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Analysis of Quality of Life and Rural Development: Evidence from West Virginia Data

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ABSTRACT This paper examines the relationship between quality of life, rural development, and several socioeconomic variables. The analysis utilizes data obtained from a survey questionnaire administered to a random sample of more than 2,000 residents in West Virginia, and spatial data obtained by geocoding the survey respondents' addressees. Quality of life is measured by a three-point categorical measure of overall satisfaction, and development is measured by a goods and services availability index. A simultaneous ordered probit model is used to examine the relationships. The empirical results are consistent with the theoretical predictions and indicate a simultaneous relationship between quality of life satisfaction and rural development.

Introduction

The economic development literature advances three main approaches to development: the growth-centered, the state-centered, and the people-centered approach (Van Zyl 1995). Here, the people-centered (quality of life, QOL) approach is utilized to investigate the effects of several factors that have been found in the previous studies (Clark and Oswald 1994; Gerdtham and Johannesson 1997; Gove et al. 1983; Mencken 1998; Sousa-Poza and Sousa-Poza 2000) to influence responses to questions about QOL, well-being, or happiness. This is done in an attempt to identify and measure the impacts of specific and definable regional forces, including government policies, on QOL and to examine how these variables relate to the development of rural West Virginia.

Historically, West Virginia's economy has been much more volatile than that of other states. Although a few geographic areas in the state are currently enjoying relatively strong economic growth, most of West Virginia, especially rural mining communities located in the central and southern regions, is experiencing little growth. Understanding how individuals in these distressed communities find ways to create life satisfaction is important because these subjective evaluations determine life adjustment and mobility behavior and are the basis of demand for public actions.

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The rest of the paper is organized into four sections. First is the introduction of the theoretical model on which the analysis is based. The theoretical model is adopted from Gerdtham and Johannesson (1997) and examines the relationships between happiness, health, and economic factors. Next, the analytical framework is presented for the ordered probit model, and then the data. Finally, the empirical results are discussed, followed by the conclusions.

Theoretical Model

Apparently, economic theory emphasizes the process by which individuals rationally allocate resources to meet their needs, thereby "producing" utility. Thus, individuals derive utility according to the following function:

$$U_i = U_i(h_i, x_i, s_i), \quad \text{where} \tag{1}$$

U_i represents utility or life satisfaction of individual i (i = 1, ... , I), h_i is the health status of individual i, x_i is a vector of private goods consumed, and s_i is a vector of socioeconomic variables that affect utility (Gerdtham and Johannesson 1997). Utility is maximized subject to the budget constraint: $Y_i = P_{xi}x_i + P_{mi}m_i$, where Y_i is the exogenously given income of individual i, P_{xi} is a vector of private goods prices faced by individual i, and P_{mi} is a vector of health goods prices faced by individual i.

The health variable (h_i) in equation (1) is produced according to a health production function:

$$h_i = f(m_i, h_{0i}, s_i) \tag{2}$$

where m_i is a vector of health goods such as medical care, and h_{0i} is the initial health status. Following several steps of derivation, the following indirect utility or life satisfaction function (V_i) is obtained:

$$V_i = V_i(h_i(Y_i, P_{xi}, P_{mi}, h_{0i}, S_i), Y_i, P_{xi}, S_i) \tag{3}$$

The exogenous variables (Y_i, P_{xi}, S_i) in equation (3) may influence quality of life either directly or indirectly through the intervening health variable.

The economic development equation (d_I) determines the linkage between county development

(I = 1, ... , 21), life satisfaction (V_i) and a set of socio-economic variables.

$$d_I = d(v_i(h_i(Y_i, P_{mi}, h_{0i}, S_i), Y_i, P_{xi}, S_i), Y_i, P_{xi}, S_i) \tag{4}$$

Similarly, the exogenous variables (Y_i, P_{xi}, S_i) in equation (4) may influence development either directly or indirectly through the intervening quality of life function (V_i). This suggests two alternative approaches to estimating the economic development model. First, the intervening health and life satisfaction variables can be modeled explicitly in the following equation system:

$$d_I = \beta_1 + \beta_2 Y_i + \beta_3 P_{xi} + \beta_4 S_i + \beta_5 v_i + \varepsilon_1 \tag{5}$$

$$V_i = \beta_6 + \beta_7 Y_i + \beta_8 P_{xi} + \beta_9 h_i + \beta_{10} S_i + \beta_{11} d_I + \varepsilon_2 \tag{6}$$

$$h_i = \beta_{12} + \beta_{13} Y_i + \beta_{14} P_{xi} + \beta_{15} P_{mi} + \beta_{16} h_{0i} + \beta_{17} S_i + \varepsilon_3 \tag{7}$$

