The Demand for Leisure

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Complementarity between leisure time and market recreation is estimated empirically by regressing the demand for leisure time of U.S. employees in the 1900–1961 period on the relative price of recreational goods and services, holding real income and the relative price of leisure time constant. The results support the complementarity hypothesis: about 25 percent of the estimated long-term increase in the demand for leisure is explained by a decline in market recreation prices. An observed negative partial regression of the demand for market recreation on the relative price of leisure time further supports the notion that the two goods are closely related.

I

Empirical analysis of changes over time in the demand for leisure time has for the most part focused on the response of hours of work to changes in the hourly wage rate.[1] The main goal of this empirical work has been to determine the existence and the extent of the backward-bending supply curve of labor. However, if estimation of the demand for leisure time is seen as a generalized problem in applying the theory of consumer demand, some additional approaches suggest themselves. Not only can

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[1] Jones (1959) and Lewis (1957) each examined the influence of nonwage factors on movements over time in hours of work. However, the factors studied (unionism and legal regulation, respectively) were chosen to show to what extent collective, as opposed to individual, decision making determines the demand for leisure time in the United States. Their empirical work supports the view that collective decision making plays a relatively minor role in determining the aggregate demand for leisure time.

the backward-bending supply curve of labor hypothesis itself be examined more carefully in an expanded model of consumer choice, estimates can also be made of the relationship between the demand for leisure time and the demand for a closely related good: market recreation.

Commercial recreation and leisure time are closely related goods in that they are used together in consumption. This is a matter of everyday observation, and can also be confirmed by a survey of the various time-budget studies that are available to us.[2] While the fact that leisure time and market recreation are used together does not necessarily imply that they are complements,[3] their close juxtaposition in consumption at least suggests an a priori argument that price changes in the one good will affect the demand for the other.

In order to analyze leisure time more consistently as a consumer good, and especially to facilitate the empirical study of the possible complementarity between leisure time and market recreation, it will be useful to employ a variation on the conventional demand analysis.

Let the individual maximize a utility function:

$$U = U(L, R, X) , \tag{1}$$

where L equals hours of leisure time; R, quantity of market recreaction; and X, quantity of all other consumer goods.

Let the individual be paid an hourly wage, w, and work for H hours. Then, if property income taxes and savings are assumed to be equal to zero:

$$wH = RP_R + XP_X . \tag{2}$$

If the total time available to the individual for work and leisure is T, then:

$$H + L = T . \tag{3}$$

The individual's maximum money income (Becker's "full income"[4]),

$$F = wH + P_L L = RP_R + XP_X + LP_L , \tag{4}$$

[2] See, for example, two well-known studies of community time allocation: Komarovsky, Lundberg, and McInerny (1934) and De Grazia (1961). See also Young Women's Christian Association (1934), National Recreation Association (1934), White (1955), and Clarke (1956).

[3] They could also be substitutes. Even if all leisure time were devoted to using market recreation, and vice versa, the market recreation–leisure time mix might be expected to vary with changes in the relative prices of these goods. If the degree of substitution between market recreation and leisure time were large relative to substitution between recreation-leisure activity and other consumption, a decline in the relative price of market recreation could lead to a *decline* in the demand for leisure time (see the discussions of leisure activity in Owen 1964, 1969*a*; and Becker 1965. For a somewhat different treatment of consumer activity, see Lancaster 1966).

[4] Becker (1965), p. 497. The full income constant is, of course, used here independently of his activity analysis.

where P_L is the price at which the individual can sell additional hours of work. If $P_L = w$, the simpler equations

$$F = wT = RP_R + XP_X + Lw \tag{5}$$

may be used.

In this model (whether or not $w = P_L$) demand equations for leisure time and market recreation may be termed in the form:

$$L = L(F, P_L, P_R, P_X) , \tag{6}$$

$$R = R(F, P_L, P_R, P_X) . \tag{7}$$

Equations (6) and (7) may be written in the form of differential equations as:

$$E_L = E_F\eta_L + E_{P_L}\xi_{L,P_L} + E_{P_R}\xi_{LP_R} + E_{P_X}\xi_{L,P_X} \tag{8}$$

$$E_R = E_F\eta_R + E_{P_L}\xi_{R,P_L} + E_{P_R}\xi_{R,P_R} + E_{P_X}\xi_{R,P_X} \tag{9}$$

where $E_L = (dL)/L$, $E_F = (dF)/F$, the η's are income elasticities, and the ξ's price elasticities.

The six price elasticities in these two equations may be rewritten with the use of well-known results in consumer demand theory and equations (10) and (11) obtained:

$$E_L = E_F\eta_L + E_{P_L}K_L(\sigma_{LL} - \eta_L) + E_{P_R}K_R(\sigma_{LR} - \eta_L) + E_{P_X}K_X(\sigma_{LX} - \eta_L) , \tag{10}$$

$$E_R = E_F\eta_R + E_{P_L}K_L(\sigma_{LR} - \eta_R) + E_{P_R}K_R(\sigma_{RR} - \eta_R) + E_{P_X}K_X(\sigma_{RX} - \eta_R) , \tag{11}$$

where $K_L = (LP_L)/F$, and so forth ($K_L + K_R + K_X = 1$), and σ_{LR} is the partial elasticity of substitution between L and R in the utility function, et cetera.

