

TAXATION AND THE ISSUE OF EQUITY IN PERCEIVED SACRIFICE

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Tax reform, the incidence of taxation, and any implied restructuring of the rates at which individuals are taxed are recurrent issues which public policymakers must address. The advocacy of reform or restructuring may be couched in various terms or approaches, but ultimately it must be concerned with the incidence of taxation and the rate of taxation in relation to income level. Arguments for changes in a tax structure may range from unsubstantiated value judgments to comparisons of taxes paid in relation to income but, regardless of the justification, each proposal is based on implicit or explicit evaluation criteria. An approach based solely on a comparison of tax paid in relation to income does not address one of the central issues—the sacrifice which the taxpayer perceives as he/she gives up income.

Since the development of a social indicator scale for anomie by Srole [13] which evinced a relationship between the indicator scale and socioeconomic level, social scientists have developed and reported the relationships among social indicators of well-being, income, and various socioeconomic measures [3, 4, 5, 10]. Given that individuals with different levels of income attach different values to an additional dollar of income, the amount of tax paid must vary to provide equality of sacrifice which the individual perceives as a result of the tax paid. It seems reasonable to assume that consistency in the sacrifice perceived as a result of taxes paid would ensure individual satisfaction with the personal tax system.

A conceptualization of equity in taxation and of the incidence of taxation is attributed, in principle if not in fact, to the general public by policymakers. During their first course in the principles of economics, students are schooled in these concepts, and alternative principles of sacrifice within the tax system are stated and formalized [11, p. 164]; however, individual conceptions of the equity of the tax structure and its functioning must at some

point be founded on assumptions, implicit or explicit, about individual well-being. The assumptions are that total individual well-being results from the aggregation of the satisfaction derived from the consumption of all goods and services and thus is related at least in part to income, and that at some level of consumption the law of diminishing utility will hold for any particular good or service consumed. Hence, taxation becomes an issue of income and goods or services foregone.

If the concept of equity of perceived sacrifice from taxation and the economic concepts of utility and diminishing marginal utility are to be integrated, a conceptual framework must be established which will allow this synthesis. Harper and Tweeten [7, p. 1000-1001] advanced a quality of life index (QLI) as a public policy tool which with refinement would allow the resolution of equity questions arising from proposed changes in the determinants of individual quality of life. The QLI then would become an evaluation framework for alternative policies which would affect the individual's socioeconomic environment. Focusing on an equity dimension of the tax structure within a QLI framework, the following analysis evaluates the application of the QLI concept to structural issues of personal taxation. A representative personal tax structure is examined within the context of a QLI.

THE ANALYTIC STRUCTURE

The Theoretical Model

The nuclear QLI model was judged *a priori* to be of the following form:

$$QLI_i = f(Y_i^*, ED_i, AGE_i, N_i, L_i, R_i, S_i, \\ PERFARMY_i, NW_i, QTR, \\ T_i, E_i)$$

where

Y^* = the expected net quarterly
income of the family unit

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ED = the educational level of the individual [18]
 AGE = the age of the individual [9]
 N = the number of individuals in the family unit [12]
 L = the geographic location of the residence of the family unit
 R = the race of the individual [14]
 S = the sex of the individual
 PERFARMY = farm income/total income ratio of the family unit [14]
 NW = the net worth of the family unit [1]
 QTR = a time trend variable
 T = the negative income tax treatment of the family unit (the experimental transfer payment received by the family unit)
 E = the error term
 i = a subscript representing the i^{th} individual.

Four algebraic forms were considered initially as theoretically acceptable for the QLI relationship: logarithm, square root, quadratic, and cubic. The possibility of interactions among the independent variables also was thought to be theoretically appropriate for consideration in the model.

The Analytic Model

The Rural Income Maintenance Experiment (RIME) [2] served as the data base for the evaluation of the theoretical QLI model and the development of the empirical model. The RIME, conducted in Iowa and North Carolina during 1969-72, was a major effort "to test the behavioral consequences of a universal income-condition cash transfer program" [2, p. 1]. It focused on the rural population and followed closely the New Jersey Income-Maintenance Experiment which had as its objective the "carefully controlled, scientific field test of the effects of eight different negative income tax plans [16, 1-2].

