Rural Retail Sales and Consumer Expenditure Functions

David Henderson

Abstract. *An elasticity of retail sales with respect to farm, manufacturing, and transfer income is estimated for three community sizes and seven types of retail businesses The results indicate the aggregate marginal propensity to consume retail goods locally decreases in the smallest communities and increases in the largest communities when rural income increases The estimated elasticity ranged from minus 4 9 to positive 5 6 across the seven business types and three sources of income*

Keywords. *Elasticity, rural retail distribution system, community hierarchy*

Discussion about the economic vitality of rural communities and how to measure it has risen anew since the farm crisis of the early 1980's, the Conservation Reserve Program of the 1985 Farm Act, the drought of 1988, and the forthcoming rural development provision of the 1990 Farm Bill Most local impact models use one county or a set of counties as the impact area to quantify the effect of changes (*9*) [1] Using the county as a spatial unit of observation has been a traditional necessity because most annual local economic data are collected and reported at the county level County-level economic estimates, however, are not the best community indicators because not all communities within a county are homogeneous

Different communities within a county generally will have a different mix of economic functions, and some will be more integrated with the outside economy than others (*10*) Central place theory explains a hierarchy of communities where the number of retail functions performed at a community increases as the size (order) of a community increases (*6*) The theory predicts that the market relationship between retail business activity and rural demand will vary across communities in the hierarchy (*11*)

Larson's discussion of statistical inferences from spatially aggregated data alludes to two extreme solutions (*8*) One completely ignores the statistical problems of spatial aggregation, and the other solution uses only primary data collected from observations on individuals This article's statistical framework settles between the two extremes I decomposed the spatially aggregated county unit of observation into meaningful economic area units represented by individual Minnesota communities and developed a model that estimates the elasticity of retail sales by community size and type of retail businesses with respect to three sources of disposable rural income

A Theoretical Model of Community Retail Sales

Westward expansion of agriculture spawned most existing rural communities Retail businesses in each community were able to capture most local consumer expenditures because transportation difficulties impeded local consumers from shopping in more distant communities Today's realistic view of the rural community sees it as part of a larger retail distribution system which includes numerous different size (order) communities Rural consumers shop more frequently at more distant larger communities in the contemporary retail distribution system and no longer spend all of their disposable income in the nearest small community (*2*)

The contemporary rural retail distribution system unifies the individual communities through the maintenance of retail services that the smaller communities, as separate individual units, cannot support Given that different rural communities have different agglomerations of businesses in them and form a regional distribution system for retail goods, individual community market area boundaries are in a state of constant flux and are less well defined then in the past The consumer choice of what size community to shop at may depend more on the composition of family consumption than how close the nearest community is (*1*)

The neoclassical model's retail demand for an individual rural consumer is expressed as a function which maximizes utility subject to price and income levels, or analogously, as an indirect utility function in a cost minimization framework Neither the direct utility function nor the indirect utility function is readily observable, but an equivalent expenditure function is The consumer duality theorem states that the Marshallian demand function at the optimal level of utility equals the indirect utility function at given price and income levels and provides the theoretical link to the empirical expenditure function (*12*)

$$U^{*}[X(P\ Y\ ,\#)] = V(P^{*}Y^{*}), \tag{1}$$

$$[V(P^{*}Y^{*})]^{-1} = E(P\ U^{*}), \tag{2}$$

Henderson is an agricultural economist with the Agriculture and Rural Economy Division, ERS

[1] Italicized numbers in parentheses cite sources listed in the References section at the end of this article

where U refers to utility, P to a vector of prices, Y to a vector of incomes, * to the level of the variable or function at the optimal solution (quantity desired), and # to tastes and other endogenous arguments

