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Chapter Author: Robert T. Michael

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Additional Empirical Evidence

THREE APPLICATIONS of the model are made in this chapter. The first utilizes a portion of the Bureau of Labor Statistics' 1950 survey of consumer expenditures, which is quite similar in nature to the 1960–61 survey used in the previous chapters. The second is a reexamination of some previously published evidence on consumption patterns in Israel. The environmental variable approach discussed above is used to interpret a pattern of behavior that was previously ascribed to differences in tastes. The third application is a very brief investigation of the demand for children. In all three, the approach developed in the earlier chapters offers a generally consistent interpretation of the observed effect of education on consumption patterns.

1950 BLS CONSUMER EXPENDITURES SURVEY

The Bureau of Labor Statistics' *Study of Consumer Expenditures, Incomes and Savings, 1950,* covering 12,489 consumer units, is similar in design and nature to the 1960 survey analyzed in the previous two chapters. In the 1950 survey the household data are published in cross-classified tables in which the mean expenditures and mean values of various household characteristics are given. One important difference from the 1960 survey is that the published form of the 1950 data is more extensively cross-classified. The empirical investigation discussed in this section is limited to the North region data, containing approximately 45 per cent of the households surveyed. These 5,724 households are cross-classified by disposable income (nine groups),

education (four groups), and city size (three groups) into 103 observations (five null cells).[1]

The average cell for these data contained slightly more than fifty households, compared to an average cell size of approximately eighty-seven households in the 1960 data. Recalling that the primary reason for using the grouped data from these surveys is to reduce the biases resulting from measurement error in the income variable, note that the more detailed cross-classification, which lowers the cell size, presumably reduces this bias less adequately. Also, with the more disaggregated data, we can generally expect smaller coefficients of determination, ceteris paribus, according to Cramer.[2]

The expenditures were again first grouped into goods and services. The goods component includes expenditures for food at home, alcohol, tobacco, housing (defined as rent paid by renters, as in the 1960 data),[3] utilities, housefurnishings, clothing, reading, and automobile purchases. The service component includes food away from home, household operations, personal care, medical care, recreation, education, automobile operations, and travel expenses other than automobile. These two items were regressed on total consumption expenditures, C, the education of the head of the family, E, the age of the head, A, and the household size, F, in the same manner as for the 1960 survey. The elasticity estimates are shown in Table 20.

TABLE 20
Elasticity Estimates for Goods and Services, 1950 BLS Data, North Region

Item	*Income Elasticity*	*Education Elasticity*	*Family Size Elasticity*	$\bar{R}^2$
Linear[a]				
Goods	0.934	−0.051	0.058	.991
Services	1.397	0.064	−0.472	.983
Constant elasticity				
Goods	0.909	−0.019	0.122	.994
Services	1.305	0.070	−0.382	.989

[a] The elasticities are evaluated at the means of the relevant variables.

[1] Even more narrowly defined cells—adding an occupational breakdown of seven categories—were available. These, too, were investigated, and Appendix D discusses some of the results.

[2] J. S. Cramer, "Efficient Grouping, Regression, and Correlation in Engel Curve Analysis," *Journal of the American Statistical Association*, March 1964.

[3] Since this housing variable is not defined for cells without renters, the goods component here had ninety-six observations, i.e., seven of the 103 cells had no renters. The service component does include all 103 observations.

These results are roughly the same as the corresponding ones for the 1960 data. In comparing these two sets of results, it must be kept in mind that the discussion in Chapter 4 holds the region constant by means of a South–non-South dummy, while the data here apply exclusively to the North region. As in the previous chapter, the goods component has an income elasticity of less than unity, while services are a luxury. The education effect in these two cases suggests that an increase in education consistently shifts expenditures toward the luxury, with an increase in family size shifting expenditures toward the necessity. It should be stressed, when interpreting these results, that the restriction on the weighted mean value of the education and family-size coefficients leaves only one degree of freedom for each coefficient in the two regressions.[4]

For these data, too, the Engel curve was estimated separately for each of the expenditure items. Here the zero values for expenditures were replaced by a value of one; the number of zeros for the items are shown in the table below.