Instead of estimating a three-equation model, equation (7) could be substituted for h_i in equation (6). Then a simultaneous approach would be employed to estimate equations (5) and (6). In the above equations β_1 through β_{17} are coefficients to be estimated and ε_1 through ε_3 are error terms with zero mean and constant variance.

Estimation Model

For relationships involving ordinal dependent variables the appropriate estimation techniques are ordered probit or logit models (Hanushek and Jackson 1977). These techniques take the ceiling and floor effects into account and avoid the use of subjectively chosen scores assigned to the categories. An ordered probit model is used for the analysis because the dependent variables are ordered responses.

Let V_i^* be a continuous, latent variable representing, for instance, the cardinal utility function of the individual. Linear dependence is assumed between the latent variable V_i^* and the variables X_i, and β and ε_i, respectively. Thus,

$$V_i^* = \beta X_i + \varepsilon_i, \quad \varepsilon_i \sim N(0, \sigma^2), \tag{8}$$

The variable V_i^* defines a variable v_i, related to the above-mentioned categories in the following way:

$$v_i = \begin{cases} 0 \text{ if } V_i^* \le \theta_0 \\ 1 \text{ if } \theta_0 < V_i^* \le \theta_1 \\ 2 \text{ if } \theta_1 < V_i^* \end{cases} \tag{9}$$

where $\theta = 0,1$ are unobservable thresholds. Denoting the cumulative density function of the standard normal distribution as $\Phi(\cdot)$, it follows that the probabilities of an individual for each category are given by:

$$\begin{aligned} &\text{Prob}\,[V_i = 0] = \Phi[\mu_0 - \alpha X], \\ &\text{Prob}\,[V_i = 1] = \Phi[\mu_1 - \alpha X] - \Phi[\mu_0 - \alpha X], \\ &\text{Prob}\,[V_i = 2] = 1 - \Phi[\mu_1 - \alpha X] \end{aligned} \tag{10}$$

with $\alpha = \beta/\sigma$ and $\theta_j/\sigma = 0,1$. Note that only the ratios β/σ and θ_j/σ are estimable (Dustman 1996). To correct for misspecification, a multiplicative heteroscedasticity simultaneous ordered probit model is used to estimate the structural equation systems (5) through (7).

In the estimation process, the issue of whether proximity to a hospital adds to quality of life satisfaction using spatial data generated from geocoded household addresses is discussed. Economic theory suggests that some measure of utility exists, u*, representing the net benefit [on QOL] of residing to an equivalent location with a hospital, an unobservable variable.

Let $W = 1$ if individual i resides close to a hospital (needs hospital access due to illness)

and 0 otherwise. Then, E[W] = P(close to a hospital) = π and var[W] = $\pi(1 - \pi)$. Individual utility or satisfaction is lower the further the distance from the hospital and the greater the subjective risk. Accordingly, three spatial weight matrixes (as described in the next section) are designed based on the location of the household from the closest hospital.

Data

The micro level data used were obtained from a QOL mail survey conducted in year 2001.[1] The survey was sent to 2,000 residents in twenty-one counties located in the southern and eastern panhandle regions in West Virginia.

The counties were chosen as representative samples of the poor and rich counties in the state. The two regions differ by their proximity to big metropolitan areas (Baltimore, Maryland, and Washington, D.C.) in the eastern panhandle region. The residents were selected randomly using telephone numbers and were asked to respond to questions about satisfaction with their daily life (Table 1). Secondary data were obtained from the Bureau of Business and Economic Research (BBER 2000) and the Regional Economic Information Systems (REIS 1998).