The quality of life index is conceptualized as a relative measure of individual perceived quality of life, and it is the result of a weighted summation of three sociopsychological subindices—alienation (A), worry (W), and self-esteem (SE)—which were constructed from established social indicator scales. Derived from the RIME data base, the QLI model represents a sample population which is rural and includes two geographic regions of the economy. Because of the nature of the experiment, the data do not include a representative

number of high income individuals.

The *a priori* grouping of the scales into subindices was verified by principal axis factor analysis. Factor analysis then was used to identify factors (hypothetical constructs) which explained the variation observed within the individual scales. Individual scale values were calculated by the following functional relationship.

$$M_i = \sum_{k=1}^m E_k \left(\sum_{j=1}^n f_{kj} R_{ij} \right)$$

where

M_i = the scale value for the i^{th} individual
 m = the number of factors extracted for the scale
 n = the number of items in the j^{th} scale
 E_k = the eigenvalue for the k^{th} factor
 f_{kj} = the factor loading for the j^{th} item on the k^{th} factor
 R_{ij} = the standardized response of the i^{th} individual to the j^{th} item on the scale.

The QLI subindices were then calculated as

$$A_i = A_n i + P_i + N A_i$$

and

$$SE_i = SS_i + LS_i + PA_i$$

where

A_n = the anomie scale ($m = 1$)
 P = the powerlessness scale ($m = 1$)
 NA = the negative affect scale ($m = 2$)
 SS = the self-satisfaction scale ($m = 2$)
 LS = the life satisfaction scale ($m = 2$)
 PA = the positive affect scale ($m = 1$), all for the i^{th} individual

The worry subindex (W) consisted of only one scale with $m = 1$.

The final step of the QLI construction was the weighted summation of the three subindices. QLI_i was calculated as

$$QLI_i = E_a A_i + E_w W_i + E_{se} SE_i$$

where E_a , E_w , and E_{se} are the respective eigenvalues obtained from the analysis that verified the grouping of the scales into subindices. By use of this framework, empirical QLI values were calculated for each individual. These QLI_i then were taken as the dependent variable in a regression analysis of alternative empirical forms for the theoretical QLI model outlined above.

the range of income considered in this analysis (see Table 3).

TABLE 3. FEDERAL INCOME TAX AND ACCOMPANYING QLI CHANGES^a

Level of Income	Tax From Schedule ^b	Marginal Tax	Marginal Tax Rate ^c	QLI _{T_x}	Marginal Change in QLI _{T_x}
-----DOLLARS-----					
<1,000	0		0	0	0
1,000-1,999	0		0	0	0
2,000-2,999	0		0	0	0
3,000-3,999	0		0	0	0
4,000-4,999	0		0	0	0
5,000-5,999	81	81	.081	-0.34	-.34
6,000-6,999	226	145	.145	-0.92	-.58
7,000-7,999	382	156	.156	-1.51	-.59
8,000-8,999	548	166	.166	-2.11	-.60
9,000-9,999	729	181	.181	-2.72	-.61
10,000-10,999	919	190	.190	-3.33	-.61
11,000-11,999	1,109	190	.190	-3.91	-.58
12,000-12,999	1,281	172	.172	-4.37	-.46
13,000-13,999	1,450	169	.169	-4.80	-.43
14,000-14,999	1,635	185	.185	-5.23	-.43

^aTax schedule used in the analysis assumes a taxpayer filing jointly with three dependents.

^bU.S. Department of the Treasury - Internal Revenue Service, "1975 Federal Income Tax Form," U.S. Government Printing Office, Washington, D.C., 1975.

^cMarginal tax rate = tax on extra dollar of income.

