The Comparison of Farm and Nonfarm Households Consumption : A Case Study of South Korea

By Eui-Gak Hwang*

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I. Introduction

The objective of this paper is twofold:

(1) To obtain consistent estimates of Engel curves fitted to income and expenditure (and family size if needed) of the groups of households in South Korea.[(1)]

(2) To examine the hypothesis of differential consumption patterns with reference to the permanent income hypothesis. According to Friedman(1957) the difference in measured income elasticities of nonfarm and farm households is largely due to the stability of income.[(2)] The removal of the effects of transitory components of income would give the difference in permanent income elasticities of the two households. This remaining difference reflects differences in tastes and preferences.

Using the 1973 surveys of consumption expenditures of urban and farm households in South Korea, Engel curves for the following major categories of consumption are estimated for comparison.

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*The author is a post-doctoral research fellow in the Department of Economics, University of Chicago.

(1) In cross-section studies of demand relationships prices are not treated as variables. The reason is that all the households face the same market possibilities over the period of survey and there is very little perceptible variation in the prices confronting different households.

(2) See Friedman (1957), pp. 58-59.

X_1 = total food
X_2 = grains (rice, barley, and other cereals)
X_3 = meat, fish, milk, eggs, and processed food
X_4 = vegetables, seaweed and fruits
X_5 = condiments
X_6 = confectioneries, soft drinks and alcoholic drinks
X_7 = meals away from home
X_8 = housing (rents paid, rental value of owner-occupied housing, water charges, house repairs, furniture and utensils)
X_9 = fuel and light
X_{10} = clothing
X_{11} = education, reading and recreation, and stationery
X_{12} = medical and personal cares
X_{13} = transportation and communication
X_{14} = cigarettes and tobacco
X_{15} = other miscellaneous expenditures
X_{16} = entertainment and ceremonies (in rural areas)

X_{16} is included only for farm households. In rural areas, a considerable amount of family expenses are noneconomically spent on "entertainment and ceremonies" such as wedding, funeral, and traditional celebration and family memorial days.

II. Estimation Methods

1. Ordinary Least Squares

The traditional method of estimating Engel curve parameters uses either recorded income (Y) or total expenditure (C) as an independent variable in least square analysis.(3)

Neither Y nor C is, however, a satisfactory index of the true economic position of the family. The reason is that the observational errors in the variables (Y and C) result in biased and inconsistent estimates of the income elasticities of the various consumption categories. Aside from the

(3) See Houthakker and Taylor(1970), Summer (1959), Perry(1967), Crockett and Friend(1960) for various arguments either for supporting or not for supporting the use of Y or C as regressor.

obvious dangers of observational errors, the respondents frequently conceal or understate their income, and any attempt to inquire further into the matter will reduce the response rate of the survey.

Even if the recorded income were a perfectly accurate record of current income, Friedman (1957) argues that spending decisions are based on "permanent income" and thus the divergence between the empirical measure of income and its theoretical counterpart leads to biased and inconsistent estimates when Y instead of permanent income (Y^*) is used. This may be shown as follows: let us suppose that there is an exact relationship between the variables x^* and y^* such that

$$x_t^* = \beta y_t^* \tag{1}$$

but that these true variables are unobserved. Our sample consists of observations on the measured variables x and y that are related to the true variables by

$$x_t = x^*_t + U_t, \quad y_t = y^*_t + V_t \tag{2}$$

where U_t and V_t are the errors of observation.(4) Thus,

$$x_t = \beta(y_t - V_t) + U_t = \beta y_t + (U_t - \beta V_t) = \beta y_t + W_t. \tag{3}$$

It is often plausible to assume that the measurement errors have zero mean constant variances, that they are uncorrelated, and that they are independent of true variables so that

$$\begin{aligned} &E(U_t) = E(V_t) = 0 \\ &E(U_t)^2 = \sigma_u^2 \\ &E(V_t)^2 = \sigma_v^2 \\ &E(U_t X_t^*) = E(V_t Y_t^*) = E(V_t X_t^*) = 0. \end{aligned} \tag{4}$$

