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QUALITY OF LIFE ON THE AGRICULTURAL TREADMILL: INDIVIDUAL AND COMMUNITY DETERMINANTS OF FARM FAMILY WELL-BEING*

J. GORDON ARBUCKLE, JR.
IOWA STATE UNIVERSITY

and

CHRIS KAST
IOWA STATE UNIVERSITY

ABSTRACT

Individual quality of life (QOL) is a critical foundation of stable and cohesive societies. This research examines QOL among Iowa farmers, who as a group have seen their numbers decline precipitously over the past decades as the farm economy has undergone major restructuring processes. Farm families are nested in rural communities, many of which have also experienced persistent population loss and economic decline over the same period. A multilevel modeling approach is employed to examine determinants of subjective QOL over time, using 29 years of longitudinal data. Results point to positive relationships between household income, community vitality, and farm family QOL. Individual stress and economic dependence on farming were negatively associated with QOL. The finding that community vitality is a critical determinant of farm family quality of life supports long-standing appeals to increase investment in community development efforts.

By many measures, rural areas across the United States have experienced long-term stagnation or decline in well-being compared with metropolitan areas. Long-term trends of population and economic decline have been punctuated by crises (e.g., the Farm Crisis of the 1980s) that have precipitated major changes in quality of life for many rural people. These dynamics have been felt more strongly in the Midwest and Great Plains, where processes of agricultural consolidation and restructuring and loss of manufacturing jobs have led to population loss and concomitant declines in ability to provide necessary services among municipalities (Carr and Kefalas 2009; Johnson and Cromartie 2006; Longworth 2008; Morgan, Lambe, and Freyer 2009). Taken together, these long-term and ongoing processes

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have had a profound impact on the quality of life (QOL) prospects of rural populations.

Restructuring and consolidation processes have radically changed the face of agriculture over the past 70 years. Following the Second World War, the products of agricultural research and shifts in economic policy led to major changes in the U.S. agricultural sector (Altieri 2000; Redclift 1990). Mechanization, the development of crop varieties whose yields are highly responsive to chemical fertilizers, and the advent of agrochemicals for weed and pest control increased yields among the commodity crops that were the focus of agricultural research (Altieri 2000). Simultaneous policy efforts increased access to low-risk credit and other subsidies for machinery and off-farm inputs, and Extension-led promotion of the new practices sped the widespread adoption of specialized crop monocultures that were high-yielding, highly dependent on purchased inputs, and capital intensive (Altieri 2000; Gardner 2002; Redclift 1990). The substantial increases in yield and productivity, combined with decreased importance of labor in the production process, led to a swift decline in the number of farms and farmers. Between 1940 and 1999, the number of farms in the United States decreased from more than six million to just more than two million (Antle and McGuckin 1993; Gardner 2002).

The process whereby this increasingly capital-intensive and specialized production of a handful of commodity crops has fueled the long-term decline in farm numbers is often called the "agricultural treadmill" (Cochrane 1993). In short, the treadmill mechanism operates as follows. Because most farmers specialize in production of commodities such as feed corn or soybeans, which cannot be differentiated in the marketplace (i.e., Farmer John cannot claim that his feed corn is superior to Farmer Jane's, because for most intents and purposes, the corn is identical), they must take whatever the market price is when they choose to sell their crops. Because the price of grain is the same for all farmers, the farmers who earn profits are those who aggressively adopt new technologies that reduce production costs and boost yields relative to other farmers. While these "early adopters" profit from the use of new technology, once a given yield-enhancing technology is widely used, the resulting increases in supply lowers prices for all farmers. Only by 1) staying at the forefront of the technological curve, and 2) expanding their operations to spread costs over more acres, can farmers maintain viable enterprises. Historically, this expansion has come as farmers who cannot keep up with the treadmill are "cannibalized" by those who can (Cochrane 1993).

These changes in the agricultural sector have had substantial impacts on farm households and farming communities. The enormous increases in yields and productivity have not led to agricultural livelihood security among most of U.S. farmers. The USDA (United States Department of Agriculture) considers the threshold for farm economic sustainability to be gross annual revenue of $250,000 (Lobao and Meyer 2001). As of 2002, only 7 percent of farms met this criterion (Hoppe et al. 2007), meaning that the vast majority of U.S. farm families cannot sustain themselves through farming alone. Indeed, it is estimated that nearly 90 percent of farm household income is derived from off-farm sources (Lobao and Meyer 2001).

Assessments of rural America's current and future prospects beyond the farm gate, particularly in the Corn Belt Midwest, are increasingly negative. Evidence suggests that the farm policies and programs that have traditionally been the nation's *de facto* rural development strategies have hastened the decline of the diversified family farm that once served as a bulwark of rural society (Dimitri, Effland, and Conklin 2005; National Research Council 2010). Lacking policy and programs to address the consequences of that structural change, these processes have led to "de-development" of rural areas, through population loss, and increases in socioeconomic inequality (Falk and Lobao 2003). Recent research and journalistic accounts have drawn attention to phenomena such as the "rural brain drain," through which rural areas lose their best and brightest young people to urban areas where employment opportunities and quality of life are ostensibly better (Carr and Kefalas 2009), and a rise of "rural ghettos," where poverty and a sense of hopelessness among those who stay behind fuel rampant drug use (Longworth 2008; Reding 2009). The evidence cited above indicates that, in many areas and respects, rural quality of life is on the decline.

Simultaneously, however, quality of life is also seen as a foundation for rural development activities (Morgan et al. 2009). Rural residents have been found to express higher ratings of quality of life than their urban counterparts, particularly regarding their physical and social surroundings (Campbell 1981), and current economic development strategies are largely based on ways that rural areas can capitalize on that perceived advantage (Morgan et al. 2009). Indeed, the periodic "rural rebounds," or bursts of rural population growth that have occurred over the last several decades, mainly in metro or metro-adjacent counties or areas with high levels of amenities, have in large part been attributed to pursuit of better quality of life (Johnson and Cromartie 2006; Johnson and Rathge 2006; Thomas and Howell 2003). Migration or return to these rural areas has been tied to a desire to escape

the negative aspects associated with urban living, such as crime or a frenetic pace of life (Dillman and Tremblay 1977), or a wish to live in areas with abundant natural amenities, primarily mountains and bodies of water (Brehm, Eisenhauer, and Krannich 2006; Deller 2001; McGranahan and Beale 2002).