An evaluation of the federal income tax rates based on the QLI framework also shows an inconsistency within the marginal change in QLI due to the tax. The reduction in QLI resulting from a tax (QLI_{T_x}) was calculated as:

$$QLI_{T_x} = [b_y(Y^* - T_x) - b_{y^2}(Y^* - T_x)^2] - (b_y Y^* - b_{y^2} Y^{*2})$$

where b_y and b_{y^2} are the coefficients for the respective income components, Y^* and Y^{*2} are quarterly income and quarterly income squared respectively, and T_x is the tax which is subtracted from quarterly income.

QLI_{T_x} resulting from the federal income tax is found to be progressive, but the marginal change in QLI_{T_x} fluctuates over the range of incomes considered. Given the QLI relationship used in this analysis and the range of income considered, the perceived sacrifice resulting from the federal income tax increases first at an increasing rate and then at a decreasing rate. This variation in the marginal change of QLI_{T_x} raises a question about the perceived distribution of sacrifice within the progressive structure of the federal income tax.

State Income Tax

State income tax structures generally were found to feature percentage rates of taxation which increase as income increases or a formula based on the federal income tax. Four states, however, were found to have income taxes which are based on a constant percentage of income [17, p. 104-108].

In the state income tax schedule used in the analysis, percentage of taxable income increases as income increases. The tax, marginal tax, marginal tax rate, and relevant QLI changes resulting from the state income tax are shown in Table 4. The schedule shows a

TABLE 4. STATE INCOME TAX AND ACCOMPANYING QLI CHANGES^a

Level of Income	Tax from Schedule ^b	Marginal Tax	Marginal Tax Rate ^c	QLI _{T_x}	Marginal Changes in QLI _{T_x}
-----DOLLARS-----					
<1,000	0	--	--	--	--
1,000-1,999	0	--	--	--	--
2,000-2,999	0	--	--	--	--
3,000-3,999	0	--	--	--	--
4,000-4,999	0	--	--	--	--
5,000-5,999	5.40	5.40	.005	-.02	-.02
6,000-6,999	16.80	11.40	.011	-.07	-.05
7,000-7,999	29.80	13.00	.013	-.12	-.05
8,000-8,999	45.20	15.40	.015	-.18	-.06
9,000-9,999	64.00	18.80	.019	-.24	-.06
10,000-10,999	85.60	21.60	.022	-.32	-.08
11,000-11,999	109.60	24.00	.024	-.39	-.07
12,000-12,999	133.00	23.40	.023	-.47	-.08
13,000-13,999	156.54	23.54	.024	-.53	-.06
14,000-14,999	183.20	26.66	.027	-.61	-.08

^aTax schedule used in the analysis assumes a taxpayer filing jointly with three dependents.

^bTaken from "1975 New Mexico Individual Income Tax General Instructions," 1975.

^cMarginal tax rate = tax on extra dollar of income.

^dAssumes federal income tax has been deducted.

progressive tax rate and change in QLI resulting from the tax collected. The marginal tax and marginal change in QLI_{T_x} do show variability, but it is not as pronounced as in the case of federal income tax.

Sales Tax

When the graduated income tax is cited as a progressive tax, the general sales tax is identified as generally regressive [11, p. 165]. In the consideration of a sales tax, it is assumed that federal and state income taxes have been withdrawn from personal income, MPC = 0.9, and that a 4 percent sales tax applies on all consumption items.

The results of the sales tax are shown in

Table 5. As one would expect, the marginal tax rate and the marginal change in QLI_{T_x} de-