Item	*Number of Zero Values for Each Item*
Education	10
Automobiles (purchases)	8
(Rent)[a]	(7)
Alcohol	2
Tobacco	2
All other	0

[a] Since the rental item had a zero value only where the percentage of renters in the cell was also zero, these observations were deleted (see footnote 3).

Table 21 presents the estimated income, education, and family-size elasticities for each item using the form which gave the highest adjusted $-R^2$. It is tempting to make a detailed comparison of these elasticities with those in Table 4. Readers making such a comparison should keep in mind that the 1960 data include all regions while the 1950 data include only the North. Notice, in particular, that housing and housefurnishings are luxuries in the 1950 data, that the education effects for clothing and leisure have reversed their sign, and that the travel expenditures are not comparable since automobile operations expenditures are included in "automobile" for 1960 and in "travel (service)" for 1950.

[4] Obviously, the constraint is not precisely satisfied in this case, since the two sets of point estimates contain different numbers of observations (see footnote 3).

For the fifteen items in Table 21, food at home, tobacco, and personal care are necessities with negative education effects; food away, housing, household operations, education, and the two travel expenditure items are luxuries with positive education effects. The remaining six items cannot be consistently interpreted within the context of the neutrality model for education. Alcohol, utilities, and medical care were similarly "nonneutral" in the 1960 data. The additional three items are housefurnishings, clothing, and leisure. One possible explanation for the results for housefurnishings and clothing lies in the durables bias discussed in Appendix B. If the smaller cell size of the 1950 data increases the durables bias, it could explain why the income elasticities are appreciably higher (and the education coefficients lower) in the 1950 estimates.

TABLE 21
Elasticity Estimates, 1950 BLS Data, North Region, Form with Highest $\bar{R}^2$

Item	*Income Elasticity*	*Education Elasticity*	*Family Size Elasticity*	$\bar{R}^2$	*Mean Expenditure*	*Form*
Food (home)	0.4328	−0.1179	0.6833	.9803	978	7
Food (away)	1.8361	0.0990	−1.5458	.8824	224	2[a]
Alcohol	1.3317	−0.5261	−0.2101	.8615	75	2[a]
Tobacco	0.7189	−0.6298	0.0944	.8931	72	4
Housing	1.2179	0.2273	−0.6465	.9030	553	7
Utilities	0.0514	0.4648	1.2426	.7765	171	7
Household operations	1.2807	0.3493	−0.6205	.9562	187	7
Housefurnishings	1.3450	−0.2416	0.0390	.9194	259	7
Clothing	1.4041	−0.0857	−0.2132	.9880	465	5[b]
Personal care	0.9123	−0.1228	−0.1231	.9769	88	5
Medical care	0.8688	0.1381	0.1760	.8724	201	7
Leisure	1.3987	−0.1995	−0.0131	.9688	218	7
Education	2.5419	1.2538	−0.3991	.7936	25	7
Auto (purchases)	1.1685	0.1285	0.5251	.8018	237	2[a]
Travel (service)	1.0299	0.0496	0.4473	.9615	256	5

Note: Regression forms are as follows:

1: $X_i = f(C, E, A, F)$
2: $X_i = f(C, E, A, A^2, F)$
3: $\ln X_i = f(\ln C, \ln E, A, \ln F)$
4: $\ln X_i = f(\ln C, \ln E, A, A^2, \ln F)$
5: $\ln X_i = f(\ln C, \ln E, A, F, (\ln C \cdot \ln E), (\ln C \cdot A))$
6: $\ln X_i = f(\ln C, \ln E, \ln A, \ln F)$
7: $\ln X_i = f(\ln C, \ln E, A, \ln F, (\ln C \cdot \ln E), (\ln C \cdot A), (\ln C \cdot \ln F))$

[a] In the three cases in which the dependent variable is linear, the adjusted $-R^2$ is considerably higher than in the best logarithmic form: food (away): 0.8824 (linear), 0.8447 (form 7); alcohol: 0.8615 (linear), 0.7843 (form 7); auto purchases: 0.8018 (linear), 0.7022 (form 5). In all other cases the logarithmic form gave the highest $\bar{R}^2$, but see footnote 3, Chapter 3.