Farmers and farm families, especially in the U.S. Midwest, occupy a problematic space between the two sides of the rural quality of life coin. On the one hand, to the degree that they participate in the specialized production of commodities, they are denizens of a treadmill existence that demands constant individual innovation and success that over time leads to economic failure of fellow farmers and the decline in numbers of financially viable farms (Cochrane 1993). In addition, mounting questions regarding the nutritional value of food and social and environmental impacts of production processes have led to an increasing chorus of critiques of the U.S. food system from nutritionists, environmentalists, and social justice quarters alike (Hinrichs and Lyson 2007; Lyson 2004; Pollan 2007; Schlosser 2001). On the other hand, rural life is often seen as superior to urban living, in both physical and social aspects (Campbell 1981; Morgan et al. 2009).

Given that rural and farm life has been subject to such turmoil and change over recent decades, maintaining a research focus on quality of life in rural areas is important, especially among farmers. If high quality of life is the key to retaining rural populations, attracting new residents, and sparking rural economic development, continual improvement of our understanding of the determinants of rural quality of life is imperative. This study seeks to shed light on the determinants of quality of life among Iowa farm families.

This study employs a longitudinal, multilevel modeling framework to examine factors that have determined changes in Iowa farmers' perceptions of quality of life between 1982 and 2010. Our longitudinal data set spans the 1980s and the Farm Crisis (Elder Jr., Robertson, and Ardelt 1994), and continues through a period of accelerated restructuring throughout the U.S. food system that continues today (Dimitri et al. 2005; Heffernan and Hendrickson 2002). Our analytical approach allows us to conduct intra-individual and inter-individual comparisons to examine the influence of key variables—in particular community satisfaction and perceived community vitality—on subjective QOL among Iowa farmers over this turbulent time in U.S. agriculture.

QUALITY OF LIFE RESEARCH: MEASUREMENT APPROACHES

There are few constructs as nebulous to define and measure, yet so unanimously understood as critical to the stability of societies, as quality of life (QOL). Quality

of life is a general term, the meaning of which overlaps significantly with similarly imprecise constructs such as happiness, life satisfaction, and well-being. Despite the variation and vagueness of the terminology used, research suggests strongly that higher levels of QOL are associated with beneficial individual and societal outcomes, in that people with higher levels of well-being often contribute more to the generation and maintenance of social support systems (Diener and Ryan 2009). Indeed, individuals who rate their QOL as high have a greater tendency to engage in pro-social activities such as charity work (Diener and Ryan 2009) or peace activism (Diener and Tov 2007). These connections suggest that QOL is important at both the individual and societal levels.

Quality of life has traditionally been conceptualized and measured following two major approaches. The predominant approach, often labeled the "objective" or "social indicators" approach, tends to measure quality of life in terms of aggregate measures of social condition factors external to the individual. Such research largely uses measures that reflect general social circumstances present in a given time or place, such as levels of economic activity, employment, public health, or crime, to predict quality of life among individuals in society. Such factors are viewed as objective because their importance as contributors to quality of life is based in the normative ideals of society, meaning that most members of society would agree on the desirability or undesirability of a given indicator.

While the objective approach is perhaps still the predominant strategy for measuring quality of life, especially for national, regional, or global-scale research (Møller and Huschka 2008), there has been growing interest in subjective approaches to measurement of QOL (Diener, Helliwell, and Kahneman 2010; Diener and Suh 1997; Eid and Larsen 2008). Subjective indicators focus on the individual's judgment of their condition in life and are designed to gauge the opinion of the individual about their QOL. Questions comprising such measures typically ask respondents to rate their overall satisfaction with life compared with some standard. A major strength of the subjective approach is that it facilitates examination of both overall quality of life and the various domains that comprise it, such as work and the family (Tsou and Liu 2001).

An important thread of research on subjective QOL is social comparison theory. Festinger (1954) theorized that individuals generate self-evaluations in large part by comparing their own situation with that of people who surround them. More recent work suggests that people value social comparisons because they convey meaning that objective standards do not (Foddy and Crundall 1993). Foddy and Crundall (1993) proposed that objective measures of quality of life are only

meaningful insofar as individuals perceive them as superior, inferior, or on par with other individuals. In certain situations, social comparisons have even been preferred by the individual over objective standards (Miller 1977). Klein (1997) suggested that social comparisons are preferred in situations where they present a more desirable outcome than the objective information that is available. Wood and Wilson (2003) in their review of the literature on objective versus social comparison measures of quality of life concluded that, given the critical importance of social context in determining perceived quality of life, social comparison approaches to measuring quality of life may be as valuable as, or even preferred to, objective approaches.

The social comparison approach recognizes the role that cultural and material norms play in determining how individuals perceive their relative well-being (Easterlin 1995), and that people often assess their well-being—economic or otherwise—relative to some standard, whether the status of other individuals (Lance, Mallard, and Michalos 1995; Veenhoven and Ehrhardt 1995), or their own status over time (Diener and Ryan 2009). That is, individuals often rate their well-being as high if they believe that they are doing as well as or better than others around them (Klein 1997).

An important variant of this approach is within-individual comparison, in which people judge their well-being relative to their own past states or standards. This approach is called adaptation theory (Diener and Ryan 2009) or habit formation (Easterlin 1995) because although individuals often judge their current well-being relative to some past state of quality of life, they also can become accustomed to the level at which they may find themselves. A change in circumstances may cause an abrupt change in QOL assessment, but over time people adapt to their new station, whether higher or lower. Thus, social comparison, whether between or within individuals, has been found to play a major role in subjective appraisals of QOL.

This research follows the subjective approach to quality of life assessment. The main objective of the study is to examine the influence of community factors on quality of life among Iowa farmers and their families. The covariates include traditional measures of farm-structural and individual-level determinants of QOL as controls, but the primary contribution of this research to the body of work on farmer QOL is the inclusion of measures of farmer perceptions of community vitality and social comparison QOL as predictors. The following section examines the limited literature on quality of life among U.S. farmers and provides a rationale for expansion of farmer QOL research frameworks to encompass community-related variables.