These price elasticities in each of these equations contain an income as well as a substitution effect. To obtain coefficients net of these income effects, a Laspeyre-type price deflator of the form:

$$D' = \frac{X_0P_{X_1} + R_0P_{R_1} + L_0P_{L_1}}{X_0P_{X_0} + R_0P_{R_0} + L_0P_{L_0}} \tag{12}$$

may be introduced, and deflated values of the variables obtained:

$$P'_L = P_L/D' , \quad P'_R = P_R/D' , \quad P'_X = P_X/D' , \quad \text{and} \quad F' = F/D' .$$

Then, using the fact that

$$K_L E_{P'_L} + K_R E_{P'_R} + K_X E_{P'_X} = 0\ ,^{5} \tag{13}$$

$E_{P'_X}$ can be eliminated from the demand equations, and equations (14) and (15) derived:

$$E_L = E_{F'}\eta_L + E_{P'_L} K_L(\sigma_{LL} - \sigma_{LX}) + E_{P'_R} K_R(\sigma_{LR} - \sigma_{LX})\ ; \tag{14}$$

$$E_R = E_{F'}\eta_R + E_{P'_L} K_L(\sigma_{LR} - \sigma_{RX}) + E_{P'_R} K_R(\sigma_{RR} - \sigma_{RX})\ . \tag{15}$$

Alternatively, a conventional price deflator (omitting leisure time) may be employed:

$$D^* = \frac{X_0 P_{X_1} + R_0 P_{R_1}}{X_0 P_{X_0} + R_0 P_{R_0}}\ . \tag{16}$$

Then, defining $P_{L^*} = P_L/D^*$, $P_{R^*} = P_R/D^*$, $P_{X^*} = P_X/D^*$, and $Y^* = F/D^*$, and using the relationship

$$K_R E_{P_{R^*}} + K_X E_{P_{X^*}} = 0\ ,^{6} \tag{17}$$

equations (12) and (13) may be rewritten, respectively, as:

$$E_L = E_{F^*}\eta_L + E_{P_{L^*}} K_L(\sigma_{LL} - \eta_L) + E_{P_{R^*}} K_R(\sigma_{LR} - \sigma_{LX})\ , \tag{18}$$

$$E_R = E_{F^*}\eta_R + E_{P_{L^*}} K_L(\sigma_{LR} - \eta_R) + E_{P_{R^*}} K_R(\sigma_{RR} - \sigma_{RX})\ . \tag{19}$$

If the price of leisure is in fact equal to the wage rate, then $F = wT$, $w = P_L$, $E_w = E_F = E_{P_L}$. Writing $w' = w/D$, equation (14) may then be rewritten for empirical estimation as:

$$E_L = E_{w'}[\eta_L + K_L(\sigma_{LL} - \sigma_{LX})]E_{P'_R} K_R(\sigma_{LR} - \sigma_{LX})\ , \tag{20}$$

or, in the alternative form (deflating by D^*),

$$E_L = E_{w^*}[(1 - K_L)\eta_L + K_L\sigma_{LL}] + E_{P_{R^*}} K_R(\sigma_{LR} - \sigma_{LX})\ . \tag{21}$$

In either form, the measure of the elasticity of the demand for leisure time with respect to the relative price of market recreation will provide a measure of complementarity, while the sign of the coefficient of the real wage rate will provide a test of the backward-bending supply curve of labor theory.

The models in equations (20) and (21) were fitted in a linear least-

[5] This holds strictly only for small movements in the variables from their base period values. For other changes, this interpretation of the Laspeyre's index is only approximately correct.

[6] See n. 5 above.

squares regression model to full-employment peak data for nonstudent male employees in the private, nonagricultural sector in the United States in the 1900–1961 period.

The choice of a full-employment peaks model was dictated by the assumption made in this first model, that the wage rate measures the marginal price of leisure. This implicitly assumes that employers are willing to accommodate their work force by making variations in the overall plant hours schedule without changing the average wage rate (although it does not imply that *individual* employees can freely vary their hours without economic loss).[7] At any time, this is, at best, a very approximate description of the hours-determination process. In periods of widespread unemployment, it is not at all realistic. Therefore, ten years in which the unemployment rate was minimal were selected for use here.[8]

The leisure time of nonstudent male employees in the private, nonagricultural sector was selected for study for three reasons. First, this group constitutes a large majority of the work force. Second, nonstudent males have fewer nonmarket work obligations than do either females or male students. Hence, it is easier to measure their leisure time from hours-of-work data. Finally, nonlabor income is relatively small for the average members of this group.

In order to compute this measure of leisure time from hours-of-work data, it was necessary to obtain a measure of time available for either leisure or market employment ($T = L + H$). To calculate T in this first model, time spent in nonmarket work was first subtracted from the total time available to the individual. In this calculation, the definition of nonmarket work time was restricted to time spent in commuting, personal care, and other pursuits closely related to the process of earning a living. Analysis of time budgets collected over a number of years suggested that about eighteen hours a week would be a reasonable estimate for such activities.

The hours-of-work data used in this calculation were derived from interview data for the period since 1940. Establishment data for earlier years were then linked with these interview data. The hours-of-work series was adjusted to include vacations and holidays, so as to arrive at a

[7] See Owen (1969*a*) for a discussion of some of the factors that might make this assumption a tenuous one, even in periods of full employment. See also Oi (1960) and Rosen (1968) for useful discussions of the influence of employer investments in employees (for example, in on-the-job training) on hours determination.

[8] "Full-employment peak" years were selected by the following rules: (1) Unemployment should be less than 4.5 percent. (2) Years should not be closer than every third year, to avoid taking more than one observation per cycle. (3) In each such period of relatively full employment, the year of lowest unemployment was selected. This selected ten years in the 1900–1961 period.

more realistic estimate of changes in work time (that is, vacations and holidays were considered here to be a component of leisure time). Real hourly-wage-rate data were calculated so as to be approximately comparable with the hours-of-work series. A description of the sources for the hours- and wage-rate series is given in the Appendix.