[b] Uses $(\ln F)$ instead of (F).

To obtain a quantitative measure of the relationship between the income and education elasticities and of the implied elasticity of consumption income, regressions were run across Engel curves in the manner already discussed in the preceding chapters. The observations are the estimates for each item shown in Table 21; the regression was run once weighted by expenditure shares and forcing the intercept to be zero, and again in weighted and unweighted form without forcing the regression line through the origin. Table 22 indicates that in each case the slope coefficient—the estimate of the consumption-income elasticity—is positive, although not statistically significant. The point

TABLE 22
Summary of the Relationship Between Income and Education Elasticities Across Items, 1950 BLS, North Region

Weighting Procedure	*Means*		*Correlation*	*Regression*[a]		
	ϵ_{iE}	η_i	$(\epsilon_{iE}\eta_i)$	$\epsilon_{iE} = a + b\eta_i$		$\epsilon_{iE} = b(\eta_i - 1)$
				a	b	b
Weighted by expenditure shares	0.009	1.016	0.082	−0.047	0.055	0.056
				(−0.30)	(0.40)	(0.40)
Unweighted	0.052	1.169	0.410	−0.317	0.316	0.315
				(−1.25)	(1.62)	(1.75)

[a] t values are in parentheses.

estimate here, +0.05, is smaller than the estimates derived from the 1960 BLS data, as summarized in Table 18 for the forty-five categories of total expenditure (+0.11) or as summarized in Table 13 for the fifty-two detailed categories (+0.08).

Considering all the estimates of the slope coefficient from weighted regressions across items from Chapters 4, 5, and 6, as well as Appendix C, the value appears to be in the general vicinity of one-tenth when all items are included.[5] In this general sense the evidence from the 1950 BLS survey for the North region tends to support the conclusion drawn from the 1960 survey that the consumption-income elasticity is positive, although relatively small in magnitude.

Total consumption expenditure from the 1950 data was regressed as before on the other three independent variables to obtain an estimate of the elasticity of total consumption (or money income) with

[5] The subset of nondurables discussed in the previous chapter and in Appendix C consistently yields a higher estimate of the elasticity. The unweighted estimates for the whole group are not as easily summarized since they are considerably more erratic.

respect to education. The estimate of this elasticity, in double-log form, was 0.817 ($t = 10.79$), which is also quite similar to the estimate from the 1960 data of 0.793 (see Chapter 4). So the evidence from the earlier survey broadly supports the conclusions reached on the basis of the more recent BLS data in the last two chapters: in the context of the analytical framework suggested here, education appears to have a small positive effect on real full income, an effect which is smaller than the implied money-income elasticity of education when estimated by a single regression across expenditure elasticities.

CONSUMPTION PATTERNS IN ISRAEL

Reexamining the findings of two studies of consumption patterns in Israel within the theoretical framework developed in this study has yielded some interesting results. The first, by Liviatan, is based on a family expenditures survey of 6,500 Jewish wage-earning families living in cities of over 10,000 for the period May 1956–May 1957, with each month representing an independent sample of new families.[6] The unique feature of these data is that 5,800 of the families surveyed were immigrants, that is, the head of the family was not born in Israel.

Liviatan studied the consumption patterns separately for Euro-American (E) immigrants (4,211 families) and Afro-Asian (A) immigrants (1,581 families). For each of the two groups he estimated the equation

$$X = b_0 + b_1 C + b_2 \log S, \tag{6.1}$$

where X is the expenditure on the good, C is total consumption, and S is family size. The regression also held constant the duration of residence and occupation, given the assumption that these variables affect only the level and not the slope of the consumption functions.[7] The estimated income elasticities, computed at the overall sample means, are given in Table 23 below.

[6] Nissan Liviatan, *Consumption Patterns in Israel,* Jerusalem, Falk Project for Economic Research in Israel, 1964.