Then it is shown form (3) that the regressor (Y_t) is contemporaneously correlated with the disturbance:

$$\begin{aligned} E(y_t w_t) &= E[(y^*_t + V_t)(U_t - \beta V_t)] \\ &= E(y^*_t U_t) - \beta E(V_t V_t) - \beta E(y^*_t V_t) + E(V_t U_t) \\ &= 0 - \beta \sigma_{vt}^2 - \beta \cdot 0 + 0 \\ &= -\beta \sigma_{vt}^2. \end{aligned}$$

(4) For reference to permanent income hypothesis developed by Friedman (1957), x^*_t is equivalent to permanent consumption and y^*_t permanent income, and U_t is transitory consumption and V_t is transitory income.

In this case, the OLS estimator for equation (3) gives the asymptotic bias[5] as

$$\text{plim } \hat{\beta}-\beta=-\frac{\sigma^2_{vt}\cdot\beta}{\sigma^2_{y^*}+\sigma^2_{vt}} \text{ or plim } \hat{\beta}=\frac{\beta}{1+\sigma^2_{vt}/\sigma^2_{y^*}}. \tag{5}$$

Since $Ey^2=E(y^*+V_t)^2=Ey^{*2}+EV_t^2+2E(y^*\cdot V_t)^2=\sigma^2_{y*}+\sigma^2_{vt}$, equation (5) shows that the true slope will be underestimated.

2. Instrumental Variables

Measurement errors in the variables lead to biased and inconsistent estimates by the OLS method. Liviatan (1961) developed a method to obtain consistent estimates of the parameters of Engel curves by using the instrumental variable approach.

From (2) it is clear that if a matrix Z of instrumental variables can be found which is uncorrelated in the limit both with the disturbance term U_t and the measurement error V_t, then

$$\hat{\beta}=(Z'y)^{-1}Z'x \tag{6}$$

will be a consistent estimator of β, with asymptotic covariance matrix

$$Asy\ Var\ (\hat{\beta})=\sigma^2_{vt}\ (Z'y)^{-1}Z'Z(y'Z)^{-1}. \tag{7}$$

To illustrate an alternative instrumental approach, let us consider Liviatan's model:

$$X_i=\alpha_{o1}+\alpha_{1i}Y^*+U_i,\quad (i=1,\cdots,m)$$

$$C=\sum_{i=1}^{m}X_i=\alpha_0+\alpha_1Y^*+V \tag{8}$$

where X_i denotes expenditures on the ith commodity, Y^* is the true income (unobservable), the α's are constants and U_i and V are stochastic elements uncorrelated with Y^* in the cross-section data.

Since Y^* is unobservable, solve (8) for the observable variable X_i and C, which results in:

$$X_i=\beta_{0i}+\beta_iC+W \tag{9}$$

where $\beta_{0i}=\alpha_{0i}-\frac{\alpha_{1i}\ \alpha_0}{\alpha_1}$, $\beta_i=\frac{\alpha_{1i}}{\alpha_1}$ and $W_i=U_i-\beta_iV$.

Since C and W_i are both functions of V, they are correlated. Thus the OLS estimate of β_i is biased and inconsistent.

(5) For proof, see J. Johnston (1970) Chapter 9.

Liviatan used an instrumental variable Z which is correlated with X_i but not correlated with the stochastic elements U_i and V (and therefore with W_i) to obtain a consistent estimator of β_i in (9).

$$\beta_i=\frac{Cov(X_i, Z)}{Cov(C, Z)}=\frac{Cov[(\beta_{0i}+\beta_i C+W_i), Z]}{Cov(C, Z)}=\beta_i+\frac{Cov(W_i, Z)}{Cov(C, Z)}=\beta_i \qquad (10)$$