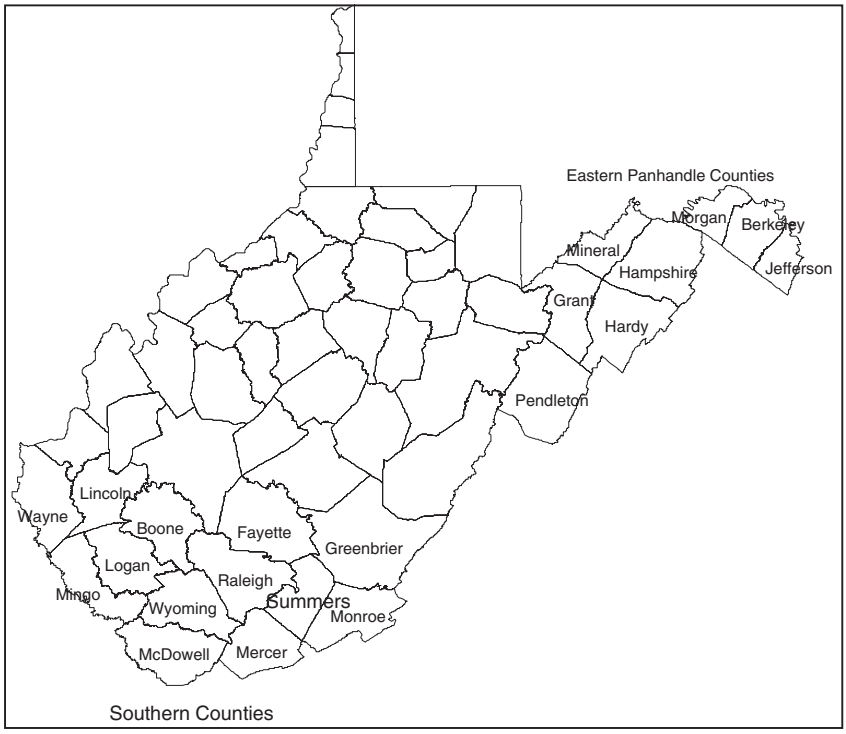

FIGURE 1. MAP OF WEST VIRGINIA.

TABLE 1. SUMMARY OF VARIABLES.

1. Dependent variables

a.) CATEGORICAL QUALITY OF LIFE SATISFACTION Assessment of personal satisfaction:
0 = the daily life is never a source of personal satisfaction,
1 = the daily life is sometimes a source of personal satisfaction,
2 = the daily life is a source of personal satisfaction most of the time.

b.) CATEGORICAL HEALTH INDEX Assessment of own health on a three-point scale:
0 = poor health, 1 = fair health, 2 = good health.

c.) CATAGORICAL DEVELOPMENT INDEX Assessment of the percentage of goods and services purchased outside the county of residence: 0 = 71% to 100%; 1 = 36% to 70%; 2 = 0% to 35%.

2. Independent variables

MALE	= 1 if male
RACE	= 1 if white
AGE1	= 1 if age is 18-34 years
AGE2	= 1 if age is 35-44 years
AGE3	= 1 if age is 45-64 years
AGE4	= 1 if age is >64 years
UNEMPLOYM	= 1 if unemployed
CIVIL STATUS	= 1 if the individual is not married or cohabiting
HPROBLEMS	= 1 if the parents or siblings had any health problems
EDUC1	= 1 if less than high school education
EDUC2	= 1 if high school education
EDUC3	= 1 if university education
INC1	= 1 if the gross annual income is in the first quartile of the income distribution, i.e., <$20,000
INC2	= 1 if the gross annual income is in the second quartile of the income distribution, i.e., $20,000–$25,353
INC3	= 1 if the gross annual income is in the third quartile of the income distribution, i.e.,$25,354–$34,075
INC4	= 1 if the gross annual income is in the fourth quartile of the income distribution, i.e., >$34,076
RELIGION	= 1 if religion is said to be a source of strength and comfort
AMENITIES	= 1 if there is a hospital or college/university in the county of residence
HEALTH0	= 1 if the health status is rated as bad health in the categorical health question

TABLE 1. (CONTINUED)

HEALTH1	= 1 if the health status is rated as fair in the categorical health question
HEALTH2	= 1 if the health status is rated as good in the categorical health question
LOCAL GOVT.	= 1 if the performance of the county government is rated as fair or good
REGION	= 1 if the individual lives in a county located in Southern WV.
GOVT. EDUC. EXP	= Government expenditure on education and training assistance in 1998
YEARS OF RESIDE	= 1 if more than 10 years of residence
NEIGHBORHOOD	= 1 if satisfied with the neighborhood as a place to live
ENVIRONMENT	= 1 if concerned with the quality of the environment in the county
SPATIAL EFFECT	= 1 if the household falls within the designed distance buffers

