." Journal of Human Resources, Vol. 21, No. 2, pp. 252-66.