The market price of recreation-time series used here was computed by carrying back the recreation component of the U.S. Bureau of Labor Statistics Consumer Price Index to 1900.[9] Thus, the index is essentially a measure of the relative price of commercial recreation. It includes motion picture admissions, sporting goods, television sets, radios, phonographs, and other recreational goods and services. Because the government index was not initiated until 1935, and was greatly expanded only in 1950–53, prices from advertising catalogs and daily newspapers had to be obtained for the earlier years in order to complete the series for the 1900–1961 period. The price of recreation-time series is also described in greater detail in the Appendix.

These data series were then used to calculate the elements in equations (20) and (21), L, P'_R, P_{R^*}, w', and w^*. Some results of fitting these equations, as well as of fitting a simpler equation to these data, are given in table 1.

TABLE 1

DEMAND FOR LEISURE TIME: FULL-EMPLOYMENT (PEAK YEARS) MODEL, 1900–1961

	Estimating Equations*	Coefficient of Determination (Adjusted)	Simple Coefficient of Correlation of w, $P(R)$	Test Statistic: Autocorrelation of Residuals†
1.1....	$L = 89.79 + .116W^*$ (.017) [.108]	.831	...	0.64
1.2....	$L = 107.80 + 095W^* - .158P(R)^*$ (.018) (.081) [.089] [−.159]	.875	−.588	1.48
1.3....	$L = 85.99 + .182W' - .042P(R)'$ (.060) (.026) [.206] [−.060]	.964	−.956	1.80

* Figures in parentheses are estimates of the standard errors of the regression coefficients. Figures in brackets are elasticities calculated at the observed means of the variables.

† Test statistic is the Durbin-Watson d.

[9] An attempt was made to expand the price of recreation index to include estimates of the cost of transportation used in recreation activities (see Owen 1964, chaps. 7 and 8). However, the introduction of recreation transportation did not in any way improve the statistical estimation of the demand for leisure time. For a further discussion of the relationship between commuting and the demand for leisure time see Owen (1969*b*) and the references cited there.

The simple regression of hours of leisure time on the real wage rate yields a coefficient of determination of .831. Closer fits of the demand for leisure time are obtained first by introducing the relative price of recreation as an independent variable (1.2) and then by including leisure time in the measure of income and of the general price level (1.3). The coefficient of determination rises to .875 in equation (1.2) and to .964 in equation (1.3).

A significant level of autocorrelation was found among the residuals when the demand for leisure time was estimated in a simple regression (1.1). This autocorrelation was reduced to an insignificant level when the relative price of recreation was introduced as a regressor (1.2) and when the price of leisure was introduced into the measure of the price level (1.3).[10]

The regression estimates obtained here support the hypothesis that leisure time and market recreation are complements. In both of the estimating equations in which it appears (1.2, 1.3), a decline in the relative price of recreation, holding the real wage rate (and hence real income and the relative price of leisure) constant, is associated with an increase in the demand for leisure time.

The theory of the backward-bending supply curve of labor also gains support from these regression results. In the simple regression (1.1), the demand for leisure time is positively related to the real wage rate. This relationship continues to hold when the price of recreation is added as a further explanatory variable (1.2) and when leisure time is included in the estimates of income and price level (1.3).

II

If changes in the price of leisure, $P(L)'$, are not equal to changes in the real wage rate, w', then, since $F = wH + P'_L L$, $E_F \neq EP'_L \neq E_{w'}$. It is then appropriate to employ equation (14) for purposes of statistical estimation. In this case it may be possible to obtain separate estimates of the effects of changes in real income and in the relative price of leisure on the demand for leisure time.

In years of widespread unemployment, it is in fact reasonable to assume that the price of leisure of an employed worker (that is, the dollar value in the market of an additional hour of the employee's work or leisure time) is not simply equal to his wage rate, but is rather a function of the unemployment rate as well. When unemployment is high, ad-

[10] When these regressions were run in an alternative form, the increase in the coefficient of determination and the Durbin-Watson test statistic for autocorrelation, obtained by including leisure time in the measure of income and the general price level, was much diminished.

ditional hours of work for employed workers will not be easily forthcoming. In fact, many who keep their jobs will find themselves on short hours. If an employer has reason to believe that the demand for his firm's product will eventually recover, a cutback in hours per employee will minimize his reduction in work force and, hence, the cost of hiring and training new employees when demand increases. The employer thus has a financial incentive to reduce hours when demand is slack.

Even if the employer has decided to reduce hours, however, he may still be persuaded not to do so if offered some inducement by the employee. Moreover, the employee might be willing to take lower wages in order to obtain a less drastic hours cut. He may be able to find a full-time job at his current wage rate with another employer, but such a change will require search costs (which would be expected to rise with the general level of unemployment). Alternatively, he may find a full-time job elsewhere at a lower wage rate, but with reduced search costs. In view of these costs, then, the employee may decide to accept a lower wage rate in return for a less sharp cut in hours of work.

Hence, it is reasonable to conclude that in times of less than full employment, the market price of the leisure of employed persons will be less than the average wage rate paid, and that the differential will rise with the unemployment rate.[11]

Thirty years in the 1929–61 period (excluding the war years 1943–45) were selected for the estimation of equation (14). In many of these years, unemployment was quite high. In others, it was minimal, thus assuring a wide range in the price-of-leisure variable. (This sample is referred to hereafter as the "annual-variations" model.) Estimates of hourly wages, price of recreation, and leisure time were made here by the method described in the full-employment peaks model.