[7] The data were grouped by duration of residence and by occupation and the variables X, C, and S were expressed as deviations from their mean within the cells from the two-way classification. The effects of these two additional variables can be analyzed by adjusted means, discussed below. Also, for the regressions for nonfood expenditures, disposable income, Y, and family size, S, were used as instrumental variables since the data were not grouped by Y. For food expenditures, the log of C was used; see Liviatan, Chapters 4 and 5 for the details of the estimation procedure.

TABLE 23

Income Elasticities and Relative Levels of Consumption in Israel by Continent of Origin and Duration of Residence

Item	*Income Elasticity*		$\frac{E-A}{A}$ (Per Cent)	$\frac{EN-AN}{AN}$ (Per Cent)	$\frac{EV-AV}{AV}$ (Per Cent)	$\frac{AV-AN}{AN}$ (Per Cent)	$\frac{EV-EN}{EN}$ (Per Cent)
	Asian (1)	*European* (2)	(3)	(4)	(5)	(6)	(7)
Clothing	1.527	1.420	−27.5	−28.8	−21.2	−12.0	−2.6
Footwear	1.204	0.465	−15.8	−14.0	−10.0	−14.5	−10.5
Durables	1.505	2.313	−10.4	−7.7	−17.6	+12.8	+0.7
House maintenance	0.765	0.784	+16.7	+12.4	+14.3	+10.1	+11.9
Tobacco	0.482	0.776	−25.7	−16.2	−32.0	−3.6	−21.9
Education	2.001	1.216	+136.9	+92.3	+124.4	+29.3	+50.8
Literary	1.858	1.710	+93.4	+74.9	+99.6	+9.0	+24.4
Health	1.303	1.276	+70.0	+70.8	+31.4	+50.8	+16.0
Fees	1.403	1.240	+21.3	+25.6	+20.8	+4.5	−8.2
Entertainment	1.814	2.145	−4.7	+5.0	−21.6	+29.1	−3.5
Total food	0.582	0.516	−2.0	−0.3	−3.6	+0.5	−2.8

Source: N. Liviatan, *Consumption Patterns in Israel*, pp. 50–69.

The aspect of this Israeli study of particular interest in the context of the model developed here is that the continent of origin as well as the duration of stay in Israel are shown to have an effect on consumption patterns. Liviatan investigated the consumption level of various goods and related the differences in these levels to the continent of origin. From the fact that consumption patterns were found to differ between the two groups E and A after differences due to income and family size had been removed, Liviatan concluded, "We may therefore ascribe the remaining differences largely to differences in taste."

But since we can ascertain the relative educational attainment of the various continent groups, we may interpret their different consumption patterns as resulting from variations in the amounts of their human capital.[8] These educational differences are suggested by another Falk Institute publication, which states: "Continent of origin and length of residence in Israel are also connected with level of education: persons of European origin are concentrated in higher levels of education than persons from Asia and Africa, and the level of education rises together with the duration of residence in the country."[9] More specifically, Appendix E estimates the educational attainment of the four groups—European veterans (EV), European new immigrants (EN), Afro-Asian veterans (AV), and Afro-Asian immigrants (AN)—and indicates that the education level rises monotonically from (AN) to (AV) to (EN) to (EV), for males and females separately. Consequently, we can expect to observe that the more educated European veterans consume relatively more of the luxuries and less of the necessities (after removing the effects of money income and family size)—relative, that is, to the other groups. Similarly, the veteran Asians, AV, would be expected to shift their consumption pattern toward luxuries vis-à-vis the new immigrants from Asia, AN.

To test this, we may use Liviatan's study of differences in consumption levels by continent and duration of residence. This is done by an analysis of adjusted means. The adjusted mean, or calculated consumption level, is

$$X_j^* = \overline{X}_j + b_{1j}(\overline{C} - \overline{C}_j) + b_{2j}\,(\overline{\log S} - \overline{\log S}_j), \qquad (6.2)$$

[8] We compare the groups only with respect to years of formal schooling, but the continent of origin may reflect a more general human capital variable, including health and other forms.