QUALITY OF LIFE AND FARMING: FARM STRUCTURAL, INDIVIDUAL, AND COMMUNITY-LEVEL FACTORS

Interest in measuring the impact of the massive, ongoing restructuration processes that have marked the trajectory of U.S. agriculture has ebbed and flowed over the last decades. During and immediately following the Farm Crisis of the 1980s, public concern about rural and farm well-being spiked (Murdock and Leiseritz 1988). Much of the sociological research undertaken at the time examined the relationship between structural changes in agriculture—changes in acreage, sales, tenure and ownership, capitalization, labor relations, and so on—and the well-being of farmers (Coughenour and Tweeten 1986) and the communities where they lived and worked (Lobao and Lasley 1995).

While those two threads of research have led to important improvements in our understanding of how structural changes have affected individual and community-level quality of life (QOL), there remain critical gaps in the literature, especially regarding determinants of farm family well-being that are not farm-structural or individual in nature (Coughenour and Swanson 1992; Coughenour and Tweeten 1986). In this section we first examine research on farmer and farm family QOL to establish a rationale for inclusion of farm structural or individual variables as controls. Second, we look to research on community satisfaction as well as studies of the influence of social comparison within social networks on QOL and propose an expansion of the typical farm structural QOL assessment framework to include measures of community vitality. Because "…attitudes about personal well-being of community, family, home, work, and the like tend to be more closely interwoven for farmers than others" (Coughenour and Swanson 1992:80), a framework that includes key measures of community well-being may better explain variation in quality of life among farm families.

Farm Structural Factors

While the term farm structure can refer to a range of farm characteristics and linkages between individual farms and the food and fiber system, much of the research on farmer QOL has focused on the interrelated areas of income (both farm and household), farm size, and employment. Household income has consistently been positively related to QOL among the public (Diener and Diener 1995), although overall it is agreed that income effects are relative and dependent on comparisons to others (Diener and Suh 1997). This relationship appears to hold for farmers as well: Molnar (1985), Coughenour and Swanson (1992), and Coughenour

and Tweeten (1986) all found total family income to be positively associated with QOL.

Farm size, whether measured through acreage or income (net or gross), can be viewed as a measure of the farm's contribution to household economic well-being. In contrast with total household income, farm income has not been related to QOL. No significant relationship has been found between farmer QOL and net farm income (Coughenour and Swanson 1992), gross farm income (Molnar 1985), or acres of land operated (Molnar 1985).

Examination of the relationships between farm and off-farm employment and QOL has suggested a positive association between off-farm work and QOL. Molnar (1985) hypothesized that higher levels of off-farm employment would predict higher levels of QOL; while Coughenour and Swanson (1992) predicted that a farm family's ability to sustain itself more fully through farming would result in higher QOL. Both studies, however, found that increases in off-farm income were related to improvements in QOL.

Taken together, these findings suggest that the relationships between the economic dimensions of farm structure and quality of life may be tenuous. This finding may be due in part to the nature of the farm occupation and the satisfaction that farmers and farm families draw from the farm lifestyle (Coughenour and Swanson 1988). From an economic standpoint, overall household income may be what allows families to maintain their farming lifestyle and quality of life. Indeed, the consistent finding that off-farm work is a better predictor of QOL than farm structural factors (including farm income) (Coughenour and Swanson 1992; Molnar 1985) suggests that off-farm income might provide some income stability that serves to buoy farm family QOL. Accordingly, we hypothesize that overall household income is positively associated with QOL and greater household dependence on farm income is negatively related with QOL.

Individual-level: Personal Characteristics, Attitudes, and Stress

At the individual level, farmer quality of life research has focused on the traditional demographic variables age and education, as well as on attitudes and perceptions about farming and being a farmer. Age, net of health considerations, has long been associated with higher subjective ratings of quality of life (Diener and Ryan 2009), and results of QOL research with farmers has generally been concordant with studies of other groups. Both Molnar (1985) and Coughenour and Swanson (1992) found positive associations between age and assessments of QOL. Despite widespread popular belief in an inverse relationship between education and

subjective quality of life, education has been found to have a positive, but weak relationship with ratings of QOL (Diener and Ryan 2009). Results for farmers have been mixed: Coughenour and Swanson (1992) detected a negative relationship between education and QOL, while Molnar (1985) noted a slight positive association. While both age and education have been found to influence farmer QOL, we did not have data that would allow us to control for their influence in this study.

Other individual-level variables that can be strong predictors of subjective assessments of QOL are personal temperaments and attitudinal orientations, such as optimism or neuroticism, (Diener and Ryan 2009). Research on farmer QOL has found that satisfaction with farming as an occupation (Coughenour and Swanson 1992; Molnar 1985), self-appraised farming skill level (Molnar 1985), and optimism about the prospects of farming (Coughenour and Swanson 1992) are all fairly strong positive predictors of farmer QOL. In concordance with earlier findings, we hypothesize that satisfaction with farming would be positively related to QOL.

An area that has not been examined in-depth among farmers is the relationship between stress and quality of life. Stress is omnipresent in farming (Kjersti 2003), and stems from numerous sources such as the vagaries of agricultural policy, finances, lack of control over natural processes, personal hazards, and time pressure (Deary, Willock, and Mcgregor 1997; Murdock et al. 1988). Presence or absence of personal stress has been linked to QOL, especially in cases of illness (Ashing-Giwa and Jung-won 2009) and traumatic events (Landolt et al. 2009; Schnurr et al. 2009). Other research has demonstrated that stress has significant negative effects on QOL, even when controlling for such negative experiences (Masthoff et al. 2006). We hypothesize that personal stress levels would be negatively associated with QOL.

Community Level

Three tracks of research on community life can be viewed as at least indirectly focused on quality of life. The first type of study is concerned with the impacts that structural changes in farming have had on rural communities. Such studies generally consider the community to be the primary unit of analysis, and use aggregate measures of socioeconomic well-being such as income, poverty, unemployment, population change, crime rate, and other social indicators to determine the overall impact that changes in farming have effected at the community level (Goldschmidt 1978; Lobao and Stofferahn 2008). Results of such studies have been mixed, but evidence points to a preponderance of negative effects

(Lobao and Stofferahn 2008). While these studies are critically important to understanding how changes in agriculture might influence quality of life at the aggregate, community level, they do not shed light on how community-level conditions relate to individual-level determinants of quality of life, for farmers or rural residents. We cite this literature nevertheless, because our results may allow us to comment on potential relationships between individual-level subjective quality of life and community-level quality of life as measured through objective, aggregated indicators.