However, in reality it is difficult to find an instrument (Z) that would satisfy the condition of being uncorrelated with disturbances while being correlated with X_i. Therefore, Liviatan has shown the rationale for using Y as an instrumental variable (using the "indirect least squares") by proving that the ratio of the OLS estimates of a_{0i} and a_1 (denoted by $\hat{a}_{1i}$ and $\hat{a}_1$) in

$$X_i=a_{0i}+a_{1i}Y+U_1 \quad (i=1, 2, \cdots, n) \qquad (11)$$

and

$$C=a_0+a_1Y+U_2 \qquad (12)$$

is a consistent estimate of β_1 in (9). That is,

$$\hat{\beta}_i=\frac{Cov(X, Y)}{Cov(C, Y)}=\frac{\hat{a}_{1i}}{\hat{a}_1}=\frac{\alpha_{1i}\delta}{\alpha_1\delta}=\beta_i$$

where $$\hat{a}_{1i}=\frac{Cov(X_i, Y)}{Var(Y)};$$

$$\hat{a}_1=\frac{Cov(C, Y)}{Var(Y)};$$

$$\delta=\frac{Cov(Y^*, Y)}{Var(Y)}=1$$

Thus, $\hat{\beta}_i$ is a ratio between two least squares coefficients with Y as the independent variable, both of which are biased. The relative bias is the same, however, in both cases and therefore the ratio $\frac{\hat{a}_{1i}}{\hat{a}_1}$ is a consistent estimate of $\frac{\alpha_{1i}}{\alpha_1}=\beta_i$ (Liviatan, pp. 340-341).

3. Two Stage Least Squares

Two stage least squares (TSL) is, in fact, equivalent to the instrumental variable estimation with fitted value C in (12) being used as an instrumental variable for Y in (11). This method consists of two stages: In the first stage we find the predicted value of C by fitting OLS to the equation (12). In the second stage Y in (11) is replaced by C and then OLS is applied. The coefficient of C derived in the second stage is identical with the consistent estimate $\beta_i = \frac{\hat{a}_{1i}}{\hat{a}_1}$ obtained by the instrumental variable method.(6) Since TSLS is most convenient for computation, we adopted this method as our estimation method. Additional regression was also computed by introducing family size(7) as an explanatory variable to investigate the effect of family size on consumption. The equations (11) and (12) become as follows if N is included in the regressions

$$X_i = a_{0i} + a_{1i}Y + a_{2i}N + U_1 \qquad (11)'$$

and

$$C = a_0 + a_1 Y + a_2 N + U_2 \qquad (12)'$$

All equations are computed in log-linear form, because this provides superior fit, ease of interpretation and considerable reduction of heteroscedastisity.

III. Comparison Procedure of Consumption Patterns

To develop comparison procedure with reference to permanent income hypothesis, let us rewrite (11) and (12) in natural logarithm form:

$$\ln X_i = a_{0i} + a_{1i}\ln Y + U_1 \qquad (11)''$$

and

$$\ln C = a_0 + a_1 \ln Y + U_2 \qquad (12)''$$

Then, $\hat{a}_{1i}$ is an estimate of the measured income elasticity for X_i to be denoted by $\hat{a}_{1i} = N_{X,Y}$. Similarly, let $\hat{a}_i$ be an estimate of the measured income elasticity of total consumption to be denoted by $\hat{a}_1 = N_{C \cdot Y}$. Note that the ratio $\hat{a}_{1i}/\hat{a}_1$ is an estimate of the expenditure elasticity for X_1, to be interpreted as the true income elasticity ($N_{X_i \cdot Y^*}$) because this is a consistent estimate

(6) For proof of equivalence of these two procedures (or instrumental variable interpretation of TSLS) see Ronald J. Wonnacott and Wonnacott, Thomas H., *Econometrics* (John Wiley and Sons, Inc. 1970), pp. 358-364.

(7) Houthakker stated that "the most important of noneconomic variables is probably family size, or more generally, family composition" (Houthakker, 1968, p. 136). But as mentioned in the earlier chapter, there is usually a high correlation between household size and income. The simplest and most common way of accounting for variation in family size is to let consumption per capita depend on income per capita, that is the assumption of homogeneous of degree one. But this assumption fails to allow either for any economies of scale in consumption or for any differences in the age composition of households. To permit analysis of the separate effects of household income, size, and age composition on household coesumption, an appropriate specification of model with a set of variables should be derived, but this is beyond the scope of this study.