[9] Ruth Klinov-Malul, *The Profitability of Investment in Education in Israel*, Jerusalem, Falk Project for Economic Research in Israel, 1966, p. 5.

where j is an index of continent of origin and duration of residence; $\overline{X}_j$, $\overline{C}_j$, and $\overline{\log S_j}$ are the average consumption of good X, total consumption, and log of family size in each group; and $\overline{C}$ and $\overline{\log S}$ are the overall sample means. The comparison of levels between groups does "not take into account the differences between the continents in occupational [or educational] structure and distribution by duration of residence. . . . [The] comparison therefore shows the differences between families of Asian and European immigrants who have the same incomes and family size but retain the occupational structure and distribution by duration of residence of their continent group as a whole."[10]

Columns 3–7 of Table 23 compare the levels of consumption for the eleven subcomponents of total expenditure by continent of origin (columns 3–5) and duration of residence (columns 6 and 7), expressing differences as a percentage of the less educated group's consumption level.[11] In column 3, for example, which covers families irrespective of duration of residence, a positive figure implies that the Europeans spent more on the good, with income and family size held constant. Our model leads us to expect positive values for goods with income elasticities greater than unity and negative values for goods with income elasticities less than unity. The same predicted signs hold for all columns, since all are defined in the same way—relative to the less educated group.

To determine how well this predicted relationship holds, we may use the two-way schematic diagram as before, without, however, referring to statistical significance. For the $(E - A)/A$ comparison in column 3 we have:

Human Capital	*Income Elasticity*	
	$\eta > 1$	$\eta < 1$
(+)	Education Literary Health Fees	House maintenance
(−)	Clothing Durables Entertainment	Tobacco Food

[10] Liviatan, *Consumption Patterns in Israel*, p. 64.

[11] For example, the X_A^* for clothing is 33.68 and the X_B^* is 24.42. That is, given the same income and family size (the overall mean income and S), the

In this instance the predictions held in six out of ten cases (footwear cannot be judged in intercontinent comparisons since its estimated income elasticity changes from 0.46 to 1.20 between continents). In each of the other four comparisons the predictions were at least as good: (EV — AV)/AV (column 5), 6 out of 10; (EN — AN)/AN (column 4), 7 out of 10; (EV — EN)/EN (column 7), 7 out of 11; and (AV — AN)/AN (column 6), 7 out 11. In all cases at least 60 per cent of the items were consistent with the model.

Of even more importance is the stability seen here, both internally and in comparison with the U.S. data. Seven of these items showed the same sign for each comparison; thus the ranking for, say, "literary" was: AN spent less than AV who spent less than EN who spent less than EV, which is as expected, given the education ranking of the four groups. Also, at least six of the items for these Israeli data are in the same "cell" as in the BLS data, and only one is consistently in another cell (health consumption, as defined here, is a luxury).

Our interpretation of these expenditure patterns goes far in resolving what was a puzzle to Liviatan. He states:

> The 'continent effect' works in the same direction both for newcomers and veterans . . . [and] . . . there is no general tendency for the differences between continents to be reduced (i.e., to be smaller for veterans). . . . While the effect of duration of residence on Asian immigrants lends itself to a simple interpretation—mainly, as a desire to imitate the European standards—it is difficult to rationalize the effect of duration of residence on *European* immigrants.[12]

He also indicates:

> For reasons we were not able to determine, the European immigrants tend to change their nonfood consumption patterns in precisely the same direction as the Asian immigrants.[13]

Our interpretation does not suggest that Asian veterans try to imitate Europeans or change their tastes toward European patterns. Rather,

Asian household (using *its* estimated coefficients) would spend 33.68 IL [Israeli pound] per month on clothing, etc. Then

$$(E - A)/A = (24.42 - 33.68)/33.68 = -9.26/33.68 = -0.275.$$

Given the same (mean) income and family size, the European household would spend 27 per cent less on clothing. Similarly, (EV — AV)/AV is the computed level of the European veterans' consumption relative to the computed level of the Asian veterans' consumption.