The second thread of research is the community satisfaction/attachment literature, which, as the descriptive terms indicate, focuses on the determinants of residents' satisfaction with and attachment to the communities in which they live. Considering how much research has focused on residents' satisfaction with their communities (e.g., Filkins, Allen, and Cordes 2000; Goudy 1990; Theodori 2004), it is surprising how few research efforts have examined community satisfaction as a potential determinant of quality of life. Indeed, it is startling that the community satisfaction literature generally conceives of "satisfaction" or "attachment" as the desirable result instead of quality of life, even employing quality of life variables as predictors of community satisfaction (Filkins et al. 2000). We posit that from a social standpoint, quality of life is a critically important outcome determined, in part, by the degree to which residents are satisfied with their communities and, in this study, hypothesize that community satisfaction would be a positive predictor of subjective QOL.

A third line of research on the relationship between community and quality of life has focused on social networks and connections between individuals and other members of the communities in which they live. Studies have demonstrated the importance of social comparison as a means through which individuals evaluate their own state of QOL relative to standards among communities of individuals within which they are embedded (Beaumont and Kenealy 2004; Franz et al. 2000). Fowler and Christakis (2008) found that frequency of interaction with other persons who are "happy" is a predictor of individual happiness. Further, they found that such effects may reach beyond immediate interactions, extending up to three degrees of separation away (e.g., friends of one's neighbors' friends). Their research suggests that QOL may be determined both by perceptions regarding QOL within immediate social networks and by perceived well-being at a higher-order community level. That is, that QOL is determined by perceived QOL at the level of close associations and the aggregate, community level. For farm families, these close associations are the other families with whom they interact within their

communities. Because the well-being of other farm families—friends, neighbors, and others who form the greater community—would likely exert an effect on individuals' perceptions of their own QOL, we hypothesize that perceptions of quality of life among other families in the community would predict assessments of quality of life among farm families.

DATA AND METHODS

Analytical Approach

A longitudinal multilevel framework was used to model variations in farmers' assessments of their QOL from 1982 to 2010. This analytic strategy nests multiple measurements within individuals to account for the interdependence among responses that occurs when multiple observations are taken from the same individuals over time. This tactic partitions the variance of the dependent variable into that which occurs between individuals and that which occurs within each individual over time (Laird and Ware 1982; Snijder and Bosker 1999). This is accomplished by using a level-one equation, which accounts for the variation of the dependent variable for the individual over time, and level-two equations, which account for the variation between individuals. This decomposition of variance allows for the examination of the unique contributions of change over time and individual differences respectively for measurements of the dependent variable.

Multilevel modeling builds from the traditional regression model, and in its simplest form, without any random effects, matches that used for multiple regression. The general equation indicates that a dependent variable Y_{ij} may be predicted through the combination of an intercept B_{0j}, the product of estimated coefficients B_{1j} and explanatory variables $X_{ij,}$ and a random residual R_{ij}. This is similar to the traditional OLS (ordinary least squares) regression equation except for the addition of the subscripts. These subscripts denote the individual (i) and period (j) to which that specific value refers. This equation, $Y_{ij} = B_{0j} + B_{1j} * X_{1ij} + R_{ij,}$ is designated the level-one equation. The level-two equations attempt to predict the coefficients of the level-one equation using level-two independent variables. These equations are $B_{0j} = \gamma_{00} + \gamma_{01} * W_{1j} + U_{0j}$ and $B_{1j} = \gamma_{10} + \gamma_{11} * W_{1j} + U_{1j,}$ with U representing the unexplained group effects. The terms γ_{00} and γ_{10} represent intercepts, while γ_{01} and γ_{11} represent slopes that, when combined with level-two independent variables W_{1j} and an error term $U_{1j,}$ form a linear equation that attempts to predict the level-one coefficients. The level-one and level-two equations are traditionally combined into a single equation, $Y_{ij=} \gamma_{00} + \gamma_{10} X_{ij} + U_{0j} + U_{1j} X_{ij} +$

$R_{ij,}$ that is estimated using a combination of maximum likelihood and least squares estimation.

Covariates in this type of longitudinal analysis may be defined as either time-variant or time-invariant variables and are entered into the equations at level one or level two respectively. Time-variant variables vary between measurements, while time-invariant variables generally remain the same over time, but may vary between individuals. In this context, examples of time-variant variables are measures such as income or individual attitudes, while time-invariant variables are traits such as overall disposition.

Data

Data for this analysis were collected through the Iowa Farm and Rural Life Poll (IFRLP), an annual longitudinal survey of Iowa farmers established in 1982 to provide relevant and timely information on agricultural and rural development issues. The original sample consisted of a random sample of 2,000 farmers throughout the state. The IFRLP is a panel study designed to allow for the examination of trends by mailing questionnaires to the same farm families each year. Attrition is always a factor in such longitudinal studies, and when sample size has fallen below one thousand, another random sample of Iowa farmers has been conducted to bring the sample size back up to 1,200 or more. Data from 29 years (1982 to 2010) were analyzed, and the 11,699 individual farmers who had participated in at least one wave of the survey were included in the sample.

On average, participants contributed five years of observations to the dataset. The weighted mean number of observations was 4.89 (SD=13.12). Thirty percent of participants contributed a single year of data, 18 percent contributed two years of observations, and the balance participated in the survey for three or more years. While assessment of intra-individual variation is limited to those participants who contributed at least two observations (70 percent), data from single-observation participants improves our capacity to analyze inter-individual variation.

This "unbalanced" sample highlights a main advantage of the multilevel modeling technique (Snijder and Bosker 1999). Multilevel modeling is quite flexible in dealing with longitudinal projects such as this one, in which some cases have incomplete data. Because the tenure of given random participants does not necessarily overlap, participants who leave or enter the sample can be included and contribute to the estimation of coefficients, allowing use of information from the widest group of participants possible. Even instances in which participants contribute a single observation to the analysis increase the ability to estimate

population parameters for level-two, inter-individual differences. While multiple observations are necessary for estimating level-one "weights" for intra-individual differences, even cases for which only two years of data are available contribute to parameter estimation. Thus, both single and multiple observations for individuals are important for the overall statistical power of the analysis.

