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Restricted Opportunities, Personal Choices, Ineffective Policies: What Explains Food Insecurity in Oregon?

**Stephanie L. Bernell, Bruce A. Weber,
and Mark Evan Edwards**

This study examines the extent to which household demographics, local economic and social conditions, and federal food security programs explain the likelihood of household food insecurity in Oregon. Between 1999 and 2001, Oregon had the highest average rate of hunger in the nation and ranked in the top five states with respect to food insecurity. Statistical analyses using a multivariate logit model reveal that food insecurity is influenced by much more than demographics and individual choices. County-level factors such as residential location (urban versus rural) and housing costs significantly affect the likelihood that families will be food insecure.

Key words: food insecurity, food stamps, hunger, rural residence

Introduction

As the extent of household food insecurity in the United States has become better understood, policy makers at the federal and state levels have wanted to learn more about the multiple causes of food insecurity. Some have sought the explanation in the personal choices about marriage, child bearing, education, and other life decisions that increase the vulnerability of a household (Kasper et al., 2000; Nelson, Brown, and Lurie, 1998; Olson and Rauschenbach, 1997; Rose, Gunderson, and Oliveira, 1998; Tarasuk, 2001). Others have looked to the economic context, at the state level, in which individuals and households make their choices—the availability of jobs, wage levels, and the costs of living (Bartfeld and Dunifon, 2004; Borjas, 2004; Opsomer, Jensen, and Pan, 2003). Although results have been mixed, other researchers have sought the explanation in governmental and nongovernmental institutional responses to economic distress (i.e., Food Stamp Program) (Jensen, 2002; Gunderson and Oliveira, 2001; Borjas, 2004; Bartfeld and Dunifon, 2004).

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Notwithstanding the substantial contributions of prior research, it is reasonable to expect that household food insecurity is also influenced by the local community in which the household resides. For example, certain communities may have a greater sense of social connectedness or more effective social policies. These factors, in turn, may result in a decreased likelihood of household food insecurity.

The goal of this study is to identify the role of local factors in understanding the likelihood of food insecurity. Specifically, we advance the literature and inform the policy discussion by examining the extent to which *county-level* characteristics related to economic opportunity, social conditions, and food security programs explain household food insecurity. We believe this is the first study to investigate the role of local county-level contextual factors in explaining household food insecurity.

The U.S. Department of Agriculture measures hunger in American households in two ways: (a) “food insecure”—which means a family has limited or uncertain access to nutritionally adequate and safe foods, or limited or uncertain ability to acquire acceptable foods in socially acceptable ways; and (b) “food insecure with hunger”—which means a family occasionally has to go hungry because they cannot afford food. The specific focus of this study is food insecurity in the state of Oregon. Between 1999 and 2001, Oregon had the highest average rate of “food insecurity with hunger” in the nation, with 6% of Oregonians considered hungry. The national average during this same time period was 3.3%. Based on the findings of a 2003 study, Edwards and Weber noted that the uniquely high hunger rates in Oregon, especially among employed families and two-parent family households with children, make this an especially important state to examine with regard to the influence of county-level social context and policy variables. Edwards and Weber found that economic factors and the demographic composition of the Oregon population do not entirely explain its high hunger rates; hence, the effects of social context and local policy are likely to play important roles in influencing the state’s distribution of hunger and food insecurity. The presence of such effects in Oregon, where excellent contextual and policy data are available, would suggest the possibility of similar effects in other states, where such data are not currently available.

The analyses for this study are based on the 2000 Oregon Population Survey data, supplemented by data from the 2000 *Census* and other sources (identified later in table 2). The Oregon Population Survey contains information on food insecurity and personal characteristics of Oregon residents. The supplemental data contain county-specific information on wages, unemployment, program use, and community affiliations and participation. We use a multivariate logit model to estimate the probability of household food insecurity. Maximum-likelihood coefficients and marginal effects are presented. In addition, based on the multivariate model results, we calculate and present predicted probabilities of food insecurity for composite individuals living in different settings.

The remainder of the paper is outlined as follows. The next section develops a theoretical foundation from which the empirical model is derived. Statistical analysis and results are then discussed, and concluding remarks are presented in the final section.