To generate the spatial data, the regions of analysis were defined as counties in West Virginia. Topological information was generated through geographical information systems (GIS). To create the spatial weight matrix that describes the linkages, the "address geocoding process" in ArcView 3.2 was used. This process created a theme based on addresses in a table, using a reference feature theme. The "reference theme" (street theme with address ranges on each street segment) is drawn from a TIGER (Topologically Integrated Geographic Encoding and Referencing) file, and the information is converted to an ARC INFO street coverage with address ranges in its attribute table. The data were obtained from ESRI-ArcData online (ESRI 2000).

Three distance buffers (one mile apart) were designed around the existing hospitals in the counties; and households that fall within the buffer zones were assigned an adjacency value of one (1); all other households were assigned adjacency values of zero (0). This process yielded weight matrixes[2] that were used to define three spatial dummy variables: SPATIAL1, if a household falls within the one-mile distance buffer around the hospital; SPATIAL2, if a household falls within the two-mile buffer; and SPATIAL3, if the household falls within the three-mile distance buffer. The reference category is the one-mile distance buffer (SPATIAL1).

To measure QOL satisfaction, many studies, particularly those conducted by psychologists, have used additive indexes of some kind (Ellen and Turner 1997; Vanfossen 1981; Gove et al. 1983; Sousa-Poza and Sousa-Poza 2000; Lu 1999). In compiling these indexes, researchers first determine a list of personal or neighborhood attributes that are deemed

important to individuals. Then they ask respondents to rate the attributes on a Likert-type scale, i.e., to express the extent of their agreement or disagreement with statements that reflect positive or negative attitudes toward these attributes. The ratings are then added up to generate an aggregate measure (Clark and Oswald 1994). Such aggregate measures of satisfaction have been deemed unreliable, however (Golant 1982; Gerdtham and Johannesson 1997), on the ground that an individual is likely to attach different levels of importance to various attributes of his/her life and that their weights are not likely to be well understood (Moore 1986).

This QOL index was obtained by asking a categorical question and rating the responses on a three-point scale. The ranking of the responses provides three levels of satisfaction. Similarly, the health index is represented by a categorical measure (Table 1). This type of categorical health measure has been shown to capture important information about the individual's health (Connelly et al. 1989) and to be an important predictor of mortality (Wannamethee and Shaper 1991; Kaplan and Camacho 1983; Idler and Kasl 1991).

Lastly, development is measured by a goods and services availability index. Traditionally, economic development is measured by variables like the rise in real per capita income or the extent of specialization. However, for distressed economies like southern West Virginia, such global measures of development may not capture the local sense of development. Thus, an index of development is formulated based on categorical questions about the approximate percentages of goods and services (groceries, small appliances, auto supply and repair, electrical services, gasoline, plumbing, etc.) that residents purchase outside the county of residence. The questions were rated on a three-point scale and used as a proxy for rural development (Table 1). This type of index is shown to capture local sense of development and to be a feasible indicator of rural development (McBeth 1993).

Empirical Results and Analysis

The overall simultaneous equation results suggest that the estimated equations capture a reasonable amount of the variations in the dependent variables. The goodness of fit value (pseudo R-square) is 0.211 and 0.244 in the development and quality of life satisfaction equations, respectively. However, the pseudo R-square as a measure of goodness of fit deserves only limited attention because it is chosen to maximize the joint density of the observed dependent variables rather than maximizing a fitting criterion based on prediction of y, as it is in the classical regression with R^2. To further examine the goodness of fit of the estimated equations, frequencies of actual and predicted outcomes of the simultaneous model are reported in Table 2. Based on the results in Table 2, the model predicts 579 of 1,028, or 56 percent of the observations correctly in the development equation, and 701 of 1,028, or 68 percent of the observations correctly in the quality of life equation.

Specifically, the development equation predicts that 898 of the total 1,028 respondents fall in the highest development category, as opposed to the observed 584 respondents. Similarly, the quality of life equation predicts that 429 of the total 1,028 respondents fall in the higher satisfaction category, as opposed to the observed 383 respondents (Table 2).