Roy's identity formalizes the relationship between the unobservable utility function, which underlies the ordinary demand function, and income, which underlies the observable expenditure function (*12*) The optimal solution of the expenditure function with respect to changes in income is identical to the optimum solution derived from the demand function (*3*) The identity provides a rationale for empirically estimating demand for consumption goods without requiring direct information about the utility function of individual rural consumers [2]

$$
\begin{aligned}
U' &\equiv \delta V(P^*Y^*)/\delta Y_i \\
&\quad + [(\delta V(P^*Y^*)/\delta P_i)(\delta E(P^*Y^*)/\delta Y_j)], \\
U^* &\equiv -\delta V(P^*Y^*)/\delta Y_j \\
&= [(\delta V(P^*Y^*)/\delta P_i)(\delta E(P^*Y^*)/\delta Y_j), \\
U^* &\equiv -\delta V(P^*Y^*)/\delta Y_j)/(\delta V(P^*Y^*)/\delta P_i) \\
&= \delta E(P^*Y^*)/\delta Y_j, \\
&= \delta X(P^*Y^*)/\delta Y_j
\end{aligned}
\qquad (3)
$$

The identity empirically requires that the amount of disposable income ($\Sigma_j(Y)$) spent by a consumer at businesses in a community equals the consumer's expenditures ($\Sigma_j E(P^*Y^*)$) at businesses in a community, which, in turn equal the total retail sales ($\Sigma_n(P^*_h X_h)$) by retail businesses to the consumer in a community during a given time period

$$\Sigma_j Y \equiv \Sigma_j E(P^*Y^*) \equiv \Sigma_n(P^*_h X_h), \qquad (4)$$

where n is the number of retail goods, j an element of rural disposable income, and Y (Σ_j) total disposable income spent in the community by the rural consumer The Marshallian demand function generalized to n commodities and aggregated across all individuals obtains a continuous market demand function for each good (*3*) With prices constant and rural income as an independent identical distribution, the continuous community budget constraint is the horizontal summation of all individual consumer budget constraints (*12*)

$$\Sigma_i\Sigma_j\Sigma_k Y \equiv \Sigma_i\Sigma_j\Sigma_k E(P^*Y^*) \equiv \Sigma_i\Sigma_n\Sigma_k(P^*_h X_h), \qquad (5)$$

where k is the number of rural consumers and i refers to the communities where the consumers purchase goods

The identity does not constrain consumers to spending all of their total disposable income in any one nested community market but instead allows them to spend their disposable income at any community market in the hierarchy during a given time period The optimum solution to the theoretical community demand function with respect to income is identical to the optimal solution of the community expenditure function with respect to income

$$\delta\Sigma_i\Sigma_j\Sigma_k E(P^*Y^*)/\delta\Sigma Y = \delta\Sigma_i\Sigma_n\Sigma_k X(P^*Y^*)/\delta\Sigma Y \qquad (6)$$

Both the community demand function and the aggregate community budget constraint are linear and continuous so the result for the individual consumer from equation 3 generalizes to the community market of equation 6 Changes in the level of income shift the aggregate budget constraint, cause movement along the expenditure function, and alter retail sales in a community

Data and Model Specification

The Minnesota Department of Revenue furnished the retail sales data The data covered 1979-86 and included annual gross retail sales by community and by Standard Industrial Classification code The data contained information for 79 communities, of which 2 averaged 219 retail businesses per year over the period, 10 averaged 101, and the remaining 67 averaged 40 The 79 communities were divided into three mutually exclusive groups based on the number of retail establishments to identify the community hierarchy of the region [3] Data for the independent variables were collected from the Census of Agriculture, Census of Population, and the Bureau of Economic Analysis of the Department of Commerce

The empirical community demand function must have a variable that accounts for the mutual attraction of a larger number of retail businesses being located in the bigger communities (*4, 6*) The community hierarchy variable must be endogenous because the larger set of goods offered in the bigger communities affects rural consumers by inducing them to spend a higher proportion of their disposable income in the larger communities than in the smaller communities (*1, 10*) The community demand function, with a community hierarchy, was identified as follows

$$\Sigma_n\Sigma_k D(x) = f(P\ Y\ H\ ,\#), \qquad (7)$$

where D is aggregate demand summed across all goods (n) sold in community i and all consumers (k) who purchase goods in community i, x is aggregate