obtained by either IV or TSLS. Friedman (pp. 206-207) decomposes the elasticity of X_i with respect to measured income Y as

$$N_{X,Y}=\frac{dX_i}{dY}\cdot\frac{Y}{X_i}=\frac{dX_i}{dY^*}\cdot\frac{dY^*}{dY}\cdot\frac{Y}{Y^*}\cdot\frac{Y^*}{X_i}=\frac{dX_i}{dY^*}\cdot\frac{Y^*}{X_i}\cdot\frac{dY^*}{dY}\cdot\frac{Y}{Y^*}$$
$$=N_{X,Y^*}\cdot N_{Y^*Y}$$

But on the assumption that $C^*=k\cdot Y^*$ we obtain

$$N_{Y^*Y}=\frac{dY^*}{dY}\cdot\frac{Y}{Y^*}=\frac{1}{k}\,\frac{dC^*}{dY}\cdot\frac{kY}{C^*}=\frac{dC^*}{dY}\cdot\frac{Y}{C^*}=N_{C^*Y}$$

so that

$$N_{X,Y}=N_{X,Y^*}\cdot N_{C^*Y}$$

where C^* is permanent consumption.

But note that N_{C^*Y} is the same as N_{CY}, because when the regression of measured expenditures on measured income is computed from budget data for a group of families, the transitory component of measured consumption (C) tends to average out (Friedman, p. 205).

N_{X,Y^*} reflects the influence of tastes and preferences proper and N_{C^*Y} the effect of transitory components of measured income. Thus, the measured income elasticity $N_{X,Y}$ reflects both the consumer's tastes and preferences and the effects of transitory components of income (p. 207). Note that we obtained the true (permanent) income elasticity $\beta_i=\frac{\hat{a}_{1i}}{\hat{a}_1}$ by applying TSLS to both (12)′ and (11)′ and also the effects of transitory components of income $N_{CY}=\hat{a}_i$ by fitting (12)′. This explains the reason that, in order to assess the role of the stability of income as a contributing factor to the difference of consumption patterns, we need equations to be fitted by both OLS and TSLS. Thus, if we compute these regression equations separately for farm and nonfarm households, the results will provide the differences in intercepts and income elasticities of the two groups of families. Now let us postulate that the two households have identical intercepts (equivalent to identical "basic consumption" if we fit a linear equation instead of a log-linear equation) and/or identical income elasticities. In this case, the equality of income elasticity between the two households can be tested by the following dummy variable technique with pooled data.

$$\ln X=b_{0i}+b_{1i}\ln C+\gamma_{1i}(D\ln C)+U \qquad (13)$$

where $\ln C$ is the fitted value for $\ln C=b_0+b_1\ln Y+d_iD$,

and $D=1$ if the observation belongs to nonfarm families,
and $D=0$ if it belongs to farm families.[8]

Then, γ_{1i} in (13) indicates the difference in $N_{X_iY}*$ between two households, if the other regression coefficient ("intercept" if we do not include family size N in the equation) is the same for the two families. Note that this restricted γ_{1i} is not equal to the difference of income elasticities obtained by fitting separate regressions for farm and nonfarm families. (In the later case, we have the estimated values of intercepts which are not equal for the two groups.)

IV. Data

Data were obtained from the 1973 Bureau of Statistics (BS), Economic Planning Board and Ministry of Agriculture and Fishery (MAF) surveys of household's economy. The BS survey covered 1,800 urban salary and wage earners' families and the MAF survey included 2,517 farm sample families. The BS data were classified by monthly income and expenditure per household by income groups in all cities. The income groups were classified into eight classes, from under 19,999won and over in 7,999won intervals. For each income group, average family size was given. The MAF data were cross-classified by monthly living expenditures and size of cultivated land per household. In these data, size of cultivated land was classified into five classes, from under 0.5 cheongbo (hectar) to 2.0 cheongbo and over in five cheongbo intervals. For each size of cultivated land, average family income

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(8) Alternatively, the equality of intercept between the two households can be tested as follows:

$$\ln X_i = b_{0i} + b_{1i}\ln\hat{C} + d_{1i}D + U \qquad (13)'$$

where $D=1$ if nonfarm families,
0 if farm families.

Then taking conditional expectations of (13)'

$$E(\ln X_i \mid D=1) = b_{0i} + d_{1i} + b_{1i}\ln\hat{C}$$

$$E(\ln X_i \mid D=0) = b_{0i} + b_{1i}\ln\hat{C}$$

$d_{1i} = b_{0i} + d_{1i} - b_{0i} =$ difference in intercepts between the two families.