TABLE 2. FREQUENCIES OF ACTUAL AND PREDICTED OUTCOMES FOR 2SLS ORDPROBT MODEL.

	Development Equation Predicted					Quality of Life Equation Predicted			
Actual	0	1	2	Total	Actual	0	1	2	Total
0	34	18	74	126	0	351	0	0	351
1	11	14	293	318	1	1	107	186	294
2	12	41	531	584	2	9	131	243	383
Total	57	73	898	1028	Total	361	238	429	1028
Model Prediction				56%					68%

The predicted percentages are calculated as: (predicted/total sample) * 100.

In summary, the estimated results of the simultaneous ordered probit model suggest that the model explains a substantial amount of the variation in the dependent variables.

To control for heteroscedasticity in the data, the variance of the error terms was assumed to take the form: $\mathrm{Var}[\varepsilon_i] = [\exp(\gamma' zi)]^2$. The variables included in Z_i are income and government expenditure. The estimates of the variance functions based on the above specification suggest that income and government expenditure significantly explain the variation in the disturbance variances across observations.[3]

The estimated coefficients for the simultaneous equation system (equations 5 to 7) are presented in Table 3. To facilitate the interpretation of the results, the marginal effects of each explanatory variable on the dependent variables are reported in Tables 4 and 5 for the quality of life and development equations, respectively. It was hypothesized that QOL and development affect each other, with better QOL leading to a higher level of development and vice versa. The results from the simultaneous model support this hypothesis. In the development equation, the QOL variable is positive and statistically significant ($P < 0.05$). Similarly, in the QOL equation the development variable (DEVELOPM) is significant ($P < 0.01$). The results suggest that QOL has a stronger influence, in terms of probability, on development than development has on QOL. The marginal effect of QOL on the highest level of development is 0.398 (Table 4), whereas that of development on the highest level of QOL satisfaction is 0.105 (Table 5).

Looking at the effects of the demographic variables, being older and being single have larger probabilities of being associated with both development and QOL satisfaction. On the other hand, gender appears not to be a significant factor in the pursuit of development and in influencing an individual's level of satisfaction with life quality. The coefficient of the age variable (AGE4) is negative and statistically significant in the development equation, but insignificant in the QOL equation. This implies that counties with a high share of people sixty-four years of age and older are less likely to observe development than those with a high share of people less than sixty-four years old. The cause and effect

TABLE 3. ORDERED PROBIT MAXIMUM LIKELIHOOD 2SLS ESTIMATION.

Variables	Development Equation		QOL Equation	
	Coefficient	t-ratio	Coefficient	t-ratio
ONE	1.681***	4.128	0.305***	2.712
MALE	0.046	0.584	0.026	0.153
SINGLE	–0.182**	–2.813	–0.196**	–2.204
UNEMPLOYM	–1.373***	–15.223	–0.766***	–6.171
RELIGION	–0.142	–1.105	–0.590	–0.211
AGE2	0.301	1.294	0.266	0.740
AGE3	0.005**	2.303	0.145	1.140
AGE4	–0.504*	–1.643	–1.543	–0.530
EDUC2	0.298***	2.950	1.383***	20.877
EDUC3	0.281***	11.549	0.279***	12.677
WHITE	0.127*	1.814	0.0009	0.401
INC2	0.194**	2.332	0.279***	12.677
INC3	1.177**	2.085	1.297***	14.087
INC4	0.750***	6.408	0.220**	2.281
HEALTH1	0.383	0.262	—	—
HEALTH2	0.032	0.620	—	—
HPROBLEMS	—	—	–0.769***	–6.640
DURATION2	–0.128*	–1.823	0.062	1.318
LOCAL GOVT. SERVICES	1.171*	1.633	0.124	1.504
ENVIRON. SERVICES	0.250	0.753	–0.658**	–2.024
REGION	–0.087	–1.397	–0.304*	–1.732
NEIGHBORHOOD	0.0009	0.434	0.251**	1.944
AMENITIES	0.054	0.853	1.349*	1.775
GOVT. EXP. ON EDUC.	0.684e-01**	2.045	1.0613*	1.827
SPATIAL2	—	—	0.058	0.905
SPATIAL3	—	—	–0.587*	–1.746
QOL	0.181**	1.904	—	—
DEVELOPT	—	—	1.177***	3.157
μ_1	0.991***	19.342	0.750***	6.418
Interactions completed	25		23	
Sample size	1028		1028	
Log-L	–963		–963	
Model χ^2	40.71		40.71	
Pseudo R^2	0.211		0.244	
DF	1004		1003	

*** $p < .01$, ** $p < .05$, * $p < .10$.

TABLE 4. MARGINAL EFFECTS FOR 2SLS ORDPROBT: DEVELOPMENT EQUATION.