Dependent Variable

The IFRLP has collected data on subjective quality of life among farm families every even-numbered year over the life of the project. The dependent variable for this analysis is a measure of farmers' perceived change in their families' quality of life over the previous five years (FFQOL). The survey has consistently defined quality of life as "the degree of satisfaction with all aspects of your life," and asked respondents to rate change in the "quality of life for your family" on a five-point scale ranging from "became much worse" (1) to "became much better" (5). This question represents a subjective indicator of QOL designed to examine farmers' assessments of how their families had fared over the period leading up to each survey point.

Covariates

Farm structural variables. Because overall household income has been found to outweigh economic measures of farm structure such as gross farm income or acres farmed as determinants of QOL (Coughenour and Swanson 1992; Molnar 1985), we included a level-one, time-variant measure of overall household income (HHINC). This variable was measured on a seven-point scale ranging from less than $2,500 to $75,000 or more. This question was posed 16 times over the study period and is a measure of income trajectory over time. Because previous research has shown that degree of off-farm employment is positively related to ratings of subjective QOL (Coughenour and Swanson 1992; Molnar 1985), we also included a time-variant measure of long-term household dependence on farm income (FARMDEP). This level-one variable asked respondents to indicate the proportion of their overall household income that came from the farm. This variable was measured on a five-point scale ranging from less than 10 percent to 76 percent or greater. This question was asked at 11 points in time over the study period. Taken together, these variables control for the interaction between farm and household income over time.

Individual-level variables: Farm profitability and perceptions of personal stress. Two time-invariant, level-two variables measuring individual-level characteristics were included in the model: satisfaction with the profitability of farming and levels of

personal stress. Satisfaction with farm profitability (SATISPROF) is a measure of perceived sufficiency of the economic returns from farming. This variable was measured in the 1991, 1996, 1999, and 2007 waves of the survey through a five-point scale ranging from very unsatisfied (1) to very satisfied (5) in response to the prompt, "please indicate your level of satisfaction with your farm's profitability." An average for each farmer was calculated from the four years of observations.

Personal stress was measured through a scale that represents average stress levels during the study (STRESS). Respondents were asked to rate—on a five-point scale that ranged from greatly declined (1) to greatly increased (5)—changes that they had experienced over the previous five years on three dimensions of stress. The three items read: "has your personal level of stress…," "has your concern with your level of stress," and "on a day-to-day basis has your stress…" These items were included in the 1988, 1994, 1999, 2004, and 2009 waves of the survey. Summative scales were constructed for each year (Cronbach's alpha ranged from .911 to .921) and an overall mean score was calculated for each farmer to control for these two individual-level determinants of QOL.

Community-level variables. Three variables measured community-level factors expected to influence quality of life assessments among farmers. A community satisfaction scale (COMMVITA) was included as a time-invariant, level-two measure of farmers' overall satisfaction with key dimensions of community life. Four items were presented to respondents at four points in time over the research period (1994, 1999, 2004, and 2009). Each item elicited a rating—on a five-point scale ranging from strongly disagree (1) to strongly agree (5)—of the following statements: 1) this community would be a good place for future generations to raise their families, 2) the future of this community looks bright, 3) this community has more things going for it than other communities in this area, and 4) I can't think of any other community where I'd rather live. A summative scale was constructed for each year (Cronbach's alpha ranged from .703 to .811) and a mean score calculated as a measure of average community satisfaction over the study.

Two variables—one level-one and one level-two—measured perceived quality of life among other families in farmers' communities. Rooted in the social comparison approach to the study of quality of life, these variables represented farmers' assessments of how other families in their communities have fared over time. Both variables were constructed from a survey item that asked farmers to rate, on a five-point scale ranging from "became much worse" (1) to "became much better" (5), the degree to which quality of life for families in their communities had changed over the previous five years. This question was asked at the same interval

as the question that comprises the dependent variable, for a total of 11 measurements over the study period.

The time-variant, level-one variable, community family quality of life (CFQOL1), was group-mean centered, which denotes that the mean for the individual over the course of the study was subtracted from their responses for each year. This allows us to distinguish clearly between within-person effects, such as those attributable to changes in that person's judgment over time, and differences between individuals. The time-invariant, level-two variable (CFQOL2) was an average of the 11 observations of farmers' rating of quality life among other families in their communities. Both of these variables represented farmers' assessments of the quality of life of other members of their community, and facilitated evaluation of social comparison effects on their own quality of life.

RESULTS

Preliminary descriptive analysis of the level-two variables allows some general conclusions to be drawn about the sample population (Table 1). These values represent the overall mean values for the sample over the entire study period. It is important to note that individuals who spent more time in the sample contributed more observations, weighting the coefficient toward those individuals. The mean of 3.1 (out of five) for satisfaction with farm profitability indicates that on the whole, farmers were neither satisfied nor dissatisfied with farm income. In general, participants rated QOL among other families in their communities as relatively stable, and were largely satisfied with the communities in which they lived.

Average change in QOL for both the farmers' families and their assessments of other families in their community were plotted on a graph (figure 1), which shows how mean values on these variables fluctuated over time. These yearly averages give a broad picture of what is occurring, but limit our ability to examine individual differences. That said, we note that FFQOL consistently plots higher than CFQOL, suggesting that on average individuals judge their own fortunes more positively than those of other farm families in their communities. Examining the pattern of change for each individual separately over the sample period allows for the introduction of covariates to explain the individual variation of those that display more extreme patterns. Although the overall means are relatively flat over time, with a clear dip in the mid-1980s coinciding with the farm crisis, significant variations between individuals exist.

This type of composite measure obscures much of the individual variation in the data and has been found inappropriate in longitudinal studies (Snijder and Bosker

TABLE 1. IOWA FARMERS' DESCRIPTIVE STATISTICS FOR LEVEL-TWO, TIME-INVARIANT VARIABLES.