The conventional test of significance on b_{0i} is testing whether the farm families' intercept is significantly different from zero. The same test on d_{1i} is testing whether there is any significant difference between the two households' intercepts. If we wish to test whether the nonfarm families intercept is significantly different from zero, the hypothesis is $(b_{0i}+d_{1i})=0$, so we add the estimated coefficients to obtain $(\hat{b}_{0i}+\hat{d}_{1i})$ and compare this sum with the standard error

$$\sqrt{Var(\hat{b}_{0i}) + Var(\hat{b}_{1i}) + 2Cov(\hat{b}_{0i}, \hat{d}_{1i})}.$$

and family size were given.

Since these published data are grouped data,[9] we weighted these data by the number of households in each Y class for our actual computation purpose. The reason is that if we use the grouped data, the disturbance term $\bar{U}_h = \frac{1}{n_h} \sum_i U_{hi}$ where $i=1, 2 \ldots N_h$, is no longer homoskedastic; $\bar{U}_h$ is the mean of N_h independent variates with a common variance σ^2, so that $\mathrm{Var}(\bar{U}_h) = \frac{\sigma^2}{n_h}$. Hence this is heteroskedastic, and efficient estimation of β_{0i} and β_{1i} requires that the group means are weighted in all regression formulae with weights inversely proportional to the disturbance variance. By the above variance term, this means that the group means must be weighted by the n_h, that is, by the number of individual observations that they each represent in each income class.

V. Summary of Results

Table 1 shows income elasticities estimated by OLS and TSLS for farm and urban (nonfarm) households without including family size (N) in the regression equation.[10] Table 2 gives both the results of income and family size elasticities by OLS and TSLS. The majority of family size elasticities have negative sign because an increase in N makes the family relatively poorer. The family with an increase in N have less to spend on other commodities after an increase in expenditures on relatively necessary goods such as food.

The N_{CY} (total expenditure elasticity with respect to income) measures simply the fraction of total variance of income in the group contributed by permanent income, according to Friedman's permanent income hypothesis (PIH); hence the more stable income will result in a larger N. In case of log-linear form, the ordinary least squares estimate of N_{CY} measures (1)

(9) For the grouping of obervations, see J. Johnston (*Econometrics*, 1972), pp. 228-238.

(10) It must be noted that the formulation of regression equation with omission of family size variable (**N**) might have led to the bias of β_1 (estimated income elasticity) unless income and family size are uncorrelated. The direction of bias of β_1 depends on (*a*) the sign of β_2 (estimated family size elasticity) and (*b*) the direction of correlation between the omitted variable (**N**) and the included variable (*Y*). Since *Y* and **N** are positively correlated, β_1 if obtained from equation without including **N** is likely to be upward biased.

the fraction of total variance of logarithmic value of measured income in the group contributed by the logarithmic value of permanent component of income. On account of interpretation (1), the ordinary least squares estimate of N_{CY} varies inversely with the variance of measured income in the group. Thus, under the permanent income hypothesis of Friedman, a larger estimated value of N_{CY} reflects less volatile measured income in the group.(11) By comparison of the results in both Table 1 and Table 2, the estimated N_{CY} is much larger for nonfarm (urban) than for farm households. Thus we have an evidence that under the permanent income hypothesis the income of urban households is more stable than that of farm households. Also, the estimates of $N_{X,Y}$'s are all substantially larger for the urban group than for the farm group for most of items. Some estimatesof $N_{X,Y*}$'s(results for TSLS) for the farm families are larger than corres ponding estimates for nonfarm families but the difference in estimates of $N_{X,Y*}$ is smaller than the differences in estimates of $N_{X,Y}$ between the two groups of families in most cases.(12) Therefore, it may be concluded that the relatively smaller estimates of $N_{X,Y}$'s are partially attributable to more variable (unstable) income.