Variable	Y = 0	Y = 1	Y = 2
ONE	–.3955	–.3983	.7938
MALE	–.1519	–.1530	.3049
SINGLE	.0853	.0859	–.1712
UNEMPLOYM	.0529	.0532	–.1061
RELIGION	.0021	.0021	–.0041
AGE2	–.0066	–.0067	.0133
AGE3	–.0006	–.0006	.0012
AGE4	.0384	.0386	–.0770
EDUC2	–.1533	–.1543	.3076
EDUC3	–.2840	–.2860	.5700
WHITE	–.0463	–.0466	.0929
INC2	–.0217	–.0218	.0435
INC3	–.1478	–.1489	.2967
INC4	–.0663	–.0462	.1125
HEALTH1	–.0196	–.0197	.0393
HEALTH2	–.0036	–.0037	.0073
DURATION2	.0259	.0177	–.0436
LOCAL GOVT.	–.0529	–.0532	.1061
ENV. SERV.	–.0382	–.0356	.0738
REGION	.1353	.1343	–.2696
NEIGHBORHOOD	–.0125	–.0124	.0249
AMENITIES	–.0040	–.0040	.0080
GOVT. EXP.	–.0336	–.0829	.1165
QOL	–.1148	–.2833	.3982

relationship between age and development is not clear, however. It is possible, and in some cases likely, that a county's population is old because the economy has been lagging and young, working-age, people have left. In other words, it is possible that poor development causes demographic imbalance toward the elderly.[4] The effects of AGE2 and AGE3 are positive, but only AGE3 is statistically significant in the development equation. In the quality of life equation, the overall results suggest a U-shape relationship between age and quality of life satisfaction, with quality of life satisfaction being lowest in the age group forty-five to sixty-four years.

Similarly, the coefficient on the marital status variable (being single) is negative and statistically significant in both equations. This result makes sense, but again there is the question of cause and effect. Using Gary Becker's theory of marriage, one would argue that individuals living in stagnant or declining counties are less attractive as spouses because their economic future, which is linked to that of the county, does not look very

TABLE 5. MARGINAL EFFECTS FOR 2SLS ORDPROBT: QUALITY OF LIFE EQUATION.

Variable	Y = 0	Y = 1	Y = 2
ONE	–.3958	–.3980	.7938
MALE	–.1517	–.1532	.3049
SINGLE	.0853	.0859	–.1712
UNEMPLOYM	.0529	.0532	–.1061
RELIGION	.0013	.0013	–.0027
AGE2	–.0021	–.0021	.0041
AGE3	–.0136	–.0137	.0273
AGE4	.0073	.0060	–.0133
EDUC2	–.1533	–.1543	.3076
EDUC3	–.2364	–.2346	.4710
WHITE	–.0016	–.0003	.0019
INC2	–.0463	–.0466	.0929
INC3	–.6636	–.4627	.2009
INC4	–.2840	–.2860	.5700
HPROBLEMS	.1478	.1489	–.2967
DURATION2	–.0036	–.0037	.0073
LOCAL GOVT.	–.0196	–.0197	.0393
ENV. SERV.	.0217	.0218	–.0435
REGION	.1433	.1422	–.2855
NEIGHBORHOOD	–.0713	–.1836	.2549
AMENITIES	–.1069	–.1057	.2126
SPATIAL2	–.0170	–.0168	.0338
SPATIAL3	.0390	.0380	–.0770
GOVT. EXP	–.0044	–.0044	.0088
DEVELOPM	–.0528	–.0524	.1052

promising. In the quality of life equation, the observed negative effect on the marital status variable implies that unmarried individuals are less likely to be satisfied with the quality of their life than married people. These results conform to the findings of Gove et al. (1983), who showed that there is a strong causal relationship between marriage and quality of life.