[2]Community utility functions traditionally have been derived from an aggregation of individual indifference curves (*11*)

[3]The hierarchy was constructed so the variance of the independent variable was approximately equal across the three community size groups Other stratifications that did not equalize the variances increased heteroskedasticity in the estimates

retail sales in community i, P is a vector of prices, Y is a vector of disposable incomes spent in community i, H is a variable that accounts for the community hierarchy effects of different sets of retail goods being sold (purchased) in different size communities, and # are tastes and other endogenous arguments

Two models were specified, the first to estimate the elasticity of aggregate retail sales in communities of different sizes with respect to different sources of rural income (farm, manufacturing, transfer payments), and a second model to estimate the elasticity of retail sales by business type with respect to the basic sources of rural income by community size In both models, equation 7 was specified as [4]

$$C_{iht} = \alpha + \beta Y_{jt} + \beta HY_{jt} + \beta P_t + \beta CP_t + \beta FN_t + \beta OCP_t + \beta ROY_t + e_{iht}, \quad (8)$$

where C is real retail sales (deflated by the implicit price deflator) by community (i = 1 79) and retail business type (h = 1 7), α is an intercept term, β are parameters to be estimated, Y is the rural income of interest (j = farm income, or manufacturing income, or transfer payments), P is a Minnesota consumer price index, H is a dummy variable used to stratify the communities by size, CP is the population of each community, FN is the number of farms in a county, OCP is open country nonfarm population in a county, ROY is total personal income minus Y_j and minus the income from the retail sector of interest in the county in which the community was located, t refers to year (1979-86), and e is a random additive error term The equation was specified to facilitate estimation of the elasticity of retail sales by community size with respect to different sources of basic rural income with price (P), total population (CP + OCP + FN), and all other income (ROY) intended to control for the other observable endogenous arguments

The model estimates coefficients on farm, manufacturing, and transfer income separately because of their contribution to basic income in the rural economy of the region and because the relationship between the different income sources and retail sales may vary Families who derive their income from farming are at a different income level and could have different tastes than families who earn income from manufacturing income or transfer payments If the relationship between the different basic incomes and retail sales differs by community size, then changes in the income levels will have a different impact on the rural retail distribution system

The estimated partial derivative of retail sales with respect to a rural income leads to inferences about the marginal propensity to consume retail goods locally by source of income, type of business, or size of community over the period A positive derivative indicates that an increase in the income of interest leads to higher rural expenditures and a higher marginal propensity to consume retail goods locally A negative derivative indicates that an increase in the income of interest leads to lower rural expenditures and a lower marginal propensity to consume retail goods locally

The sign of the partial derivative of retail sales with respect to income at the community level reflects changes in rural expenditure patterns within the rural retail distribution system (*2*) Other things being equal, changes in rural expenditures at businesses increase or decrease total retail revenues (sales) and partially determine the profit of retail businesses in different size communities (*11*) When profit levels of retail firms change within the rural retail distribution systems, some communities become better locations for retail businesses than other communities Over time, the retail distribution system of the area changes as the number of different types of retail businesses within the different size communities adjusts (*4*)

Estimation

A Generalized Least Squares (GLS) regression procedure was run on the cross-sectional time series data as the error could have had both heteroskedastic and autoregressive attributes Heteroskedasticity was anticipated in the data and was minimized in the estimation and sampling procedure The study area was constructed from contiguous counties that were homogeneous with respect to the independent variables used [5] The construction of the hierarchy dummy variable equalized the variance of the independent variable across the three community size groups

The observation on the dependent variable is at the community level and the observation on the independent variable is at the county level The independent county-level observations (Minnesota Crop Reporting District 7 plus Yellow Medicine County) are variables from identical distributions The identical distribution of the independent variables across the spatial units of observation establishes a zero covariance and independence (*7*) The sample design facilitates a special case of equivalency between the GLS (SUR) and the Ordinary Least Squares (OLS) regression techniques (*5*)

A first-order autoregressive parameter was estimated separately for each aggregate community market time series I estimated 237 autoregressive parameters across the 79 communities and 3 income categories for

[4]A linear model was chosen over other functional forms because of its better fit

[5]Chi-square homogeneity tests indicated approximately equal variances among the income variables across the counties, showing regional homogeneity and minimal heteroskedasticity

the aggregate community sales function. Not all retail business types were present in all the communities, so a total of 546 autoregressive parameters were estimated across 26 representative community markets and 3 income categories for the 7 business-type sales functions.