Theoretical Framework

A standard household production framework provides a theoretical foundation from which to base our empirical analysis. The theoretical model outlined in this section draws heavily from Becker (1965); Blaylock (1991); Gawn et al. (1993); Lancaster (1966);

and Rose, Gunderson, and Oliveira (1998), but integrates county-level factors related to economic opportunity, social supports, and food assistance policy, all of which influence household food insecurity.

Consider a utility function that is comprised of household food security (FS), a vector of other goods purchased by the household (\mathbf{X}_o), and leisure at the household level (l):

$$(1) \quad U = U(FS, \mathbf{X}_o, l).$$

Households are assumed to maximize utility subject to a traditional budget constraint and a food security production function, FS . In general, food security means all members of the household always have access to enough food for active, healthy living. The production function is represented by:

$$(2) \quad FS = f(\mathbf{X}_f, L_f, \mathbf{c}),$$

where \mathbf{X}_f is a vector of food products, L_f is the time household members spend in purchasing and preparing food, and \mathbf{c} is a vector of individual, household, and county-level characteristics that influence the environment in which production takes place. The budget constraint takes the following form:

$$(3) \quad \mathbf{P}_f \mathbf{X}_f + \mathbf{P}_o \mathbf{X}_o = V + w(T - L_f - L_o - l),$$

where \mathbf{P}_f is a vector of food prices, \mathbf{P}_o is a vector of nonfood prices, V is household non-wage income, L_o is the time that household members spend purchasing other goods, and T is total time available to the household. In this model, w is the household wage rate, and other expressions are as previously defined. The reduced-form food security equation can then be written as:

$$(4) \quad FS = f^*(\mathbf{P}_f, \mathbf{P}_o, V, w, \mathbf{c}).$$

It is quite often the case that studies using a household production approach assume prices are either fixed or are captured by regional dummy variables. The focus of these studies is mainly on income and demographic components of \mathbf{c} . In the model presented here, \mathbf{c} not only contains the standard demographic and income information, but also county-level factors representing social support, local economic opportunity, and food policy.

The Empirical Model

Food security was measured in the 2000 Oregon Population Survey (OPS) using the six-question short form food security module developed at the National Center for Health Statistics. This short form is a subset of the 18-question Food Security Core Module used by the U.S. Census Bureau to measure food insecurity in the Current Population Survey. Like the full module, the short form provides estimates of the share of a population that is food insecure with and without hunger. According to Bickel et al. (2000), the short form "has been shown to have reasonably high specificity and sensitivity and minimal bias with respect to the 18-item measure" (p. 60). The six-question short form questionnaire and scaling details are provided in the appendix.

Households are classified as food insecure if they answer two or more of the six Food Security Module questions affirmatively. Households that crossed over the threshold of food insecurity generally indicated “the food [they] bought didn’t last and [they] didn’t have money to get more,” *and* they “couldn’t afford to eat balanced meals.” Those with a greater level of food insecurity reported they cut the size of meals, ate less than they felt they should, or were hungry because they didn’t have enough money for food. Using this measure, the OPS estimated that 7.9% of Oregon households were food insecure in 2000.

The level of food insecurity reported in the 2000 Oregon Population Survey (7.9%) for the 12 months preceding the survey (conducted in the spring of 2000) is 40% smaller than the level of the 1999–2001 estimate covering the same period reported by the Economic Research Service based on the Current Population Survey (CPS) (13.7%). The OPS estimate is less than the CPS estimate for two reasons. First, the OPS questionnaire design screened out potentially food insecure/hungry households that were not screened out in the CPS survey. Specifically, the OPS screened these households out if they stated in the screening question that they had enough of the kinds of food they wanted in the previous 12 months. In contrast, the CPS applied this screen only to households with incomes above 185% of the federal poverty line, and asked all households with incomes below that level the food security questions. Second, the sample design (random-digit dialing in OPS; multistage, stratified sample from address list in CPS) and survey method (computer-assisted telephone in OPS, and face-to-face and telephone in CPS) tend to under-represent low-income households in the OPS because these individuals are less likely to have telephones. However, we believe cross-county variations in food insecurity and hunger are likely to be reliable. Admittedly, there is perhaps a small amount of cross-county bias in the OPS sampling rates due to random-digit dialing—i.e., approximately 1.6% of households didn’t have telephones in 2000, and rural counties were less likely to have phones than urban places (the range in the share of households without telephone service is 0.7% to 6.8%). Nevertheless, given the small sample sizes in rural counties, this variation is unlikely to affect the results in any appreciable way.