	N[a]	MIN	MAX	MEAN[b]
Satisfaction with farm profit (SATISPROF). ..	42696	1	5	3.10 (1.04)
Perceived quality of life-other farm families (CFQOL2).	59022	0.5	5	2.80 (0.68)
Perceived community vitality (COMMVITA).	39150	4	20	13.77 (2.69)
Perceived stress (STRESS).	39295	3	15	10.19 (2.12)

NOTES: [a]Sample pooled across multiple years; [b]Data shown are variable means with standard deviations appearing in parentheses below the coefficient.

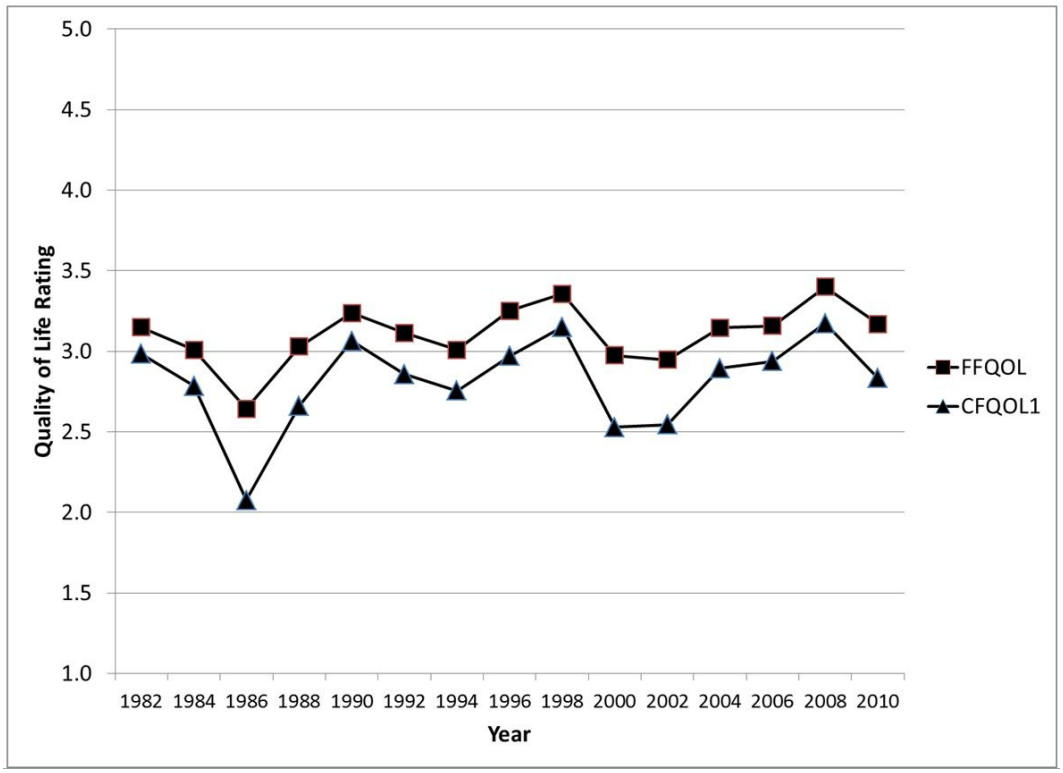

FIGURE 1. FARM FAMILY (FFQOL) AND COMMUNITY FAMILY (CFQOL) QUALITY OF LIFE RATINGS 1982-2010.

1999). Similarities that exist among multiple measurements of the same individual violate assumptions of measurement independence found in traditional OLS regression and necessitate the adoption of a multilevel modeling technique. To determine whether using this more complicated procedure is necessary, an intra-class correlation coefficient (ICC) must be calculated. This coefficient represents the resemblance between micro-units belonging to the same macro-units (Snijder and Bosker 1999). In this instance, it represents the similarity among multiple measurements of the same individual. Traditionally, values greater than .05 for the ICC indicate the need to utilize multilevel analysis. Smaller values are considered to have a trivial enough effect on overall model computations to allow the use of OLS regression. Model fit statistics resulted in an Akaike's information criterion (AIC) of 73406 and an ICC of .386 for model 1 (Table 2), indicating that multilevel modeling is a more appropriate technique for these data than traditional OLS regression. Akaike's information criterion is an unstandardized measure of model fit based upon the number of variables in the model and degrees of freedom in the model, but it should only be used for model comparison. Smaller values may be interpreted as better fit, but it should not be used as a measure of fit for a given model. Subsequently, when given two models specified from the same dataset, the one with the smaller AIC is preferred.

Model 2 includes only the linear and quadratic time components (Table 2). Model fit statistics indicate a minor reduction in AIC to 73366, which supports the earlier conclusion that only minor fluctuations in the dependent variable are occurring over time. Nevertheless, significant effects for the dependent variable were found for the linear component, indicating a positive change in QOL over time. These results suggest that while participants' perceptions of whether their QOL is getting better or worse are fairly stable, they are not static. In other words, individuals' perceptions of change in their quality of life vary over time, and are not based completely on a predisposition toward optimism or pessimism. The trend found here suggests a gradual increase. Such results, while statistically significant, are small enough to be of no practical significance, and can be sensitive to the introduction of other explanatory variables. However, we retain the time components in our models for two purposes. The first is simply a matter of statistical clarity, as it allows for direct comparisons among models. More important, significant effects on the time components in subsequent models serve as an indicator that idiosyncratic fluctuations in other significant covariates have been excluded from the model (Snijder and Bosker 1999). The absence of strong relationships between the time components and the dependent variable suggests

TABLE 2. MULTILEVEL MODELS PREDICTING PERCEIVED CHANGE IN QUALITY OF LIFE FOR IOWA FARMERS[a]

		MODEL 1	MODEL 2	MODEL 3	MODEL 4
Level 1	TIMEC (Linear)[c].		.011**	-.023***	-.011**
			(.001)	(.004)	(.004)
	TIMEC (Quadratic)[d]..		.000	-.004**	.000
			(.000)	(.002)	(.002)
	CFQOL1[e].....			.507***	.519***
				(.012)	(.013)
	HHINC[f].....			.105**	.07***
				(.006)	(.006)
	FARMDEP[g].			-.021**	-.028***
				(.007)	(.007)
Level 2	SATISPROF[h].				.049***
					(.011)
	CFQOL2[i].				.626***
					(.020)
	COMMVITA[j].....				.011**
					(.004)
	STRESS[k].....				-.062***
					(.005)
Constant.		3.07***	3.08***	2.64***	1.47***
		(.008)	(.009)	(.043)	(.104)
AIC[b].		73406	73366	18435	11300
Reduction in level 1mean squared prediction error. ..... (Pseudo R^2)					40%
Reduction in level 2 mean squared prediction error ..... (Pseudo R^2)					70%