The model allows the value of the autoregressive parameter (p) to vary from one cross-sectional unit to another. To find consistent estimates of p, I used unbiased and consistent ordinary least squares coefficients to calculate regression residuals. The estimated residuals were employed in an iterative (15 iterations) Hildreth-Lu procedure which produced maximum likelihood estimates of each autoregressive parameter. The transformation matrices (Ω) were as follows:

$$\Omega = \begin{bmatrix} \sigma^2 V_1 & 0 & \cdots & 0 \\ 0 & \sigma^2_2 V_2 & \cdots & 0 \\ \vdots & & & \vdots \\ 0 & 0 & \cdots & \sigma^2_n V_n \end{bmatrix} \tag{8}$$

$$\text{where } V_i = \begin{bmatrix} 1 & p_i & p_i^2 & \cdots & p_i^{T-1} \\ p_i & 1 & p_i & \cdots & p_i^{T-2} \\ \vdots & & & & \vdots \\ p_i^{T-1} & p_i^{T-2} & p_i^{T-3} & \cdots & 1 \end{bmatrix}$$

and

$$P_i = \frac{\Sigma e_{it} e_{i,t-1}}{\Sigma e^2_{i,t-1}} \qquad (t = 2, 3, \ldots, T)$$

Results

The following sections present estimations of the equations and retail sales elasticities, followed by an explanation of the relationship between the estimated elasticities and the rural retail distribution system.

Equation Estimates

Table 1 shows the estimated equations for total retail sales for the three different sources of rural income. I had expected positive signs for all three incomes for the largest communities and negative coefficients for the smallest communities. The significance of the estimates indicates that the relationships between different rural incomes and aggregate retail sales can be efficiently estimated across different size communities.

Tables 2 through 8 show the estimated equations for each of the seven business types. I had expected both positive and negative signs on farm, manufacturing, and transfer income. The significance of the coefficients and high R^2 indicates the relationship between different rural incomes and retail sales can be efficiently estimated for different business types across different size communities.

Table 1—Estimated aggregate community retail sales equations by rural income source

Income source	Farm	Manufacturing	Transfer
Constant	−1,187,871	−828,563	−2,390,634
	(.5227)	(.6263)	(.2691)
Size of community			
Large	65.16	90.79	138.41
	(.0010)	(.0001)	(.0001)
Mid-sized	4.76	−50.87	−63.88
	(.0001)	(.0001)	(.0001)
Small	−58.54	−91.96	−138.57
	(.0097)	(.0001)	(.0001)
Control variables			
Residual income	−38.13	−32.98	−33.33
	(.0925)	(.1343)	(.1343)
Farm numbers	810.75	−157.91	796.32
	(.0005)	(.8603)	(.3030)
Price	−10,117.45	−12,171.12	3,928.67
	(.0153)	(.2276)	(.7718)
Community population	8,628.73	8,606.35	8,182.54
	(.0001)	(.0001)	(.0001)
Residual population	347.32	405.49	419.12
	(.1217)	(.0653)	(.0616)
R^2	.9774	.9776	.9782

Probable values are in parentheses. Rather than the author arbitrarily deciding the rejection region, the reader should exercise discretionary judgment in acceptance or rejection of the two-tailed null hypothesis of $\beta = 0$.