Table 3 shows the differences of income elasticities assuming that all other things are equal for the two groups of families. The value of t-ratio is also presented for testing the hypothesis of income equality. The coefficients in the table are the income elasticities of the nonfarm households minus the corresponding estimates of the farm households. Thus, any negative number indicates that farm families' elasticity is greater than the nonfarm families' elasticity by that magnitude. In the table, farm households' income elasticities forX_2 (food grains), and X_{16} (entertainment and ceremony) are significantly greater than those of urban households with N in the equation. In the majority of items, urban households have slightly larger income elasticities than farm households, revealing the differences in the magnitude of tastes and preference of urban over farm families.

In conclusion, the major differences in consumption patterns between farm and nonfarm families were mostly due to the income variability under the permanent income hypothesis. In addition, urban households showed also

(11) See equations (2.6) to (3.14) and also (2.16′) to (3.12′) in Friedman (1957), pp. 31-34.
(12) These results exactly conform to PIH. See Friedman (1957), p. 217.

slightly stronger preferences and tastes than farm households in most of the items with exceptions of X_2, X_8 and X_{16}. It is possible to further investigate this problem for several years to check whether there is any change in the consumption patterns overtime.

Table 1. Income Elasticities for Farm and Nonfarm (Urban) Households (Engel Coefficients without Including Family Size)

(Year=1973)

Dependent Variable	Urban Households[b]			Farm Households		
	OLS	TSLS	R^2	OLS	TSLS	R^2
C	0.90468 (0.03271)		0.9922	0.65611 (0.0340)		0.9920
X_1	0.72920 (0.01207)	0.80602 (0.01334)	0.9984	0.4252 (0.01742)	0.64813 (0.02655)	0.9950
X_2	0.37987 (0.01861)	0.41989 (0.02057)	0.9858	0.42883 (0.03186)	0.65359 (0.04856)	0.9837
X_3	1.0975 (0.02309)	1.2131 (0.02552)	0.9974	0.48011 (0.07080)	0.73175 (0.1079)	0.9388
X_4	1.0030 (0.03460)	0.1087 (0.03824)	0.9929	0.21919 (0.07926)*	0.33408 (0.0208)*	0.7183
X_5	0.87442 (0.05099)	0.96655 (0.05637)	0.9800	0.28434 (0.07032)	0.43338 (0.1072)	0.8450
X_6	0.99452 (0.02461)	1.0993 (0.02720)	0.9963	0.42617 (0.05838)	0.64955 (0.08898)	0.9467
X_7	1.6457 (0.1561)	1.8191 (0.1725)	0.9488	0.49101 (0.08517)	0.74836 (0.1298)	0.9172
X_8	0.71962 (0.1115)	0.79544 (0.1233)	0.8740	0.73340 (0.02690)	1.1178 (0.0410)	0.9960
X_9	0.67679 (0.05457)	0.74809 (0.06032)	0.9625	0.35409 (0.08615)	0.53968 (0.1313)	0.8492
X_{10}	1.0215 (0.02514)	1.1291 (0.02780)	0.9964	0.72538 (0.06535)	1.1056 (0.0996)	0.9762
X_{11}	1.6238 (0.08419)	1.7949 (0.09306)	0.9841	1.1019 (0.1054)	1.6795 (0.1607)	0.9733
X_{12}	0.93863 (0.04056)	1.0375 (0.04483)	0.9889	0.80296 (0.05397)	1.2238 (0.08226)	0.9866
X_{13}	1.1075 (0.05743)	1.2242 (0.06348)	0.9841	0.69379 (0.09889)	1.0574 (0.1507)	0.9425
X_{14}	0.69851 (0.04662)	0.77210 (0.05153)	0.9740	0.24180 (0.04807)	0.36853 (0.07327)	0.8940
X_{15}	2.0644 (0.1010)	2.2819 (0.1117)	0.9858	0.97044 (0.1774)	1.4791 (0.2704)	0.9089
X_{16}[a]				1.2292 (0.2071)	1.8735 (0.3156)	0.9215

Note: Figures in parentheses are standard errors.

* indicates only the coefficient which is not significant at 5 percent level.

a is estimated only for farm families.

b is salary and wage earner's households in all cities.