As hypothesized, male gender and white race variables are both positive correlates of development and quality of life satisfaction, though only white race is statistically significant in the development equation. For gender, the marginal effect estimates (Table 4) imply that males are more likely than females to purchase less than 30 percent of the goods and services outside of their county of residence by 0.31 in probability. Similarly, the marginal effect estimates of the race variable suggest that white people are more likely to purchase less than 30 percent of goods and services outside their county of residence

than non-whites by a 0.093 difference in probability. In the quality of life equation the marginal effect estimates (Table 5) imply that males are more likely to be satisfied than females by a 0.31 difference in probability, and whites are more likely to be satisfied than nonwhites by a 0.002 difference in probability.

The results on the education variable are positive and highly significant in both equations. This conforms to the hypothesis about the effect of this variable. The results suggest that individuals without college education are less likely to contribute to both development and life satisfaction compared to those with a college or university education. These results could be interpreted to suggest that a more educated population encourages or triggers development. Once again, however, this model is incapable of differentiating between the cause and effect. Do educated individuals move to places with a growing economy, or do regions with an educated population grow more rapidly than other regions? Nevertheless, the findings concur with theory and with societal expectations that higher education attainment is associated with improved socioeconomic status, higher wage rates, and better health, all of which lead to better living standards. The marginal effects on the two education variables are 0.31 and 0.57 in the development equation and 0.31 and 0.47 in the quality of life equation.

Contrary to what is expected, no statistically significant correlation is found between being religious and health. Historically, theoreticians have seen religion as a powerful factor promoting good health among individuals (Yinger 1957) and in society, in general (Durkheim 1976). This presumption has endured in the theoretical literature, at least in part, because, as Ellison (1991) and Idler (1987) have suggested, religion appears to provide a variety of inducements to personal and community well-being, such as enhanced social integration and support. However, this view is not supported by the results of this study.

The correlation between the unemployment variable and the two dependent variables is negative, as expected. Unemployment affects development and quality of life simultaneously. For instance, earnings from the labor market are the primary source of income and savings for most families. Labor market earnings are determined by the unemployment rate, number of hours worked, and labor participation rate. Thus, unemployment leads to lower levels of quality of life and minimal development through reduced availability of savings funds that can be invested.

The signs of the coefficients of the income variables (INC2, INC3, and INC4) are positive and statistically significant in both equations. This implies that counties with higher household incomes or with higher after tax wages and salaries are more likely to have higher levels of development compared to their counterparts. Likewise, individuals with higher incomes are more likely to be satisfied with life, other things being constant. The marginal effects of the income variables are 0.044, 0.29, and 0.20, respectively, in the development equation, and 0.93, 0.20, and 0.57, respectively, in the quality of life equation. An interesting observation is that INC3 is associated with higher probabilities than INC4 in the development equation, although one would expect development to increase with income. The possible explanation for this finding might be that few individuals in

West Virginia fall within the fourth quartile of income distribution (i.e., above $35,000 in gross annual income).

The analysis also shows that government expenditures on education and local government services have positive and statistically significant effects on both development and QOL satisfaction. These results imply, for instance, that other things being equal, an increase in government expenditure on education would increase the probability of development in the counties. This is compatible with the findings from other studies. For example, Sander and Schaeffer (1988) found a positive relationship between spending on public education and employment growth. The marginal effect on the government expenditure variable is 0.034 and 0.009 for the highest levels of development and satisfaction, respectively. On the other hand, the results of local government service are not significant in the quality of life equation. The marginal effect on the local government services variable is 0.11 and 0.39 for the highest levels of development and life satisfaction, respectively.

Longer stay (DURATION2) has a negative effect on development, but a positive one on QOL satisfaction. At first sight, these results are not as expected because one would expect that over time, residents' attachment to the neighborhood may grow and consequently, the desire to attract business to enhance development would be a priority. However, the reverse is observed. This might be because of people's preference for the status quo and because of the local community's desire to preserve its unique social fabric, consisting of shared cultural traditions, association based on kinship and friendship, and strong personal commitment to the natural environment. Thus, change to them might be perceived as a disruption of their daily normal routines.

Looking at regional differences, evidence suggests that the southern region is less likely to attain development levels analogous to the eastern panhandle region. Likewise, individuals from the southern region are more likely to be dissatisfied with life compared to those in the eastern panhandle region. The coefficients for the regional variable are negative, but significant only in the quality of life equation. The marginal effects on the variable suggest that regional difference exerts a sizable amount of influence on both development and life satisfaction.