Table 2—Estimated SIC 52 (Building Materials) retail sales equations by rural income source

Income source	Farm	Manufacturing	Transfer
Constant	3,544,746	3,385,763	1,742,043
	(.0001)	(.0052)	(.2610)
Size of community			
Large	−11.41	27.01	−76.52
	(.0001)	(.0001)	(.0001)
Mid-sized	−68.37	−44.93	−137.96
	(.0001)	(.0001)	(.0001)
Small	−72.26	−52.71	−137.51
	(.0001)	(.0001)	(.0001)
Control variables			
Residual income	−51.49	−46.22	−53.28
	(.0002)	(.0015)	(.0002)
Price	−18,609.51	−16,199.38	3,770.94
	(.0052)	(.0120)	(.6840)
Farm numbers	−1416.33	−1406.85	−1665.43
	(.0019)	(.0271)	(.0046)
Community population	1,229.71	1,072.98	1,288.32
	(.0001)	(.0001)	(.0001)
Residual population	585.85	509.09	712.63
	(.0002)	(.0010)	(.0001)
R^2	.8987	.8986	.8972

Probable values are in parentheses. Rather than the author arbitrarily deciding the rejection region, the reader should exercise discretionary judgment in acceptance or rejection of the two-tailed null hypothesis of $\beta = 0$.

Table 3—Estimated SIC 53 (General Merchandise) retail sales equations by rural income source

Income source	Farm	Manufacturing	Transfer
Constant	−5,587,110	−6,140,654	−6 201,648
	(0189)	(0249)	(0391)
Size of community			
Large	26 18	−2 15	−36 88
	(0945)	(1102)	(0070)
Mid-sized	−18 03	−63 54	−139 88
	(0945)	(2870)	(0070)
Control variables			
Residual income	8 14	−14 69	−32 77
	(8266)	(6942)	(1343)
Farm numbers	2 02	861 41	−27 93
	(9989)	(6219)	(9840)
Price	11,611 12	11,525 03	25,205 65
	(4590)	(4529)	(1743)
Community population	1,003 04	1,153 74	1,048 05
	(0308)	(0097)	(0155)
Residual population	445 24	438 046	819 13
	(2278)	(2270)	(0337)
R^2	9145	9148	9226

Probable values are in parentheses Rather than the author arbitrarily deciding the rejection region, the reader should exercise discretionary judgment in acceptance or rejection of the two-tailed null hypothesis of $\beta = 0$

Table 4—Estimated SIC 54 (Grocery Stores) retail sales equations by rural income source

Income source	Farm	Manufacturing	Transfer
Constant	3,963,824	−2,322,447	23,030,665
	(1621)	(3146)	(0001)
Size of community			
Large	53 27	−165 36	942 69
	(7058)	(0016)	(0001)
Mid-sized	61 72	−52 75	1,012 44
	(0174)	(0007)	(0005)
Small	58 28	4242 52	1,210 91
	(1085)	(0002)	(0001)
Control variables			
Residual income	44 29	34 92	−23 49
	(0561)	(0476)	(1011)
Price	10,011 00	−3,287 84	−119,798 90
	(4388)	(7672)	(0001)
Farm numbers	8,812,19	4,147 71	411 63
	(0001)	(0184)	(7610)
Community population	1,222 01	2,072 98	1 571 83
	(0002)	(0001)	(0001)
Residual population	−1,136,90	−667 53	−2,864 90
	(0001)	(0024)	(0001)
R^2	9709	9828	9908

Probable values are in parentheses Rather than the author arbitrarily deciding the rejection region, the reader should exercise discretionary judgment in acceptance or rejection of the two-tailed null hypothesis of $\beta = 0$

Table 5—Estimated SIC 55 (Automotive Stores) retail sales equations by rural income source

Income source	Farm	Manufacturing	Transfer
Constant	5,058,931	1,886,383	−2,664,268
	(0584)	(4941)	(4375)
Size of community			
Large	−289 48	−122 37	−509 80
	(0001)	(0012)	(0001)
Mid-sized	−75 39	17 02	−395 17
	(0001)	(0012)	(0052)
Small	−148 77	−155 14	−496 37
	(0081)	(0001)	(0003)
Control variables			
Residual income	−95 45	−148 36	−65 87
	(0106)	(0005)	(1017)
Price	−12,492 19	17,602 63	45,620 40
	(4102)	(2773)	(0398)
Farm numbers	−4,426 88	−3,737 01	−3,504 69
	(0031)	(0423)	(0309)
Community population	3,763 13	3,834 73	3,751 03
	(0001)	(0001)	(0001)
Residual population	1,004 00	1,219 07	1,246 25
	(0114)	(0052)	(0043)
R^2	9177	9012	9071