Logistic regression was used to assess the contributions of the following factors to the likelihood of household food insecurity: household and personal demographic characteristics, county-level social supports, county-level economic measures, county-level food security policy, and affordability. The analytic sample consists of the 4,725 households in the Oregon Population Survey headed by individuals 18 years of age and older. The respondent to the survey was the household head (an adult who owns, is buying, or rents the house/apartment) with the most recent birthday.

Demographic Characteristics

Table 1 presents OPS summary statistics for Oregon households’ demographic and economic characteristics. The demographic measures captured at the household level include household composition and household income. The household composition variables indicate whether the household head is married or single, and whether children under 18 are present. Empirical work in this area has established that single individuals with children and married couple families have the highest and lowest probability of food insecurity, respectively (Nord, Andrews, and Carlson, 2003; Olson and Rauschenbach, 1997; Rose, Gunderson, and Oliveira, 1998; Gunderson and Gruber, 2001).

Table 1. Definitions of Demographic and Economic Variables and Summary Statistics for Oregon Households: Oregon Population Survey, 2000 (N = 4,725)

Variable Name	Definition	Percent of Sample (%)	Within-Variable % Food Insecure
Household Income:			
<i>Quintile1</i>	Lowest quintile of household income distribution	20.00	17.33
<i>Quintile2</i>		20.00	9.25
<i>Quintile3</i>		20.00	5.81
<i>Quintile4</i>		20.00	2.24
<i>Quintile5</i>	Highest quintile of household income distribution	20.00	0.11
Household Composition:			
<i>Married_w/Kids</i>	Household consists of married couple with children	18.51	7.08
<i>Married_No_Kids</i>	Household consists of married couple without children	35.97	3.94
<i>Single_Mother</i>	Household head is single mother	4.15	24.38
<i>Single_Father</i>	Household head is single father	1.73	3.24
<i>Single_No_Kids</i>	Household consists of single individual without children	39.64	7.95
Race:			
<i>Black</i>	Household head is African-American	1.85	13.92
<i>Hispanic</i>	Household head is Hispanic	6.94	13.84
<i>White</i>	Household head is White/non-Hispanic	88.66	6.34
Education:			
<i><HighSchool</i>	Household head has less than high school education	8.58	12.88
<i>HighSchool</i>	Household head has high school education	29.93	8.98
<i>Some_College</i>	Household head has some college education	32.36	7.34
<i>College_Degree +</i>	Household head has bachelor's degree or higher	29.12	2.46
Age:			
<i>Age18-30</i>	Age of household head is between 18 and 30	15.36	10.45
<i>Age31-64</i>	Age of household head is between 31 and 64	63.68	7.14
<i>Age65+</i>	Age of household head is 65 or over	20.96	3.72
Disability Status:			
<i>Disabled</i>	Household head is disabled	11.51	16.26
<i>Not_Disabled</i>	Household head is not disabled	88.49	5.74
Social Support:			
<i>Employed</i>	Household head is employed	60.92	5.95
<i>Unemployed</i>	Household head is not employed	39.08	8.51
<i>Mobile</i>	Household has moved across county lines in last 5 years	21.96	10.12
<i>Non-Mobile</i>	Household has not moved residence in last 5 years	78.04	6.05
<i>Homeowner</i>	Household head is homeowner	71.17	4.36
<i>Renter</i>	Household head rents home	28.83	13.31
<i>High_Volunteer</i>	Household head has volunteered >100 hours in last year	14.16	4.22
<i>Low_Volunteer</i>	Household head has volunteered <100 hours in last year	85.84	7.40