[12] Liviatan, *Consumption Patterns in Israel*, p. 67.

[13] Ibid., p. 10.

we suggest that they have more human capital than Asian newcomers, are consequently more productive in consumption, and thus have—and behave as if they had—more real income. Similarly, our interpretation of the European newcomers vis-à-vis European veterans is that the latter possess more human capital than the former, and thus have a higher real income through increased consumption income.

This same pattern exists when Liviatan briefly compares the behavior of "clerks" (nonmanual workers) with that of "laborers" (manual workers). He finds the clerks' educational level to be considerably higher than that of laborers and writes:

> The effect of occupation on nonfood expenditures tends to be in the same direction as the effect of continent. In particular, the pattern of differences between European and Asian immigrants is of the same type as the differences between clerks and laborers within each immigrant group. This suggests that the differences in nonfood consumption patterns between continents is primarily the result, not of the particular 'traditions' of the two continents as such, but of more general factors, such as formal education.[14]

In sum, in all of these comparisons between continents of origin, duration of stay, and occupation, the model developed in this study has proved useful in interpreting the observed patterns of consumption.

A similar study was made by Paroush based on the Israeli family expenditure survey for 1963–64, a more recent survey comparable in design and character to the one used by Liviatan.[15] Paroush also estimates income elasticities and family-size elasticities for the various components of total consumption, and compares the levels of consumption for the two continents of origin, E and A, by using the analysis of adjusted means. His relevant results are shown in Table 24.

With these data our two-way diagram shows:

Human Capital	*Income Elasticity*	
	$\eta > 1$	$\eta < 1$
(+)	Durables Culture	House maintenance Health
(−)	Clothing	Food Fruits Vegetables Footwear Tobacco

[14] Ibid., p. 71.

[15] Jacob Paroush, "Hefreshay Tzrechan Bain Schechavoth Ha-ochlusiah" ["Differences in Consumption Between Various Strata of the Population"],

TABLE 24
Income Elasticities in Israel by Continent of Origin, 1963–64 Survey

Consumption Item	*Income Elasticity* A	E	*Adjusted Means* $(E - A)$
Total food (excluding fruits and vegetables)	0.500	0.403	−6.29
Clothing	1.465	1.015	−6.97
Footwear	0.734	0.663	−1.10
Durables	1.079	1.173	+10.10
House maintenance	0.573	0.762	+7.73
Tobacco	0.478	0.494	−3.20
Education	1.322	0.941	+15.32
Culture	1.383	1.225	+4.29
Health	0.652	0.864	+8.11
Fruits	0.807	0.525	−0.62
Vegetables	0.379	0.369	−2.04

Source: See footnote 15.

Seven of the ten items are consistent with the prediction from the neutrality model (eight of eleven items if we include education as a luxury, which has been the case consistently elsewhere). Thus, the results for these data are also consistent with the predicted behavior in at least 70 per cent of the cases, and the configuration of the items in the two Israeli studies is quite similar. In explaining these gross comparisons of expenditure patterns by continent of origin, our model offers a fairly consistent interpretation and is a viable alternative to an explanation based on differences in taste.

CHILDREN AS A CONSUMPTION ITEM

Throughout this paper the family-size coefficients have been given several alternative interpretations—one based on complementarity, one based on production efficiency, and one based on externalities of scale. A discussion of the determinants of the family size itself is considered beyond the scope of this project, so the F variable has been taken as an exogenous one for the Engel curve analysis. If, however, the decision to have children *is* a conscious consumption decision on the part of the family, then the same reasoning applies to the consumption good "children" as to any other item in the commodity basket—if the income elasticity of children is less than unity, the effect of educa-

Riv'on Le Chalchlah [*Economic Quarterly*], June 1966. I am indebted to Jacob Paroush for bringing this study to my attention.

tion would be negative, given the positive value of $\epsilon_{Y_C E}$ and assuming "neutrality."