The price of leisure was measured in this empirical work simply by letting the relative deviation of the price of leisure from the real wage rate be proportionate to the rate of unemployment: $[P(L) - w]/w = eU$, where U is the unemployment rate and e is some constant. Solving the equation for the price of leisure yields $P(L) = w(1 - eU)$. This measure of the price of leisure was then introduced into the price index and into the measure of full income to obtain real income and the relative price of leisure and recreation in years of less than full employment.[12]

[11] See Oi (1960) for a fuller discussion of the relationship between unemployment and hours of work.

[12] This is, of course, a simplified model of the influence of unemployment on hours determination. In particular it does not introduce intertemporal substitution of income and leisure into the individual's behavior. One would expect that the neglect of intertemporal substitution of income and leisure would tend to lead to overestimates of the effects of changes in the relative price of leisure on the demand for leisure time in times of widespread unemployment. Thus, if the employee expects conditions

The value of e (the measure of the influence of unemployment on the relative price of leisure) could not be predicted in advance. However, the following a priori considerations did suggest that e would lie between 0 and 4.0: e would be greater than or equal to 0 because it is unlikely that an increase in the unemployment rate would *increase* the market price of leisure, but e would be less than or equal to 4.0 unless the price of leisure was *negative* in 1933, when the annual unemployment rate reached its peak of almost 25 percent.

It was not possible, however, to choose a particular value between 0 and 4.0 on the basis of such a priori economic reasoning, and so the demand for leisure time was estimated by iteration. Forty regressions were employed, using values of e ranging by tenths from 0.1 to 4.0.

Table 2 presents the results obtained from fitting equation (14) in this annual-variations model. Improvements in the estimate of the demand for leisure time, as measured by the coefficient of determination obtained, are observed here as the price of recreation (2.2, 2.3) is introduced. (A similar improvement was obtained in this way in the full-employment peaks model.)

Moreover, a comparison of the coefficient of determination obtained in equation (2.3) with those obtained in the several equations presented as (2.4) shows that a still more accurate estimate of the demand for leisure time is made by treating the price of leisure as a function of the unemployment rate. No further gain is obtained by discriminating among the various values of e, while there is a marked improvement as e goes from 0 to a positive value (that is, from [2.3] to the set [2.4]); the coefficients of determination show little change as e goes from 0.1 to 4.0 (that is, within the set [2.4]).[13]

The regression results from the annual-variations model give further support to the hypothesis that leisure time and market recreation are complements: in each of the estimating equations, a decline in the rela-

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to improve, he will regard both his current income and price of leisure as underestimates of their long-run values. In good times, he may regard their current values as overestimates. In a recession or depression, the expectation of better times may lead the employee to be more willing to accept an hours cut: since he will regard the low price of his leisure time in the marketplace as a temporary phenomenon, he may be unwilling to sacrifice more of it on these terms. If this is a typical employee reaction, then one would expect that changes in hours of work resulting from temporary changes in the unemployment rate would be greater than those resulting from more permanent changes in the relative price of leisure. However, several empirical experiments in which intertemporal expectations were permitted to influence behavior in this model (by the introduction of a measure of permanent income) were not successful (see Owen 1964).

[13] In order to test the validity of using this range of e, additional values of e were also used to estimate the demand for leisure time ($e = -2.0, -1.0, 5.0, 6.0, 7.0$, and 8.0). These yielded markedly inferior regression and correlation results.

TABLE 2

DEMAND FOR LEISURE TIME: ANNUAL-VARIATIONS MODEL, 1929–61 (EXCLUDING 1943–1945)

	Estimating Equations	Coefficient of Determination (Adjusted)	Test Statistic: Autocorrelation of Residuals
2.1	$L = 103.16 + .032W^*$ $(.007)$ $[.041]$	.405	.48
2.2	$L = 110.25 + .041W^* - .093P(R)^*$ $(.008) \quad (.048)$ $[.052] \quad [-.077]$	.4,1	.59
2.3	$L = 116.43 - .003W' - .093P(R)'$ $(.050) \quad (.037)$ $[-.004] \quad [-.080]$	.556	.67
2.4.a	$(e = 0.1)\ L = 89.65 + 3.645Y' - 532.62P(L)' - 3.19P(R)'$ $(.758) \quad (110.68) \quad (3.06)$ $[6.814] \quad [-6.620] \quad [-.028]$	.738	.67
2.4.b	$(e = 1.0)\ L = 91.70 + .448Y' - 54.25P(L)' - 3.55P(R)'$ $(.076) \quad (9.26) \quad (3.92)$ $[.895] \quad [-.653] \quad [-.033]$	.726	.67
2.4.c	$(e = 2.0)\ L = 93.32 + .271Y' - 28.73P(L)' - 3.78P(R)'$ $(.039) \quad (4.852) \quad (2.70)$ $[.500 \quad [-.330] \quad [-.038]$	.720	.67
2.4.d	$(e = 3.0)\ L = 95.05 + .209Y' - 20.47P(L)' - 4.03P(R)'$ $(.027) \quad (3.85) \quad (2.44)$ $[.381] \quad [-.221] \quad [-.045]$	.713	.68
2.4.e	$(e = 4.0)\ L = 96.88 + .175Y' - 16.52P(L)' - 4.29P(R)'$ $(.022) \quad (3.34) \quad (2.13)$ $[.314] \quad [-.161] \quad [-.054]$	.705	.69

NOTE.—See footnotes to table 1.

tive price of recreation is associated with an increase in the demand for leisure time.