The data set used in this analysis did not allow for inclusion of wage and nonwage income separately; however, we were able to include estimated household income, identified by quintile groups.¹ Prior research has established a strong inverse association between food insecurity and household income (Alaimo et al., 1998; Nord, Andrews, and Carlson, 2003; Olson and Rauschenbach, 1997; Rose, Gunderson, and Oliveira, 1998). In addition, there is also an indirect impact on the ability to procure transportation on a permanent and transitory basis—i.e., lack of transportation is one reason individuals have cited for not acquiring enough food (Briefel and Woteki, 1992). Low-income households are less likely than other households to own a car due to the prohibitive cost of purchasing, insuring, and maintaining a car (U.S. Federal Highway Administration and U.S. Federal Transit Administration, 2003). Furthermore, in many communities, public transportation is limited. Small urban and rural communities often lag behind in adequate public transportation. In these communities, approximately 41% of individuals have no access to transit and another 25% live in areas with below-average transit services (Community Transportation Association of America).²

Demographic variables captured at the respondent level include race, disability status, and age. Households are therefore assigned the characteristics of the individual household head. For example, if the household head is Black, or a college graduate, or disabled, then the household is regarded as being influenced by these individual characteristics of the household head. We anticipate that race of the household head is a significant contributing factor to household food insecurity (Rose, Gunderson, and Oliveira, 1998). Household food insecurity is more than twice as prevalent among African-American and Hispanic households than non-Hispanic White households (Carlson, Andrews, and Bickel, 1999; Nord, Andrews, and Carlson, 2003).

Individuals who are part of families having one or more disabled adults are also considered more likely to be food insecure. Research has shown that long-standing health problems or activity limitations are associated with higher rates of household food insecurity with hunger (Tarasuk, 2001). Although many individuals with disabilities receive disability benefits, and thus have familiarity navigating the system of public services, it is perhaps the case that the marginal cost of preparing and shopping for food, as well as the marginal cost of obtaining community services, is greater than the marginal benefit. In a 2000 survey of Americans with disabilities, 30% of respondents with disabilities reported difficulty in accessing transportation, compared to 10% of respondents without a disability (National Organization on Disability, 2001). It may also be the case that additional resources are needed to manage the disability, thereby reducing the amount of funds available for the purchase of food. Furthermore, research has shown that disabled individuals usually have lower amounts of general and firm-specific human capital (U.S. Department of Education, 1994; Lou Harris and Associates, 1987), which in turn means lower wages and possibly higher rates of food insecurity.

Recent research has determined that older individuals and those with higher levels of education experience significantly lower rates of food insecurity (Nord, Andrews, and Carlson, 2003; Olson and Rauschenbach, 1997; Rose, Gunderson, and Oliveira, 1998).

¹ The OPS collected information on income bands, rather than a continuous measure of household income. Information regarding each income source is not specified. Estimated household income was imputed as a continuous measure of income using techniques outlined by Bhat (1994) and Stewart (1983).

² A small-urbanized population is defined as between 50,000 and 200,000 individuals; a rural area population is less than 50,000 persons.

Level of education is expected to affect food insecurity directly through greater knowledge about cooking and nutrition, and indirectly through higher wage levels. Moreover, it could be argued that individuals with greater education have an easier time navigating the array of community services available to circumvent food insecurity.

Individuals over 65 are more likely to draw on social security, and their retirement savings, and they are also more likely to experience lower housing expenditures. Together, these factors increase the amount of income available for the purchase of food. In addition, older individuals have greater experience in terms of preparing and shopping for food. The relationship between Age 65+ and food security status is complicated, however, by the fact that many older individuals face transportation problems. According to a recent AARP survey, 16% of respondents over age 75 do not have a driver's license, and 25% of licensed drivers report not having driven even once during the previous month (Ritter, Straight, and Evans, 2002). Additionally, many older individuals have difficulty accessing public transportation due to physical limitations (U.S. Government Accounting Office, 2003) and, due to lower food needs and reduced hunger sensation, these individuals are less likely to self-identify as food insecure (Rolls, 1993).

Social Supports

The rationale behind including a social support component in the model is drawn from the epidemiology literature. Within this discipline, social capital, which is characterized by relationships between neighbors or community members using measures such as trust, reciprocity, and civic engagement, is thought to temper the association between income inequality and health (Kawachi et al., 1997; Kreuter et al., 1997; Martin et al., 2004; Sampson, Raudenbush, and Earls, 1997). Social supports, in the context of food insecurity, can directly affect food security by providing access to food and other resources to reduce the probability of food insecurity.