Probable values are in parentheses Rather than the author arbitrarily deciding the rejection region, the reader should exercise discretionary judgment in acceptance or rejection of the two tailed null hypothesis of $\beta = 0$

Table 6—Estimated SIC 56 (Apparel Stores) retail sales equations by rural income source

Income source	Farm	Manufacturing	Transfer
Constant	3,398,875	2,985,463	2,799,896
	(0001)	(0016)	(0106)
Size of community			
Large	−42 98	−35 28	−30 06
	(0001)	(1097)	(0007)
Mid-sized	−15 86	−15 72	16 84
	(0001)	(1490)	(0007)
Control variables			
Residual income	−16 51	−16 42	−4 24
	(0895)	(1653)	(7104)
Farm numbers	1 497 33	−1,969 21	−1,685 59
	(0003)	(0008)	(0006)
Price	−18,545 00	−15 660 07	−19,497 76
	(0001)	(0036)	(0045)
Community population	801 14	813 37	805 04
	(0001)	(0001)	(0001)
Residual population	167 21	181 17	35 11
	(1045)	(1383)	(7718)
R^2	9393	9122	9243

Probable values are in parentheses Rather than the author arbitrarily deciding the rejection region, the reader should exercise discretionary judgment in acceptance or rejection of the two-tailed null hypothesis of $\beta = 0$

Table 7—Estimated SIC 57 (Furniture Stores) retail sales equations by rural income source

Income source	Farm	Manufacturing	Transfer
Constant	1,284,581	1,316,021	8,460,080
	(0939)	(0769)	(3644)
Size of community			
Large	57 54	21 72	51 94
	(0001)	(0169)	(0004)
Mid-sized	11 94	−15 81	2 16
	(0001)	(0002)	(0001)
Small	4 18	−7 41	6 28
	(0001)	(0169)	(0004)
Control variables			
Residual income	19 69	31 12	13 28
	(0375)	(0024)	(1644)
Price	−14,532 36	−17,714 94	−11,784 90
	(0008)	(0001)	(0401)
Farm numbers	1,893 81	1,516 44	1,916 63
	(0001)	(0008)	(0001)
Community population	64 32	66 28	85 22
	(5476)	(5611)	(4501)
Residual population	−242 31	−265 41	−176 71
	(0189)	(0111)	(0043)
R^2	8949	8876	8962

Probable values are in parentheses Rather than the author arbitrarily deciding the rejection region, the reader should exercise discretionary judgment in acceptance or rejection of the two-tailed null hypothesis of $\beta = 0$

Table 8—Estimated SIC 58 (Eating Places) retail sales equations by rural income source

Income source	Farm	Manufacturing	Transfer
Constant	−247,361	−267,130	−1,420,581
	(6846)	(6523)	(0446)
Size of community			
Large	29 63	31 65	1 17
	(0001)	(0316)	(0001)
Mid-sized	1 02	−5 72	−45 63
	(0001)	(0001)	(0001)
Small	−2 37	−10 21	−56 77
	(0001)	(0002)	(0001)
Control variables			
Residual income	−45 76	13 79	10 89
	(2210)	(0720)	(0453)
Price	−808 73	−1,238 90	8,376 50
	(8005)	(6962)	(0453)
Farm numbers	−145 76	−335 79	93 82
	(6115)	(3030)	(7381)
Community population	554 85	501 44	488 67
	(0001)	(0001)	(0001)
Residual population	−46 32	−59 98	9 97
	(5482)	(8968)	(8968)
R^2	9549	9548	8876