The backward-bending supply curve of labor theory is also supported by the results in equation (2.4), in that the sum of the income and own price elasticities of leisure time is greater than zero in each case.

In fact, these sums are quite close, both to each other, ranging from .15 to .24, and to the value, .21, found in the comparable full-employment peaks model (as one would expect—see equations [14] and [20]).

A significant level of autocorrelation among the residuals was found in each of the estimates from the annual-variations models. However, when (2.4.c) was estimated in the form of first differences, the level of autocorrelation was insignificant (see table 3). The coefficient of determination obtained with first differences is much lower than that estimated in equation (2.4.c), but still significant. Moreover, almost identical regression results are obtained. Both the complementarity and the backward-bending supply curve of labor hypotheses are supported by the results in table 3.

The relationship between leisure time and market recreation can be further explored in estimating the demand for commercial recreation as a function of real income, the relative price of leisure, and the relative price of recreation (equation [15]).

Time series for recreation consumption for the 1929–61 period were obtained from the recreation sector of the personal-consumption component of the national income accounts.

An important measurement problem arises in this recreation model in that there are no separate estimates of employee recreation: available recreation production or expenditure data are typically for markets rather than for groups within them, such as employees. Some evidence is available that suggests that leisure-time patterns of employees are similar to those of other groups in the population. However, the use of

TABLE 3

LEISURE-TIME-DEMAND MODEL: STATISTICAL ESTIMATES FROM ANNUAL-VARIATIONS MODEL USING FIRST DIFFERENCES OF THE TIME SERIES, 1929–61 (EXCLUDING 1943–45)

	Estimating Equation	Coefficient of Determination (Adjusted)	Test Statistic: Autocorrelation of Residuals
3.1..	$\Delta L = -.037 + .292\Delta Y' - 31.46\Delta P(L)' - 4.54\Delta P(R)'$ (.098) (8.74) (3.65) [.539] [−.361] [−.046]	.340	1.94

NOTE.—See footnotes to table 1.

TABLE 4

MARKET RECREATION: STATISTICAL RESULTS DERIVED FROM MODIFIED EMPLOYEE MODEL. ANNUAL VARIATIONS, 1929–61

	Estimating Equation	Coefficient of Multiple Determination (Adjusted)	Autocorrelation Test Statistic
4.1...	$R = -11.41 + 1.246Y'' - .946P(L)'' - .285P(R)'$ (.572) (.539) (.129) [3.12] [−1.49] [− .36]	.930	.137

NOTE.—See footnotes to table 1.

an index of recreation consumption for employees based on national data is a most approximate one.

This measurement error becomes larger in periods of widespread unemployment: then the decline in the income and the price of leisure of the unemployed will greatly exceed that in the price of leisure of employed workers. In order to make the income and price of leisure estimates more nearly comparable with the national recreation estimates, a weighted average of the income (after tax) and price of leisure of the employed and unemployed (obtained by assigning a zero value to the market price of the leisure time of the unemployed and by giving them a weight equal to the unemployment rate) was used here (Y'' and P_L''). Estimates of the income and price of leisure of the employed were obtained from the series used for equation (2.4.c) (that is, with $e = 2.0$).[14]

The results of the regression analysis of the demand for market recreation are shown in table 4. A negative relationship was obtained between the price of leisure time and the demand for market recreation, giving further support to the hypothesis that the demands for leisure time and market recreation are closely related (see equation [15]).

The regression and correlation results presented in table 2 (equations [2.4]) showed that it was possible to use an approximate measure of the price of leisure in times of less than full employment to obtain reasonable estimates of the effects of changes in income and the price of leisure on the demand for leisure time. Moreover, while different values of e yielded rather different estimates of the income and price of leisure elasticities, the sums of these estimates were fairly stable. One would expect these sums to be equal to the measure of the elasticity of the demand for leisure time with respect to the real wage rate obtained in the full-employment peaks model (equation [1.3]), since both are esti-

[14] Selected as an average value. As noted above, the statistical analysis of the demand for leisure time afforded no grounds for selecting one value of e over another.

mates of $\eta_L + K_L(\sigma_{LL} - \sigma_{LX})$—and, in these estimations—they were approximately equal.

An alternative method of obtaining an estimate of the effect on the demand for leisure time of changes in the real wage rate and the relative price of recreation is to employ these variables directly, adding the unemployment rate as a third independent variable.

Equations (5.1) and (5.2) in table 5 present results estimated by this method; D^* is used as a deflator in (5.1), D' in (5.2).

These estimates are again consistent with both the backward-bending supply curve of labor theory and the hypothesis that leisure time and market recreation are complements. The estimate of the elasticity of demand for leisure time with respect to the real wage rate in equation (5.2), .185, is close to the estimates of $\eta_L + K_L(\sigma_{LL} - \sigma_{LX})$ obtained by summing the values of the income and price of leisure effects in equation (2.4) (.15–.24), and to that obtained in the full-employment peaks model, equation (1.3), .21.

Estimates of the effects of changes in the real wage rate, conventionally deflated, on the demand for leisure time in the full-employment peaks and the annual-variations sets of years can be compared in equations (1.2) and (5.1). Similar estimates, .07 and .09, respectively, are obtained for this wage rate elasticity (equal to $(1 - K_L)\eta_L + K_L\sigma_{LL}$, see equation [21]).