Social support factors include the following: percentage of county population living in rural areas, percentage of county population affiliated with a religious congregation, and percentage of households in the county who moved in the past five years. Existing research provides limited information regarding the relationship between the urban/rural status of the community and food insecurity at the state level. For example, although Opsomer, Jensen, and Pan (2003) found that living in a metropolitan area increases a household's risk of food insecurity, we believe individuals living in rural areas could experience either higher or lower rates of food insecurity—higher because of lower rural wages, or lower because of lower rural housing costs or greater rural social networks. We do know that urban residents have weaker ties to the community and family (Warren, 1978), and a weaker social support system tends to lead to decreased use of health services (Berkman and Glass, 1999; Putnam, 1995; Mechanic, 1998; McGuire, 1974) and a decrease in the success of health promotion and disease prevention programs (Kreuter, Young, and Lezin, 1998).

Data at the national level suggest there is a higher prevalence of food insecurity for households located in central cities than outside metropolitan areas (i.e., rural locations), with households located outside the central city but within a metropolitan area (i.e., suburb) having the lowest prevalence of food insecurity (Nord, Andrews, and Carlson, 2003). Our model uses a more refined measure of urban/rural status—the percentage of the county considered rural under the U.S. Census Bureau definition of

this term.³ With this measure, we are able to capture small incremental differences in “rurality” that cannot be analyzed with the standard metropolitan/nonmetropolitan classification system.

We expect those individuals who reside in more stable communities (in terms of people moving in and out of the community) are more likely to have community and neighborhood connections, and thus a decreased probability of food insecurity. Likewise, individuals residing in communities in which a large percentage of individuals are members of a religious congregation may benefit from informal and formal community networks and congregation-supported outreach programs (Chatters, Levin, and Ellison, 1998).

Social support is also represented at the individual level, which is again captured by the response of the household head. Individual-level social support variables include dummy variables indicating home ownership, whether an individual has moved across county lines in the past five years, whether an individual volunteered more than 100 hours in the past year, and whether an individual is employed. According to research by Tarasuk (2001), individuals who perceive themselves to be socially isolated are more likely to report food insecurity with moderate or severe hunger.⁴ Consequently, our expectation is that individuals who have committed to living in a community by buying a home and/or volunteering are more connected to their neighbors and less likely to experience food insecurity (Calabrese and Shumer, 1986; Rose, Gunderson, and Oliveira, 1998; Safrit and King, 1994). Although some researchers have argued home ownership can also serve as a proxy for asset wealth and possible liquidity level (Blaylock, 1991; Rose, 1999; Rose, Gunderson, and Oliveira, 1998), whether or not food insecure families can or do in fact convert home equity into cash-for-food is a point of debate. Hence, we conceptualize home ownership primarily as a measure of social capital. It can be thought of as a proxy for social stability and community connection rather than primarily as a source of income.

Economic Opportunity

Also included are measures related to economic opportunity—county wages and the county unemployment rate. Each of these capture the economic health of the community in which an individual resides and provide indicators of both the likelihood of working and the financial rewards to working in the community. Individuals living in counties with higher average wages are expected to have a lower probability of food insecurity for two reasons. First, wealthier communities are characterized by more charitable giving (Schervish and Havens, 2001), which should result in greater community resources (in-kind and monetary) available to combat food insecurity. Second, since average county wage is a loose representation of individual wages, individuals living in a wealthy county are possibly more likely to be wealthy themselves. Or, admittedly, it may be the situation that a small percentage of the population earns substantially more money than the remainder of the county, thereby driving up average wages. If this is the case, then increases in average county wages would not necessarily lead to a decrease in the probability of food insecurity.

³ “Rural” households are those living in open country and settlements of less than 2,500 persons. The 2000 Census defines a household as “rural” if it is outside of (a) *urbanized areas* (“a central place(s) and adjacent territory with a general population density of at least 1,000 per square mile of land area that together have a minimum residential population of at least 50,000 people”), and (b) *urban clusters* (“a densely settled territory that has at least 2,500 people but fewer than 50,000”).

⁴ In the Tarasuk (2001) study, the perception of social isolation is not associated with single parenthood.