Probable values are in parentheses Rather than the author arbitrarily deciding the rejection region, the reader should exercise discretionary judgment in acceptance or rejection of the two-tailed null hypothesis of $\beta = 0$

Elasticity Estimates

The elasticities indicate that the aggregate community sales function tends to be more inelastic than the individual business-type sales functions (table 9) The aggregate community sales function elasticities are more inelastic because they represent an average estimate of the individual business-type elasticities The average aggregate community elasticity contains both positive and negative elasticities for particular retail business types, which when averaged together, tends to weight the aggregate community elasticity toward zero

The estimated elasticities, by income source, varied by both community size and business type The varying elasticities across retail business type, when source of income and size of community are held constant, reflect different marginal propensities to consume retail goods locally, by business type The varying elasticities across community size, when source of income and type of business are held constant, reflect different marginal propensities to consume retail goods locally, by community size The varying elasticities across income source, when size of community and type of business are held constant, reflect different marginal propensities to consume retail goods locally, by income source

The estimated derivatives, which determine the sign of the elasticity, were positive for all three income sources for the aggregate community sales function in the two largest communities The estimated derivatives, conversely, were negative for all three income sources for the aggregate community sales function in the smallest communities This implies that when income increases, the aggregate marginal propensity to consume retail goods locally declines in the smallest communities and increases in the largest communities This is consistent with both theory and previous research, which shows retailing activity in smaller communities continually declining and regional growth centers emerging in other parts of rural America (*2*, *4*)

Dynamic central place theory explains changes in the number of different business functions in communities of different size when the profit level of the firm changes (*11*) Within this contemporary class of models, rural community retail businesses represent a tertiary sector supplying consumer goods to a rural population (*6*) Other things being equal, changes in rural income are a shock that alters consumer expenditures, retail business revenue (sales), and profit levels of retail businesses

In the long run, as rural expenditures and the level of retail sales change for particular business types in the different size communities, some businesses will become more profitable and others less profitable The analysis indicates that, on average, an increase in rural income increases consumer expenditures and retail sales (revenues), causes positive economic profits, and induces retail businesses to enter the larger community markets The same increase in rural income, averaged across business type, decreases consumer expenditures and retail revenues (sales), causes real economic losses, and prompts retail firms to exit the smaller community markets Over the long run, this dynamic process influences adjustments in the central-place hierarchy and partially determines which goods are offered in the different size communities of the rural retail distribution system

Table 10 shows the distribution of retail business type, by community size, for the sample area The percentages represent the average chance of finding a particular type of retail business in a community of a certain size in the sample hierarchy during the period Previous research indicates that the relative frequencies of the retail business types, by community size, will change in the long run (4)

Consider the relative frequencies of SIC 58 (Eating Places) in table 10 and the estimated elasticities for SIC 58 in table 9 The estimated elasticities are negative for all income sources for the smallest communities The estimated elasticities, however, are positive for all three income sources for the largest communities This implies that if these sources of rural income increase in the future rural expenditures, retail sales, total revenues, and profits will continue to decrease for SIC 58 in the lowest level of the hierarchy and continue to increase in the highest level of the hierarchy This implies that the proportion of retail establishments of this particular type will decrease in the smallest communities and increase in the largest communities in the long run

Further examination of the tables reveals there are many similar tradeoffs between changes in rural income and the future distribution of the samples' central-place hierarchy Most of the tradeoffs occur within the same business type between communities of different sizes Over time, some type of retail businesses, such as SIC 53 (General Merchandise), could completely disappear from the lowest level of the hierarchy and be present only in the larger communities