The demand for market recreation may also be estimated in years of

TABLE 5

DEMAND FOR LEISURE TIME AND DEMAND FOR MARKET RECREATION, ANNUAL-VARIATIONS MODEL, 1929–61: ALTERNATIVE MODEL

	Estimating Equations	Coefficient of Determination (Adjusted)	Test Statistic: Autocorrelation of Residuals
5.1....	$L = 102.66 + .054W^* - .044P_R^* + .149u$ (.008) (.043) (.045) [.068] [−.036] [.013]	.608	0.477
5.2....	$L = 88.86 + .148W' - .032P'_R + .184u$ (.047) (.029) (.037) [.185] [−.027] [.017]	.764	0.664
5.3.....	$R = 71.29 + .333W^* - .461P_R^* - 1.01u$ (.023) (.127) (.13) [.690] [−.626] [−.15]	.958	1.61
5.4....	$R = 16.82 + .624W' - .282P'_R - .915u$ (.205) (.128) (.161) [1.273] [−.395] [−.135]	.944	1.22

NOTE.—See footnotes to table 1.

less than full employment as a function of the real wage rate, the relative price of market recreation, and the unemployment rate. The results of estimations in this form, using the annual-variation set of years, are given in equations (5.3) and (5.4) of table 5 (employing D^* and D', respectively, as deflators). The real wage rate elasticity of market recreation in equation (5.4), 1.27, may be compared with the sum of the income and price of leisure elasticities in equation (4.1), $3.12 - 1.49 = 1.63$, as a measure of $\eta_R + K_L(\sigma_{LR} - \sigma_{RX})$ (see equation [15]). As one would expect, rather similar values are obtained for the two elasticities.[15]

Conclusions

From the given information, we can conclude the following:

1. Regression of the demand for leisure time on the relative price of recreation in the annual-variations and full-employment peaks models supports the conclusion that leisure time and market recreation are complements, in the sense that a decline in the relative price of market recreation will increase the demand for leisure time. The finding that changes in the demand for market recreation are negatively related to changes in the relative price of leisure time also suggests that leisure time and market recreation are closely related in consumption.

2. Significant declines in the relative price of recreation, especially in the first thirty years of this century (see table A1 in the Appendix) were an important contributing element in the decline in hours in this period. About one-fourth of the total calculated decline in the 1901–61 period in hours of work of nonstudent, nonfarm, male employees in the private sector in the United States was associated with decline in the relative price of market recreation.

3. However, the larger part (about 75 percent) of the increase in leisure time was associated with increases in the real hourly wage: these results, then, support, not contradict, the backward-bending supply curve of labor theory. Moreover, when the effects of the demand for leisure time of changes in real income and in the relative price of leisure were estimated separately (annual-variations model), the income effect dominated, thus offering further support to the backward-bending supply curve theory.

[15] Still another method of exploring the relationship between the demand for leisure time and the demand for market recreation is to regard these as demands derived from the demand for recreation-leisure activity (see n. 4 above). However, there is a difficulty in estimating this demand empirically in that some leisure time is, in practice, devoted to nonrecreational activities (for example, eating). Variations in these activities may bias the estimation of the demand for recreation-leisure activity. These problems are discussed in Owen (1969*a*), where an empirical estimation along these lines is presented.

4. Improvements in the estimation of the demand for leisure time are obtained when the price of recreation is included as a regressor and, as one would expect, when the effect of changes in the unemployment rate on the demand for leisure time is taken into account.

Appendix

A. Sources of Hours-of-Work Data

Hours worked per week per wage and salary earner in private, nonagricultural employment in the United States were estimated annually from 1900 to 1961.

The basic source for the 1951–61 period is the monthly survey of the labor force conducted by the U.S. Bureau of the Census. The relative merits of using these interview data, rather than establishment or payroll data, have been discussed elsewhere [16] and need not concern us here. Essentially, establishment data yield hours per job, while interview data yield hours per employed person. For the purpose of a study of leisure the latter would seem to be the correct measure.

A breakdown of hours worked by wage and salary earners and by the self-employed and others has been available since 1958. The wage and salary sector has been divided into government and private subsectors since 1960. As the private wage and salary group has made up a rather stable proportion of the nonagricultural labor force over the last twenty years, the ratio of their hours to those of the nonagricultural labor force prevailing in recent years, about .97, was used for the post-1940 period.

Weekly hours data for the 1900–1940 period are based on unpublished materials on employment and man-hours of wage and salary employees (excluding farm and general government) supplied to the author by John F. Kendrick. These data were linked to the survey-based data in 1941. Kendrick's materials were prepared for his book, *Productivity Trends in the United States.*

These data have the advantage of attempting to measure hours throughout the entire economy. A growing number of serious studies are available which analyze labor input and compute average hours worked in one industry or sector of the economy. Kendrick has pioneered in his careful sifting and weighting of the evidence to arrive at estimates of average hours worked for the entire economy.

Kendrick's data are based on establishment data and reflect, in come cases, hours paid for rather than hours worked. However, multiple jobholding and paid leisure have become much more significant in the post-1940 period. Thus, it is hoped that movements in the Kendrick data are reasonably accurate estimates of time worked per person in the 1900–1940 period.[17]

Vacations and Holidays

Weekly hours data were adjusted to incorporate the effect of vacations and holidays on aggregate leisure (weekly basis).

[16] Kendrick (1957), Bry (1959), Jones (1959), and Finegan (1962).

[17] Kendrick's data in the years 1929–40 and following were adjusted by him to obtain hours per full-time equivalent employee. These were converted back to hours per full- and part-time employee (see Owen 1964, pp. 194–97).