TABLE 5. SALES TAX AND ACCOMPANYING QLI CHANGES

Level of Income	Sales Tax ^a	Marginal Tax	Marginal Tax Rate ^b	QLI_{T_x}	Marginal Change QLI_{T_x}
-----DOLLARS-----					
<1,000	18.00	18.00	.018	-.09	-.09
1,000-1,999	54.00	36.00	.036	-.25	-.16
2,000-2,999	90.00	36.00	.036	-.41	-.16
3,000-3,999	126.00	36.00	.036	-.55	-.14
4,000-4,999	162.00	36.00	.036	-.69	-.14
5,000-5,999	194.89	32.89	.033	-.81	-.12
6,000-6,999	225.26	30.37	.030	-.92	-.11
7,000-7,999	255.18	29.92	.030	-1.02	-.10
8,000-8,999	284.64	29.46	.029	-1.11	-.09
9,000-9,999	313.45	28.81	.029	-1.19	-.08
10,000-10,999	341.83	28.38	.028	-1.27	-.08
11,000-11,999	370.13	28.30	.028	-1.34	-.07
12,000-12,999	399.13	29.00	.029	-1.41	-.07
13,000-13,999	428.16	29.03	.029	-1.47	-.06
14,000-14,999	456.54	28.38	.028	-1.53	-.06

^aAssumes federal and state income tax has been collected and an MPC = .9.

^bMarginal tax rate = tax on extra dollar of income.

crease as the level of income increases.

Aggregate Tax

For this analysis aggregate tax is the summation of the federal and state income taxes and the sales tax. Although the sales tax is regressive, the effect of the total tax paid at each level of income is in the aggregate progressive with respect to both marginal tax rate and QLI (see Table 6). Aggregate tax is included in the

TABLE 6. AGGREGATE TAX PAID AND RESULTING CHANGES IN QLI

Level of Income	Aggregate Tax	Marginal Tax	Marginal Tax Rate ^a	QLI_{T_x}	Marginal Change in QLI_{T_x}
-----DOLLARS-----					
<1,000	18.00	18.00	.018	-.09	-.09
1,000-1,999	54.00	36.00	.036	-.25	-.16
2,000-2,999	90.00	36.00	.036	-.41	-.16
3,000-3,999	126.00	36.00	.036	-.55	-.14
4,000-4,999	162.00	36.00	.036	-.69	-.14
5,000-5,999	281.29	119.29	.119	-1.18	-.49
6,000-6,999	468.06	186.77	.187	-1.91	-.73
7,000-7,999	666.98	198.92	.199	-2.65	-.74
8,000-8,999	877.84	210.86	.211	-3.39	-.74
9,000-9,999	1,106.45	228.61	.229	-4.16	-.77
10,000-10,999	1,346.43	239.98	.240	-4.92	-.76
11,000-11,999	1,588.73	242.30	.242	-5.64	-.72
12,000-12,999	1,813.13	224.40	.224	-6.25	-.61
13,000-13,999	2,034.70	221.57	.221	-6.80	-.55
14,000-14,999	2,274.74	240.04	.240	-7.37	-.57

^aMarginal tax rate = tax on extra dollar of income.

analysis to allow the effect of exempting food from the general sales tax to be considered as an equity adjustment within the aggregate tax structure of the analysis.

ALTERNATIVE EQUITY ADJUSTMENTS

Because the data base used to develop the QLI framework does not include sufficient observations for individuals with higher levels of income, the level of income (Y) at which

$\frac{\partial QLI}{\partial Y} = 0$ should not be taken as an unbiased

estimate of the relationship. The quadratic form of the QLI with respect to income is, however, consistent with economic theory; therefore, pending additional research, it seems reasonable to assume a QLI of the form presented in Table 1. The range of incomes used in this analysis is within the range of the data base of the QLI . As the federal income tax and most state income tax structures are progressive with respect to income, this analysis takes progressiveness within the tax structures as a given goal.

Federal Taxation

Three alternatives are considered to illustrate potential approaches for adjusting the marginal tax rate and QLI_{T_x} within the federal income tax structure.

The first alternative is to equate the reduction in QLI due to the federal income tax to the smallest reduction (QLI_{T_x}) experienced at any income level in Table 3. The smallest QLI_{T_x} occurs at income level \$5,000-5,999. Subtracting this reduction from QLI prior to taxes, one can solve for the amount of tax which would provide the new QLI for each income level. The result is a lowering of the tax collected for all but the lowest income level from which income tax is collected. If one taxpayer is assumed for each income level, this alternative causes an 88.81 percent reduction in the total amount of federal income tax collected.