Using the 1960 BLS data, cross-classified in the same way as in Chapter 4, the average number of children under the age of eighteen was regressed on total consumption, education of head, age of head, region, and the percentage of nonwhites. The results are shown in Table 25. The linear regressions had 157 observations; the logarithmic regressions contained 142 observations, since they exclude those cells

TABLE 25
Elasticity Estimates on the Demand for Children, 1960 BLS Data

A. Simple Correlation Matrix

	Education	*Age*	*Family Size*	*Per Cent Nonwhite*	*Region*	*Children*
Consumption	0.536	−0.516	0.727	−0.633	−0.197	0.592
Education		−0.693	0.210	−0.599	−0.191	0.343
Age			−0.633	0.465	0.035	−0.772
Family size				−0.317	0.074	0.921
Per cent nonwhite					0.540	−0.308
Region						0.062

B. Regression on Number of Children

	ln C	E_1[a]	E_2	E_3	*Age*	*Per Cent Non-white*	*Region*
Children	0.6346	−0.4121	−0.1551	−0.0722	−0.0634	2.3707	0.0359
t values	(8.70)	(−5.41)	(−2.30)	(−0.56)	(−11.96)	(5.50)	(0.59)
Partial correlation	0.60	−0.42	−0.19	−0.05	−0.72	0.43	0.05

C. Mean Elasticities, Various Regression Forms

Form[b]	*Income Elasticity*	*Education Elasticity*	*Age Elasticity*	*Implied Consumption Income Elasticity*
1.	0.344	−0.537	−2.113	0.819
2.	0.347	−0.538	−2.094	0.824
3.	0.499	−0.943	−3.231	1.882
4.	0.340	−0.853	−3.098	1.292
5.	0.496	−0.763	−3.049	1.514

[a] E_1, E_2, E_3 are education dummies for high school, college, postgraduate; see Appendix C.

[b] Definition of form:

	Number of observations	$\bar{R}^2$
1: x = f (C, E, A, NW, R)	157	.769
2: x = f (C, E, A, NW, R)	142	.761
3: ln x = f (ln C, ln E, A, R)	142	.808
4: ln x = f (ln C, ln E, A, R, (ln C·ln E), (ln C·A))	142	.836
5: ln x = f (ln C, ln E, A, NW, R, (ln C·ln E), ln C·A))	142	.841

Regressions with 142 observations delete those with no children to permit logs.

having an average of zero children. (The linear form was rerun on the 142 observations for comparison.) In all the various forms, the income elasticity was less than unity—ranging from 0.340 to 0.499 (or higher when the education dummies were used). The education effect was negative, as expected, in all cases,[16] and the implied elasticity of consumption income, ϵ_{Y_cE}, considerably higher here than the average estimate from either Chapter 4 or 5. The education effect is stronger at lower levels of education, as seen from the three dummies that reflect the marginal effect of high school, college, and postgraduate schooling, respectively. The age effect is consistently negative, while nonwhites and Southerners have more children, ceteris paribus.

Considerable caution should be exercised in interpreting these results for children. First, the dependent variable is not the number of children ever born or raised by the household, but, rather, the number of children under eighteen. This explains the observed effect of age, since, obviously, older households have fewer young children. Second, the direction of causation between the dependent variable and the total consumption expenditure is not clear. While the number of children desired or demanded may rise with permanent income, total consumption expenditures probably rise as a result of increases in family size. This helps explain why the observed income elasticity from these regressions is higher than that ordinarily found for children. Clearly, much more work is required on this topic, and the results shown in this section are only suggestive.

[16] A possible alternative interpretation of the education coefficient could be that E is acting as a proxy for the opportunity cost of the wife's time and is therefore positively correlated with the price of children. This interpretation could also be made for the general consumption categories discussed previously, but relative "foregone earnings intensities" and relative substitution elasticities in production would determine relative price effects, and in the absence of some information on their magnitudes, such a model has no predictive ability. As additional knowledge is acquired about nonmarket production this analysis may be modified. As a first step our model appears capable of interpreting—and predicting—much of the observed behavior. (A difficulty which arises with this opportunity cost approach regarding the interpretation of the C variable was mentioned in Chapter 4, footnote 15.)