Monthly and annual data on vacations taken by members of the labor force have been available since 1947. Since 1958, vacation data have been available for wage and salary workers in nonagricultural industries. On the basis of the labor-force estimate of average vacation time for employed members of the labor force, nonagricultural wage, and salary-worker estimates were taken back to 1947. The estimates were then extrapolated back to 1941.[18]

These adjustments were refined with the help of the measures of the underestimation of vacation time in the government statistics presented by Henle (1962). These refinements led to an upward revision of the adjustment factor by one-fifth.[19]

Elimination of Females and Students from the Hours Data

Average hours worked per week for males and females in nonagricultural employment are available from the survey data from May 1956 to date.[20] The censuses of 1940 and 1950 also give hours data by sex.

The male-female hours differential was computed for 1940, for 1950, and for 1956. The differential was then interpolated linearly for intervening years. This differential, in conjunction with annual statistics on male and female employment, permitted estimates of the male work week.

Employment statistics are available for male students by age group in the 1940–60 period for all years except 1941–43 and 1945. Average weekly hours data were published for working students in 1959 and 1960. Frequency distributions are available for earlier years, but class intervals were changed frequently, so that it is difficult to compute a time series of hours.[21]

Since the hours data are rough, fixed hours weights were used for each age class, thus making the implicit assumption that average hours in each age class were constant. However, the fact that the average age of employed students has declined and that the younger students work fewer hours a week reduced this measure of the average male student work week by about 10 percent over the twenty-year period.

B. Sources of Wage-Rate and Unemployment-Rate Data

Real hourly compensation[22] of wage and salary employees in the private, nonfarm sector of the U.S. economy are given for full-employment peak years in the 1900–1961 period in the second column of table A1. Compensation data were divided by an index of consumer prices[23] to obtain real compensation per hour.

Average compensation per man-hour was obtained for the years 1929–60 by dividing the total employee compensation (net of farm and government) sta-

[18] The percentage on vacation was extrapolated from 1947 to 1939 as an arithmetic progression equal to zero in 1939.

[19] The vacation and holiday adjustment mechanisms are discussed at greater length in Owen (1964), pp. 198–202.

[20] The data were adjusted to eliminate nonwage and salary workers.

[21] Such a series would probably show a declining movement in hours worked per student. One would also expect this on a priori grounds, since reporting of short-hours personnel has become more accurate over the years.

[22] This includes various fringe benefits, as well as cash payments (see Rees 1960).

[23] See below.

tistics published by the United States Department of Commerce[24] by Kendrick's estimates of employee man-hours in the private, nonfarm sector.[25] Kendrick designed his man-hours series to be consistent with the Department of Commerce compensation estimates, and hence no further adjustment was made.

Man-hour compensation rates in the 1919–29 period were obtained by using the compensation and employment data developed by Kuznets together with the Kendrick employment and hours data. (The Kuznets data were used to obtain a compensation-per-employee index. This was then divided by an hours-per-employee series, based upon the Kendrick estimates, to obtain compensation per hour.)

For earlier years, Kendrick estimates of compensation per man-hour for various nonmanufacturing industries in 1899, 1909, and 1919 were combined with estimates of hourly compensation in manufacturing made by Albert Rees to obtain compensation measures for these bench-mark years. Year-to-year movements in the compensation index in the 1899 to 1919 period were estimated by interpolation, using Rees's annual estimates for compensation in manufacturing.[26]

Annual estimates of the unemployment rate—unemployment as a percentage of the civilian labor force—were made for the years 1900–1961. The U.S. Bureau of Labor Statistics unemployment data were used in the post-1929 period.[27] Data for the years 1900–1929 were taken from Lebergott (1957).

TABLE A1

TIME SERIES USED IN FULL-EMPLOYMENT PEAKS MODEL

Year	Hours of Leisure per Week (L)	Real Hourly Wage Rate* (W)	Relative Price of Recreation* P_R†	Index of Income per Employee or Price of Leisure (w')	Relative Price of Recreation (Expanded Price Index) (P'_R)
1901....	91.6	45.0	121.9	84.7	229.5
1906....	93.0	50.5	121.0	90.3	216.5
1913....	95.0	54.6	92.5	94.1	159.5
1919....	100.0	67.0	97.6	104.2	151.8
1923....	100.4	77.0	103.8	110.8	149.4
1926....	100.7	78.0	96.4	111.5	137.8
1929....	101.3	83.2	96.9	114.6	133.4
1948....	108.3	136.4	96.6	136.4	96.6
1953....	108.5	163.6	93.4	143.6	82.0
1956....	108.1	184.3	92.0	148.0	73.9

* Deflated by conventional measure: U.S. Bureau of Labor Statistics Consumer Price Index.

† Series used in regression equal to 100 in 1949.

[24] See U.S. Department of Commerce, Office of Business Economics (1954), pp. 59, 68–77, for a definition of the compensation measure used there.

[25] Again, estimation of the private, nonfarm, wage and salary employee group was made possible with the help of unpublished data received from Kendrick.

[26] Kuznets (1942), and Rees (1961). See Owen (1964), pp. 100–104, for a description of these sources.

[27] Adjusted for changes in the BLS definition of unemployment in 1957 (see Owen 1964, pp. 104–5, for details).