NOTES: [a]Data shown are unstandardized multilevel coefficients with the standard error in parentheses; [b]AIC= Akaike information criterion; [c]Linear component of time; [d]Quadratic component of time; [e]Community family quality of life (time-variant); [f]Household income; [g]Dependence on farm income; [h]Satisfaction with farm profit; [i]Community family quality of life (time-invariant); [j]Perception of community vitality; [k]Perception of change in stress; *p<.05; **p<.01; ***p<.001

that variations in farm family QOL are related to changes in other variables or individual differences.

Model 3 introduces the level-one, time-variant covariates HHINC, CFQOL1, and FARMDEP. The model AIC was 18435, suggesting a significantly better fit

than model 2 (Table 2). The coefficient for the linear time component is still significant, but it becomes smaller and negative. This is most likely due to the inclusion of the covariates. Controlling for these other covariates eliminates the positive effects of time, and leaves a slight downward trend. Interestingly, the quadratic effects for time also have a significant (albeit very small) negative effect, suggesting that as time goes by this downward trend increases. Significant effects were found for all of the level-one variables. Increases in net household income (HHINC) for an individual during the study period predict more positive perceptions of change in QOL. The coefficient for FARMDEP was significant and negative, indicating that individuals for whom farm income comprised a more substantial proportion of household income over the study period expressed less positive perceptions of QOL. The level-one social comparison variable, QOL among other families in their communities (CFQOL1) was a significant positive predictor of farmer QOL, indicating that over the study period, farmers who perceived increases in QOL among neighboring families also often rated their own QOL as having improved.

These level-one results are important in that they examine the effects of actual within-individual change in these variables over time rather than extrapolating from a group of individuals with different values. Traditional cross-sectional analysis examines a group of different individuals who possess different scores on a given measure. By aggregating the scores of these individuals, the overall effect of change in that variable is computed. It is assumed that changes in the variables of interest rather than other differences between individuals are what lead to changes in the dependent variable. In contrast, our analysis examines the same individuals over time. Results represent actual within-individual change in perceptions over time rather than the effects of inter-individual differences in overall disposition, thus increasing the odds that these effects are due to actual changes in the variables of interest rather than other differences between individuals in the sample.

Model 4 introduces the level-two covariates SATISPROF, CFQOL2, COMMVITA, and STRESS. These covariates represent time-invariant differences between individuals in the sample. Model fit statistics suggest that, while not as significant a drop as found between Models 2 and 3, model 4 provides an improved fit with an AIC of 11300 (Table 2). Coefficients of variables entered previously remained substantially the same, except for a slight weakening in the effects of HHINC. Of those level-two variables, all were significant except the variable measuring satisfaction with farm profitability (SATISPROF).

As the traditional coefficient of determination is inappropriate in a multilevel analysis, a pseudo R-squared procedure proposed by Raudenbush and Bryk (2002) was used to determine the effectiveness of the final model. Change in the first-level variance is determined through the equation $R^2_1 = \sigma^2_0 - \sigma^2_1 / \sigma^2_0$, where σ^2_0 is equal to the level-one residual variance of the baseline model and σ^2_1 is equal to the level-one residual variance of the final model. Similarly, change in second-level variance was determined by the equation $R^2_2 = \tau_{00(baseline)} - \tau_{00(final)} / \tau_{00(baseline)}$, where $\tau_{00(baseline)}$ is equal to the level-two residual variance of the baseline model and $\tau_{00(final)}$ is equal to the level-two residual variance of model 4.

Overall, the inclusion of covariates in model 4 resulted in a proportional reduction in the level-two mean squared prediction error of 70 percent, indicating that the model accounts for most of the inter-individual variation in the dependent variable present in the data (Table 2). Proportional reduction in level-one mean squared prediction error was 40 percent, which indicates that a moderate amount of within-person variation in the dependent variable over time has also been accounted for. This suggests that, while a large portion of the inter-individual variation has been accounted for, influences outside the current study are contributing to the yearly change in individuals' assessments of QOL. Considered together, these calculations indicate that the model accounts for much of the variance in the dependent variable.

While average satisfaction with farm profitability (SATISPROF) did not, as hypothesized, predict judgments of QOL among surveyed farmers, the second variable related to farm structure, dependence on income from the farm (FARMDEP) was significant and negative (Table 2). In addition, higher average levels of STRESS were associated with lower ratings of QOL. These findings are consistent with previous research and align with our hypothesized relationships.

The variable measuring farmer assessments of the overall vitality of their communities (COMMVITA) was positively associated with farmer perceptions of QOL (Table 2). Individuals who, on average, were more satisfied with their communities also often rated their QOL over time more positively. This result supports our hypothesis that the relatively unexplored relationships between community well-being and individual well-being are indeed positive.

Finally, distinct from yearly variations in within-individual perceptions of change in CFQOL1, respondents who over the study period were, on average, more positive about QOL among families in their communities (CFQOL2) were also more positive about trends in their own families' QOL (Table 2). The regression coefficient indicates that perceptions about quality of life among other community

members exert substantial influence over farmers' judgments of their own quality of life. These results support the social comparison hypothesis that farm family QOL is closely tied to the QOL of other families in their communities.

DISCUSSION

Taken together, these results suggest several important conclusions about determinants of farm family quality of life. First, results for the control variables echo findings from earlier research on farmer quality of life. Total household income is more important than farm income as a predictor of QOL, and dependence on farm income is negatively associated with QOL. Stress, a variable that has consistently been tied to lower ratings of quality of life in other populations, not surprisingly is also associated with poorer QOL outcomes among farmers. The most important contributions of this research, however, are the findings on the relationships between community well-being and individual QOL.