Table 9—Estimated income elasticities for retail sales

Item	Standard Industrial Classification code[1]							
	SIC 52 sales	SIC 53 sales	SIC 54 sales	SIC 55 sales	SIC 56 sales	SIC 57 sales	SIC 58 sales	Total sales
Largest communities (2)								
Farm	−0 03*	0 06**	0 01	−0 33*	−0 25*	0 33*	0 11*	0 02*
Manufacturing	09*	− 01	− 02*	− 16*	− 24	15*	14*	01*
Transfer	− 32*	− 12*	13*	− 82*	− 25*	43*	01*	04*
Mid-sized communities (10)								
Farm	− 56*	− 13**	25*	− 17*	− 14*	28*	01*	01*
Manufacturing	− 19*	− 17	− 07*	02*	− 15*	− 19*	− 04*	− 02*
Transfer	−1 17*	− 96*	3 49*	− 87*	31*	05*	− 62*	− 05*
Smallest communities (67)								
Farm	−1 34*		28**	−1 55*		32*	− 13*	− 53*
Manufacturing	− 92*		63*	− 65*		− 47*	− 34*	− 46*
Transfer	−3 32*		5 63*	−4 91*		68*−	−3 28*	−1 33*

[1] Refer to *Standard Industrial Classification Manual*, Executive Office of the President, Office of Management and Budget 1987, for a complete description of retail activities included in the analysis Significance levels (two-tailed test of $\beta = 0$) * = 5 percent, ** = 10 percent Elasticities could not be estimated for the small communities in the case of SIC 53 or 56 because the sales data were not available

Table 10—Distribution of retail businesses by community order

Item	Standard Industrial Classification code							Community frequency
	SIC 52	SIC 53	SIC 54	SIC 55	SIC 56	SIC 57	SIC 58	
	Percent							
Community order[1]								
Trade centers	6	3	5	13	8	11	13	59
Satellite centers	4	2	3	6	3	4	6	28
Smallest centers	2	0	2	3	2	2	2	13
Sector frequency	12	5	10	22	13	17	21	100

[1] Distribution based on a representative sample of 26 communities that had four or more businesses in an SIC code for every year between 1979 and 1986

Conclusions and Implications

The elasticity of retail sales with respect to rural income varies by type of retail business, source of income, and size of community The varying elasticity of retail sales based on rural income by type of business and size of community implies that the marginal propensity to consume retail goods locally varies by source of income, type of business, and size of community The results demonstrate that different rural development strategies that change the various rural income sources will result in different adjustments in the rural retail distribution system

The estimates point to some retail business types having a better chance of success in some sizes of communities than in others This information could help both to decrease the failure rate for new small retail enterprises and to increase the efficiency of investment in Main Street retail businesses in rural communities Increasing the efficiency of investment and stabilizing rural retail businesses could enhance rural planning efforts and help provide a more stable general economic environment for public services in rural areas

References

1 Fothingham, A S "A New Set of Spatial Interaction Models The Theory of Competing Destinations," *Environment and Planning* Vol 15, 1983, pp 15-36

2 Henderson, David, Luther Tweeten, and Dean Schriener "Intraregional Development Agriculture and Nodal Adjustment in Oklahoma's Southern High Plains," *Regional Science Perspectives* Vol 18(2), 1988, pp 44-59

3 Henderson, James, and Richard Quandt *Microeconomic Theory A Mathematical Approach* New York McGraw-Hill Co , 1980

4 Johansen, H , and G Fuguitt *The Changing Rural Village in America Demographic and Economic Trends Since 1950* Cambridge, MA Ballinger Publishing Co , 1984

5 Johnston, J *Econometric Methods* New York McGraw Hill Co , 1984

6 King, Leslie J *Central Place Theory* Beverly Hills, CA Sage Publications, 1984

7 Larson, Harold J *Introduction to Probability Theory and Statistical Inference* New York John Wiley & Son, 1982

8 Larson, Robert "The Invalidity of Modifiable Areal Unit Randomization," *Professional Geographer* Vol 38(4), 1986, pp 369-74

9 Nelson, Marlys, and Lloyd Bender *Choosing Among Local Impact Models* RDRR-63 U S Dept Agr , Econ Res Serv , Nov 1986

10 Shaffer, Ron *Community Economics Structure and Change in Smaller Communities* Ames Iowa State University Press, 1989

11 White, R "Dynamic Central Place Theory," *Geographical Analysis* Vol IX, 1977, pp 226-43

12 Varian, Hal *Microeconomic Analysis* New York W W Norton & Co , 1984