Health status, as hypothesized, shows a positive effect on development, but it was not statistically significant. The effect of good health (HEALTH2) seems to be greater than the effect of fair health (HEALTH1). In the quality of life equation, the proxy variables for the initial inherited health status, health problems in the family (HPROBLEMS), is negative and statistically significant. The marginal effects of being satisfied most of the time is 0.04 and 0.007 for HEALTH1 and HEALTH2, respectively, in the development equation and −0.3 in the quality of life equation, for if the parents or siblings had any health problems (HPROBLEMS).

Amenities, environmental services, and neighborhood variables have statistically significant effects, but only in the quality of life equation. Although there have been speculations that rural amenities might attract new firms (Glasmeier and Howland 1994), the exact package of amenities that leads to economic development remains unclear, and

the coefficient of the amenity variable is not significant in the development equation. As for the environmental services variable, a negative statistically significant effect is observed in the QOL equation, but a positive effect is observed in the development equation. Similarly, satisfaction with one's neighborhood as a place to live appears to play a significant role in enhancing quality of life satisfaction, but less of a role in the development equation.

Lastly, the spatial weight matrixes were included as a measure of utility, u*, representing the net benefit [on quality of life] of residing closer to a hospital, in addition to other aspects of geographical space, which could influence the analysis. In the quality of life equation, the two-mile spatial matrix variable (SPATIAL2) is positive but shows no significant effect. On the other hand, the three-mile spatial matrix variable (SPATIAL3) is negative and statistically significant. These results suggest that individuals residing at a distance more than three miles from a medical facility are more likely to report a lower satisfaction level. Alternatively, these results can be interpreted to mean that satisfied or dissatisfied individuals are not clustered within three miles around the medical facilities.

Discussion and Conclusions

In general, the results suggest that an array of social, economic, and government attributes influence quality of life satisfaction and development. Several findings are particularly interesting. First, marital status significantly affects satisfaction, with being single having a negative effect on both health and quality of life satisfaction. Several explanations support this finding. Some relate to the fundamental question of whether there exists a causal relationship between quality of life and marital status. Proponents of social role explanations suggest that men derive greater benefits from marriage than women do because men's roles are less stressful and more gratifying compared to women (Bernard 1972; Gove 1979). On the other hand, proponents of the selection explanation argue that healthy, happy people are more likely to be married than unhealthy, unhappy people.

Second, education is found to have a significant effect on quality of life satisfaction and development. EDUC3 (i.e., college or university education) was associated with higher probabilities than EDUC1 and EDUC2. These findings concur with theory and with societal expectations that higher education attainment is associated with improved socioeconomic status, higher wage rates, and better health, all of which lead to better living standards.

The single component that differentiates this study from previous studies is that this study attempts to address the issue of geographical space through the inclusion of spatial variables. It is acknowledged that the treatment of spatial dependence in discrete choice models is technically more demanding than addressed in this paper (see Smith and LeSage 2001; Anselin 2001; Bell and Bockstael 2000; Fleming 2002). However, by including spatial variables in the analysis (1) this paper allows greater insights into the nature and accuracy of the examined data; (2) it provides a more detailed understanding of the nature of relationships and their variation over space; and (3) it demonstrates the possible naiveté of conventional approaches to data analysis that often ignore spatial non-stationarity

(Fortheringham and Wegener 2000: 25-26). Related studies by Clark and Oswald (1994) and Gerdtham and Johannesson (1997) did not address the issue of space.

NOTES

1. Completed questionnaires were received from 1,060 individuals (return rate 53 percent), of whom 532 were female and 528 were male. Of the completed survey questionnaires, thirty-two (32) were discarded. The data used in the empirical analysis are based on 1,028 questionnaires (return rate 51.4 percent).
2. The first-order contiguity matrix is used (row-standardized so that each row's elements sum to one). The prestandardized form of this matrix, WP, is defined such that wp_{ij} is 1 if the i^{th} and the j^{th} observation share a common buffer, and 0 otherwise.
3. Due to space limitations these results are not reported here.
4. In reality, the relationship between age of the population and development is very likely to be simultaneous, that is, jobs go where workers are and workers go where the jobs are (see Richard Muth's famous article, "Migration: Chicken or Egg" [Muth 1970]).

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