Community and Individual Well-Being

Subjective quality of life among farmers appears to depend less on farm-level circumstances and more on community context. Indeed, the findings that dependence on farm income is negatively associated with QOL, while overall household income, the non-farm portion of which is likely largely dependent on the economic climate in local communities, is positively related to QOL, suggests that—net of community context—farming as a primary occupation may actually be a drag on farm family QOL. On the other hand, perceived community vitality and perceptions of (increasing) QOL among other community members seem to buoy assessments of quality of life. Our results support our hypothesis that community well-being affects the quality of life of individual residents. In other words, at least for Iowa farmers and their families, individual-level quality of life is largely dependent on community-level well-being.

The implications of these findings are particularly salient when considered in tandem with research on the community-level impacts of large-scale, industrial agriculture. If quality of life at the community level is a major determinant of individual-level quality of life, then factors that depress community-level well-being may also decrease individual-level quality of life. If, as much research has suggested, structural change in agriculture has resulted in negative aggregate impacts on communities (Lobao and Stofferahn 2008), then the results of this study suggest that those community-level impacts can be expected to result in individual-level impacts as well. If the causal pathway through which changes in farm structure

impact individuals is mediated by community factors, that might explain why past studies have found few relationships between farm structural changes at the individual farm level and farmer quality of life.

The results of this study point to a need for more sophisticated research and modeling to examine such potential relationships. Our multilevel modeling approach, which nested multiple observations over time within individuals, relied on individual-level, subjective measures of community vitality and quality of life among community members as predictors of QOL among farmers. While this approach provided important insights into the relationships between community-related variables and the trajectory of individual-level quality of life among farmers, several shortcomings related to availability of data must be noted.

While the analysis models important relationships between subjective individual-level quality of life indicators and key measures of farm structural, household, and community characteristics, potentially important explanatory variables are not included in the model. Prominent among these are numerous individual-level variables that can influence quality of life—quality of relationships with family and friends, marital status, religious involvement, physical health, and so on (see Campbell 1981; Campbell, Converse, and Rogers 1976; Fowler and Christakis 2008)—which could not be included in the analysis because those data were not collected with any regularity over the 29 years that the IFRLP has been conducted.

Shortcomings notwithstanding, the results are compelling. All three measures of community well-being appear to predict individual QOL among our sample of farmers. Most interesting are the strong predictive effects associated with the level-one and level-two measures of perceived QOL among families in the farmers' communities. Following previous research showing that individuals often judge their state of being relative to that of those who surround them (Lance et al. 1995), these variables are conceptualized as a "community QOL yardstick," by which farmers measure their own quality of life. Similar to Fowler and Christakis (2008), who found embeddedness in "happy" social groups to be a strong predictor of individual happiness, we interpret the predictive power of perceptions regarding other community families as evidence that the ebb and flow of quality of life among the families that comprise their rural communities—ostensibly made up primarily of neighbors, friends, and acquaintances—has a strong positive effect on perceptions of QOL among farm families.

Community and Rural Development Implications

If, as this study suggests, the well-being of farm families is more dependent on collective, community well-being than on economic benefits derived from the farming occupation, this finding has important rural development implications. As noted at the outset of this paper, the federal government's traditional focus on economic support to individual farmers and landowners has come under scrutiny as social scientists have increasingly tied that approach to stagnation or decline in rural social and economic indicators (Falk and Lobao 2003). The *de facto* rural development strategy that the USDA Farm Bill programs represent dedicates far more money to commodity subsidy programs than to other rural development programs. For example, the Center for Rural Affairs (2008) estimated that over the life of the 2008 Farm Bill, more than $60 billion would be spent on commodity programs compared with $150 million in other rural development spending.

Drabenstott's (2005) analysis of the long-term rural development impact of the commodity-focused approach is sobering: the U.S. counties that have been most dependent on commodity program payments have steadily lost population and lagged in employment generation over the last several decades. He holds that commodity support programs only exacerbate the treadmill dynamic discussed at the outset of this paper. For rural economies that depend largely on commodity production, "[Farm Bill] commodity programs wed farming regions to an ongoing pattern of economic consolidation" and associated social and economic decline (Drabenstott 2005:4). His voice joins a chorus of others (e.g., Carr and Kefalas 2009; Center for Rural Affairs 2008; Wimberly 1993; Wood 2008), who increasingly call for a reorientation of rural policy away from support for commodity production and toward promotion of innovation and entrepreneurship that lead to diversified economies and vibrant communities.

CONCLUSION

The results of this research suggest that positive assessments of quality of life among farm families are tied more strongly to the non-farming elements of their lives: their communities and other community members, and overall household income. Dependence on the farm for income, on the other hand, may be a drag on quality of life. Thus, it seems that the farmers who have high subjective QOL are those who 1) have managed to reduce their overall household dependence on farming for their livelihoods and 2) live in vibrant communities with happy neighbors.

As discussed at the outset of this paper, farming, particularly the commodity farming that dominates the landscape in Iowa, has undergone major economic flux as relentless forces of consolidation have changed the structure of agriculture dramatically over the last decades. These processes can lead to a stressful treadmill existence that is subject to the vagaries of markets, weather, and policy. Those farm families who have partially insulated their households from those forces report better quality of life than those who have not.

The results of this research suggest that the sustained calls for a reexamination of rural development strategies should be heeded, and the possibility of pursuing a more balanced approach to resource allocation that effectively supports community development should be considered more carefully. There is certainly a need for continued support for the agricultural sector, especially conservation-oriented policies and programs (Napier 2010). However, rural sustainability policy requires much more than support for commodity production; it requires investment in human resources, physical infrastructure, social infrastructure, non-farm job creation, and so on (Wimberly 1993). The evidence that this study offers—that community vitality is a critical determinant of quality of life among farm families—supports long-standing appeals to increase investment in such community development efforts.

AUTHOR BIOGRAPHY

J. Gordon Arbuckle, Jr. is an Assistant Professor of Sociology at Iowa State University. His research focuses on the social and environmental performance of agriculture. He is co-director of the Iowa Farm and Rural Life Poll, an annual survey of Iowa farmers. Specific areas of interest include rural quality of life, agri-environmental policy, soil, water, and habitat quality, and natural resource-based community development.

Chris Kast is a Lecturer of Sociology at Iowa State University. His research investigates the intersection of social structure and social psychological processes, specifically how group membership influences, and is influenced, by self-evaluation.

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