C. Sources of Recreation Data

Information on the history of recreation prices in the United States is limited. Price indexes of motion picture admission charges and of newspaper prices have been published by the Bureau of Labor Statistics as part of its Consumer Price Index since 1935. Radio sets were added in September 1949, television sets in December 1950, and television repairs, toys, and sporting goods, in December 1952. Another source of data is the Department of Commerce's Wholesale Price Index, which gives prices of radios, toys, and sporting goods for the 1948–53 period. Thus, if one is willing to overlook changes in retail margins, it is possible to extend almost all of the CPI recreation component back to 1948.

A third source is the National Industrial Conference Board, which collected price data on newspapers and magazines and on motion pictures on a monthly basis from 1920. The NICB also obtained price quotes on these items in 1914 and in 1918.

In order to obtain estimates of prices of recreation goods other than reading matter or admissions prior to 1948, Sears, Roebuck and Company catalogs were employed, and prices of a number of recreation goods were obtained and aggregated into the following categories: play and sporting equipment; radios, television sets, and phonographs; records; cameras; and musical instruments and, for the 1901–29 period, sheet music. These categories were suggested by the several Bureau of Labor Statistics studies. In this way, recreational items which were of some importance in the consumer budget,[28] and which could be priced by means of the mail order catalogs, were obtained (see table A2).

Admission prices were calculated from newspaper advertisements for movies and for other entertainments. The other entertainment group included vaudeville and burlesque shows, spectacles (circuses) and musical programs. An index of newspaper prices was obtained in part from contemporary editions of N. W. Ayer and Sons' *Directory of Newspapers and Periodicals*. These data were linked with the NICB series to obtain indexes of admissions and reading prices. This series was then linked with the BLS admissions and reading indexes at 1935.

These several recreation price series were then weighted in accordance with their relative weight in the three budget studies (the 1918 study for the years 1901–29; the 1934–36 study for the 1929–42 period; and the 1950 study for 1942–48) to obtain an index of recreation prices for 1900–1948. This index was linked at 1948 to the extended recreation component of the CPI.[29]

The recreation quantity series was obtained by dividing the expenditure data by this price series. An index of the relative price of recreation ($P[R]$) was calculated by dividing the recreation-price index by a cost-of-living index. Price deflators were obtained by linking Albert Rees's cost-of-living index[30] with the U.S. Bureau of Labor Statistics Consumer Price Index in 1913 (see table A3).

[28] However, the notion of what is commercial recreation remained that which is now used by the U.S. Department of Commerce rather than that employed in contemporary budget studies. Thus, tobacco was not considered to be a portion of recreation in the 1930s, even though the budget study of 1934–36 classified it as such. Again, the 1918 budget study recreation classification was made more comparable with current notions by adding musical instruments, talking machines, cameras, dues, and reading (see note to table A2).

[29] Obtained by extending the CPI with wholesale price quotes where necessary (see above).

[30] Rees (1961).

TABLE A2

RECREATION IN BUDGET STUDIES OF 1918, 1934–36, AND 1950

YEAR	TYPE OF RECREATION EXPENDITURE										
	Play Equipment	Radios, TV, Phonographs	Records	Sheet Music	Musical Instruments	Cameras and Supplies	Newspapers, Magazines, and Books	Admissions	Club Dues	Other	Total Recreation Spending
	Percentage of Total Recreation Spending										
1918.....	9.5	6.5	2.8	5.2	11.6	...	20.9	20.4	6.5	17.0	100
1934–36...	4.2	9.1	0.3		2.1	1.1	28.8	34.9	3.7	15.7	100
1950.....	9.5	25.4	1.7		2.5	2.9	16.8	20.5	4.1	16.6	100

SOURCES: *U.S. Bureau of Labor Statistics Bulletin*, no. 357, 1918, no. 638, 1934–36. Special tabulation of 1950 Budget Study by Arnold E. Chase (personal communication, March 30, 1961): Division of Prices and Cost of Living, U.S. Bureau of Labor Statistics, Department of Labor.

TABLE A3

TIME SERIES USED IN ANNUAL-VARIATIONS MODEL

Year	Hours of Leisure per Week (L)	Per Capita Demand for Recreation (R)	Real Hourly Wage Rate* (W)	Relative Price* of Recreation ($P[R]$)
1929	101.3	50.1	83.2	96.9
1930	102.9	50.0	85.7	90.8
1931	104.4	46.5	90.5	88.0
1932	106.3	37.5	91.6	89.4
1933	106.7	35.7	91.3	88.8
1934	109.4	41.5	98.6	81.3
1935	108.3	43.9	98.3	80.1
1936	106.6	50.3	98.3	78.9
1937	106.9	54.3	102.6	78.7
1938	108.4	50.8	106.6	81.4
1939	107.9	54.3	109.1	81.6
1940	107.5	56.8	110.7	83.6
1941	106.7	62.1	114.9	81.2
1942	105.7	64.2	118.9	77.5
1946	106.7	85.9	138.1	85.1
1947	107.6	77.8	134.8	87.3
1948	108.3	67.4	136.4	96.6
1949	109.0	66.6	142.8	100.0
1950	108.9	73.5	155.8	98.4
1951	108.3	71.2	151.3	95.9
1952	108.0	74.1	156.2	92.9
1953	108.5	75.6	163.6	93.4
1954	109.6	77.1	169.4	92.2
1955	108.4	81.6	176.6	92.0
1956	108.1	84.5	184.3	92.0
1957	108.8	84.7	188.1	92.4
1958	109.1	83.6	189.0	93.5
1959	109.2	88.5	195.2	94.2
1960	109.0	89.7	200.0	95.0
1961	108.8	91.5	202.0	96.0

* Deflated by conventional measure: U.S. Bureau of Labor Statistics Consumer Price Index

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