Table 2. Income and Family Size Elasticities for Farm and Nonfarm (Urban) Households(1)
(Engel Coefficients with Inclusion of Family Size Variable)

(Year=1973)

Dependent Variable	Urban Households					Farm Households				
	OLS		TSLS		R^2 ($\bar{R}^2$)	OLS		TSLS		R^2 ($\bar{R}^2$)
	Income Elasticity	Family Size Elasticity	Income Elasticity	Family Size Elasticity		Income Elasticity	Family Size Elasticity	Income Elasticity	Family Size Elasticity	
C	0.69530 (0.2565)	0.93907 (1.140)*			0.9931 (0.9904)	0.40580 (0.1075)	0.80683 (0.3397)*			0.9979 (0.9958)
X_1	0.6229 (0.05858)	0.47947 (0.3928)*	0.89502 (0.1274)	0.36109 (0.5125)*	0.9987 (0.9982)	0.32439 (0.07939)	0.32510 (0.2508)*	0.79937 (0.1956)	0.31986 (0.4067)*	0.9975 (0.9946)
X_2	0.36869 (0.1554)	0.65014 (0.6911)*	0.53026 (0.2235)	0.44781 (0.8996)*	0.9858 (0.9801)	0.17887 (0.07918)*	0.80577 (0.2502)	0.44078 (0.1951)*	0.45006 (0.4057)*	0.9974 (0.9947)
X_3	1.0740 (0.1926)	0.10523 (0.8563)*	1.5446 (0.2770)	−1.3452 (1.115)*	0.9974 (0.9963)	1.9122 (0.09141)	−1.9122 (0.2888)	2.6450 (0.2253)	−4.0462 (0.4685)	0.9973 (0.9947)
X_4	0.94934 (0.2880)	0.24085 (1.281)*	1.3654 (0.4143)	−1.0413 (1.667)*	0.9930 (0.9901)	0.35633 (0.4798)*	−0.44205 (1.516)*	0.87808 (1.182)*	−1.1505 (2.458)*	0.7298 (0.4595)
X_5	1.0955 (0.4142)	−0.9916 (1.842)*	1.5756 (0.5958)	−2.4713 (2.398)*	0.9811 (0.9735)	0.13330 (0.4208)*	0.48686 (1.329)*	0.32849 (1.037)*	0.22182 (2.156)*	0.8547 (0.7094)
X_6	0.82748 (0.1913)	0.74913 (0.8505)*	1.1901 (0.2751)	−0.36836 (1.107)*	0.9968 (0.9956)	0.60486 (0.3371)*	−0.57596 (1.065)*	1.4905 (0.8306)*	−1.7785 (1.727)*	0.9535 (0.9070)
X_7	1.0488 (1.276)*	2.6772 (5.673)*	1.5084 (1.835)*	1.2608 (7.385)*	0.9510 (0.9314)	1.1657 (0.12006)	−2.1748 (0.6339)	2.8725 (0.4945)	−4.4925 (1.028)	0.9880 (0.9760)
X_8	1.1122 (0.9151)*	−1.7609 (4.069)*	1.5996 (1.316)*	−3.2630 (5.296)*	0.8785 (0.8300)	0.70951 (0.1654)	0.07699 (0.5225)*	1.7484 (0.4076)	−1.3337 (0.8473)	0.9990 (0.9920)
X_9	0.6441 (0.4557)*	0.14519 (2.026)*	0.92683 (0.6555)*	−0.72523 (2.638)*	0.9625 (0.9475)	−0.06706 (0.4373)*	1.3575 (1.382)*	−0.16522 (1.078)*	1.4908 (2.241)*	0.8983 (0.7966)
X_{10}	0.78396 (0.1807)	1.0654 (0.8034)	1.1275 (0.2599)	0.00676 (1.046)*	0.9973 (0.9962)	0.23851 (0.1995)*	1.5694 (0.6302)*	0.58775 (0.4915)*	1.0952 (1.022)*	0.9942 (0,9884)
X_{11}	0.80403 (0.5984)*	3.6768 (2.661)*	1.1564 (0.8606)*	2.5909 (3.463)*	0.9885 (0.9839)	0.64731 (0.5632)*	1.4653 (1.779)*	1.5951 (1.388)*	0.17834 (2.885)*	0.9800 (0.9601)
X_{12}	0.46803 (0.2642)*	2.1106 (1.175)*	0.6731 (0.3799)*	1.4786 (1.529)*	0.9933 (0.9908)	0.44554 (0.2117)*	1.1521 (0.6687)*	1.0979 (0.5216)	0.26626 (1.084)	0.9946 (0.9802)
X_{13}	1.2844 (0.4732)	−0.79352 (2.104)*	1.8473 (0.6806)	−2.5283 (2.739)*	0.9846 (0.9784)	0.90741 (0.5915)*	−0.68857 (1.869)*	2.2361 (1.458)*	−2.4927 (3.031)*	0.9462 (0.8924)
X_{14}	0.86923 (0.3818)	−0.76569 (1.698)*	1.2502 (0.5492)	−1.9397 (2.210)*	0.9750 (0.9650)	0.56317 (0.1858)	−1.0359 (0.5871)*	1.3878 (0.4580)	−2.1556 (0.9522)*	0.9585 (0.9171)
X_{15}	0.77524 (0.6121)*	5.7817 (2.721)	1.1150 (0.8803)*	4.7346 (3.543)*	0.9926 (0.9896)	−0.25501 (0.6490)*	3.9500 (2.051)*	−0.62836 (1.599)*	4.4570 (3.325)*	0.9681 (0.9362)
$X_{16}{}^{a}$						0.10504 (0.9904)*	3.6236 (3.129)*	0.25888 (2.441)*	3.4147 (5.074)*	0.9530 (0.9060)