The second alternative is to equate the reduction in QLI to that of the income level which has the largest QLI_{T_x} . The largest QLI_{T_x} occurs at income level \$14,000-14,999; therefore, this alternative would equate all perceived reductions to that experienced by the taxpayer in income level \$14,000-14,999. The result is an increase in tax collected for all but the highest income level from which tax is collected. If one taxpayer per income level is assumed, this alternative produces an increase of 69.76 percent in the total amount of federal

income tax collected.

Although alternatives one and two represent two polar extremes for changes in QLI within the tax structure, they do not represent situations which are realistic or likely to be considered by policymakers. The third alternative is to take the amount of tax to be collected as a given and to adjust the tax schedule so that the QLI_{Tx} is progressive, but the marginal change in QLI_{Tx} is constant. The tax structure which would result from this adjustment is shown in Table 7. The total amount of tax

TABLE 7. RESULTS OF REVISION OF FEDERAL INCOME TAX SCHEDULE

Level of Income	Revised Tax	Marginal Tax	Marginal Tax Rate ^a	QLI_{Tx}	Marginal Changes in QLI_{Tx}	Changes in Tax Paid
-----DOLLARS-----						
<1,000	0	0	0	0	0	0
1,000-1,999	0	0	0	0	0	0
2,000-2,999	0	0	0	0	0	0
3,000-3,999	0	0	0	0	0	0
4,000-4,999	0	0	0	0	0	0
5,000-5,999	128	128	12.8	.53	.53	+47
6,000-6,999	262	134	13.4	1.06	.53	+36
7,000-7,999	404	142	14.2	1.59	.53	+22
8,000-8,999	554	150	15.0	2.12	.53	+6
9,000-9,999	713	159	15.9	2.65	.53	-16
10,000-10,999	881	168	16.8	3.18	.53	-38
11,000-11,999	1059	178	17.8	3.71	.53	-50
12,000-12,999	1248	189	18.9	4.24	.53	-33
13,000-13,999	1449	201	20.1	4.77	.53	-1
14,000-14,999	1662	213	21.3	5.30	.53	+27

^aMarginal tax rate = tax on extra dollar of income.

collected remains constant, but the tax for some levels of income increases and the tax for others decreases. The marginal tax and marginal tax rate are now progressive throughout the range of the analysis, and a comparison of Tables 3 and 7 shows no large changes in the marginal tax or marginal tax rate.

State Level Taxation

The exemption of food and/or prescription drugs from the sales tax is a type of tax reform frequently discussed at the state level. The QLI framework can be used to evaluate the effects which would be produced by such a change. The U.S. Bureau of Labor Statistics [15, p. 443] estimates that for non-metro areas low, intermediate, and high income budget families spend 28.85, 23.92, and 20.75 percent of their income, respectively, on food. Assigning an income range of \$0.00-6,999.00 to the low bracket, \$7,000.00-12,999.00 to the inter-

mediate bracket, and \$13,000.00-14,999.00 to the high bracket facilitates analysis. Although the aggregate tax collected from any given income level is allowed to vary, the total tax revenues collected at the state level are assumed to remain constant. With the exemption of food expenditures from sales tax, the state income tax schedule is increased to offset the reduction in sales tax and to integrate the income tax increase into a progressive tax system. The results of this hypothetical adjustment are presented in Table 8. The income tax structure in Table 8 is progressive on the basis of both income and QLI. The figures for change in QLI resulting from the tax in Tables 5 and 8 are not comparable because those in Table 8 now include a part of the reduction in QLI which was produced previously by the sales tax.

The figures for the change in QLI due to the tax revision are of particular interest. To use the Edgeworth Box as an example, a point of global welfare maximization is reached where the utility from goods and services (income) is equalized. Although the QLI may be too imprecise to serve as a proxy measure for the estimation of marginal utility in interpersonal comparison, the methodology does appear sufficient for making intergroup comparisons in the formulation of public policy that will unevenly affect different groups. If the marginal change in QLI resulting from a policy change is more for gainers than losers,

$$\sum_{i=1}^n QLI_{iTx} > 0,$$

then the change would provide an increase in net social well-being. The results suggest, therefore, a potential for revision within the tax structure which will produce a net increase in social welfare, and this net increase would be due to the restructuring of the tax system, not a reduction in the tax revenues collected. This point should be of particular interest to policymakers if the objective of public policy is, in fact, to maximize the social welfare of the economy.

CONCLUSIONS

The analysis shows the feasibility of using a quality of life index (QLI) to evaluate public policy decisions, and demonstrates the potential for developing alternative approaches which may accomplish given policy objectives while increasing the social welfare of the economy.

A representative tax situation is examined to determine its degree of progressiveness. Although the income tax schedules considered

are progressive, they are not, within the QLI framework used, consistent with respect to the sacrifice perceived throughout the range of incomes considered. A uniform application of acceptable criteria could rectify this situation, and the analysis demonstrates that the adjustments are possible within the concept of the current tax structure. The precise criteria to be used would require that policymakers integrate the type of information derived in this analysis and the realities of public acceptability.

A case of structural adjustment within the aggregate tax system also is considered. The QLI used in the analysis demonstrates the

potential for increasing net social welfare without reducing the resources available to the public sector.

The geographic, population, and income range limitations of the data base must be corrected if analysis of the type reported is to be put into practice. Application of the QLI to problems such as those considered in this analysis will require additional research and development in the area of quality of life as perceived by the individual and as determined by his/her socioeconomic environment. The analysis demonstrates, however, the potential for the productivity of additional research in this area.

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TABLE 8. REVISION OF STATE LEVEL TAXES TO INTEGRATE A PROGRESSIVE INCOME TAX AND THE EXEMPTION OF FOOD FROM SALES TAX

Level of Income	Sales Tax Before Revision	Sales Tax After Revision	Income Tax Before Revision ^a	Income Tax After Revision	Net Change in State Tax ^b	Change in QLI Due to Tax Revision	QLI _{Tx} Income Tax ^c	Marginal Change in QLI _{Tx} From Income Tax
-----DOLLARS-----								
<1,000	18	12.81	0	0	- 5.19	.02	0	0
1,000-1,999	54	38.42	0	0	-15.58	.07	0	0
2,000-2,999	90	64.04	0	0	-25.96	.12	0	0
3,000-3,999	126	89.65	0	0	-36.35	.16	0	0
4,000-4,999	162	115.26	0	0	-46.74	.20	0	0
5,000-5,999	194.89	138.66	5.40	27.08	-34.55	.14	- .1129975	-.1129975
6,000-6,999	225.26	160.27	16.80	55.47	-26.32	.11	- .225995	-.1129975
7,000-7,999	255.18	194.14	29.80	85.24	- 5.60	.02	- .3389925	-.1129975
8,000-8,999	284.64	216.56	45.20	116.47	+ 3.19	-.01	- .45199	-.1129975
9,000-9,999	313.45	238.47	64.00	149.22	+10.24	-.04	- .5649875	-.1129975
10,000-10,999	341.83	260.07	85.60	183.58	+16.22	-.06	- .677985	-.1129975
11,000-11,999	370.13	281.60	109.60	219.71	+21.58	-.08	- .7909825	-.1129975
12,000-12,999	399.13	303.63	133.00	257.91	+29.41	-.10	- .90398	-.1129975
13,000-13,999	428.54	339.32	156.54	298.25	+52.49	-.18	-1.0169775	-.1129975
14,000-14,999	456.54	361.81	183.20	340.71	+62.78	-.21	-1.129975	-.1129975

^aDue to rounding error, this column will not sum to zero, and sales and income tax before revisions will not exactly equal sales and income tax after revision.

^bDue to rounding of revised income tax to the nearest cent, the tabled value will not result in the exact reproduction of the tabled QLI_{Tx} which was derived in the analysis.

^cAssumes a taxpayer filing jointly with three dependents.

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