Note: (1) Due to high correlation between income(Y) and family size(N), the test powers are very weak. The problem of multicollinearity was discussed in Chapter 1. * indicates the coefficient which is not significant at the 5 percent level by two tail test. *a* applies only to farm households.

Table 3. Differences of Permanent Income Elasticities of Farm Households From Those of Urban Households[1]

(Year=1973;Number of Observations=13)

Dependent Variable	Without Including Family Size(N) in the Equation		With Inclusion of Family Size(N) in the Equation	
	Elasticities	t-Value	Elasticities	t-Value
X_1	0.012327 (0.009609)	1.283	0.019423 (0.004319)	4.497
X_2	−0.028745 (0.01440)	−1.996	−0.017048 (0.01211)	−14.081
X_3	0.066600 (0.007687)	8.666	0.0068567 (0.008004)	8.567
X_4	0.13423 (0.01128)	11.902	0.13922 (0.01044)	13.341
X_5	0.058534 (0.01081)	5.414	0.064927 (0.008087)	8.029
X_6	0.047882 (0.008264)	5.794	0.051525 (0.07573)	6.804
X_7	0.015014 (0.01700)	0.883	0.090019 (0.01680)	0.536
X_8	−0.004298 (0.008934)	−0.481	0.001169 (0.00642)	0.182
X_9	0.001792 (0.01143)	0.157	0.009930 (0.005932)	1.674
X_{10}	0.037880 (0.004468)	8.478	0.039381 (0.00461)	8.283
X_{11}	0.021104 (0.01388)	1.521	0.011556 (0.008282)	1.395
X_{12}	0.044644 (0.003957)	11.283	0.04664 (0.003413)	13.661
X_{13}	0.075374 (0.006118)	12.320	0.075647 (0.006734)	11.233
X_{14}	0.060422 (0.01255)	4.816	0.069308 (0.006728)	10.301
X_{15}	0.12378 (0.02239)	5.530	0.10958 (0.01570)	6.980
X_{16}	−0.54734 (0.01949)	−28.080	−0.53585 (0.01543)	−34.719

Note: [1] These coefficients are the differences of permanent income elasticities of farm households from those of urban (nonfarm) households by restricting all other regression coefficients (intercepts when we do not include family size as explanatory variable; intercepts and family size elasticities when we include N in the equation) to be the same for farm and nonfarm families. Thus, the numbers are the income elasticities of the urban families minus that of the farm families. Negative numbers (elasticities) mean that farm income elasticities are greater than nonfarm household's income elasticities. Also, the estimated t-values are given for testing the hypothesis of the equality of income elasticities, when other regression coefficients are the same for the two groups of families.

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