With respect to the county unemployment rate, counties with relatively high unemployment rates may have fewer personal and community resources available to lessen food insecurity. On an individual level, families may have to make do with a lower income even if a family receives unemployment benefits. For those just above the poverty line, state-level research suggests a strong labor market and a stable community can be particularly important factors in the reduction of food insecurity (Bartfeld and Dunifon, 2004).

Food Stamp Program

We assessed the effects of county-level food security programs by incorporating a variable (*%FoodStamp*) that measures county-level food stamp use as a percentage of the county population with income below 185% of the federal poverty level.⁵ We believe program use by low-income individuals is indicative of how successful community programs are at targeting those in need. Furthermore, based on research at the state level (Borjas, 2004), it is reasonable to expect that county-level differences in outreach efforts can influence household food insecurity. Because local factors which might affect the demand for these programs (i.e., average wages, local unemployment rates) are controlled in the model, this program variable can be considered a reasonable indicator of the success of such programs in supplying services—with high use rates being indicative of more successful targeting efforts.

Housing Affordability

As this analysis is a static analysis, specific measures of food prices (P_f) and nonfood prices (P_o) are not included in the model; however, a variable that proxies the cost of purchasing goods in the respective counties was incorporated into the model. Specifically, a dummy variable (*Rent*) is included to indicate whether a household is located in a county ranking in the top quartile of the state median rent distribution. Although research suggests increases in state-level housing costs are associated with increases in household food insecurity (Bartfeld and Dunifon, 2004), at a county level, rent may not have the same effect. We expect households located in high-rent counties within the state of Oregon will be less likely to be food insecure, but low-income households located in these high-rent counties will be more likely to be food insecure. Simply put, we believe the interaction between an individual's income and the county rent is key to understanding a household's food security status. To explore this relationship, two interaction variables are included in an alternative model. In model 2 of table 3 (appearing later in the results section of the paper), the *Rent* dummy variable is interacted with the two lowest income quintile dummy variables, *Quintile1* and *Quintile2*.

Including interaction terms in our model does present an empirical challenge. Calculating the marginal effects of the interaction terms in nonlinear models is not straightforward, and most statistical packages do not readily present these results. As clearly outlined by Norton, Wang, and Ali (2004), there are four main difficulties faced by researchers when including these interaction terms in logit models:

⁵ Information regarding food stamp use was not available at an individual level. In the event such data had been available, we would have had to employ methods that take into account the endogeneity of program use (Gunderson and Oliveira, 2001; Huffman and Jensen, 2003).

First, the interaction effect could be nonzero, even if β_{12} is zero.... Second, the statistical significance of the interaction effect cannot be tested with a simple t -test on the coefficient of the interaction term β_{12} Instead the statistical significance of the entire cross-derivative must be calculated.... Third, the interaction effect is conditional on the independent variables, unlike the interaction effect in linear models.... Fourth, because there are two additive terms, each of which can be positive or negative, the interaction effect may have different signs for different values of the covariates. Therefore, the sign of β_{12} does not necessarily indicate the sign of the interaction effect (p. 105).

Thus, the size and significance of the interaction effect must be calculated for each observation. When the interaction variables (x_1 and x_2) are both dummy variables, as is the case in our model, the marginal effects of the interaction terms can be correctly calculated by taking the discrete double difference. In general notation,

$$(5) \quad F = \Pr(FI = 1),$$

$$(6) \quad \text{Interaction Effect} = \frac{\partial^2 F}{\partial x_1 \partial x_2},$$

where

$$\begin{aligned} \text{Interaction Effect} = & [F(x_1 = 1, x_2 = 1) - F(x_1 = 1, x_2 = 0)] \\ & - [F(x_1 = 0, x_2 = 1) - F(x_1 = 0, x_2 = 0)]. \end{aligned}$$

The correct standard errors of the interaction terms were also calculated using the delta method (Greene, 2003). All empirical analyses were conducted using Stata 8.0.

Results

Of the 4,725 individuals in the sample, about three-fifths (64%) were between 31 and 64 years of age; approximately one-fifth (21%) were over 65, and the remainder (15%) were under 30 (see table 1). Almost nine-tenths of the sample were White (89%). Just under one-third (30%) had a high school degree but no college, and well over half (61%) had some college experience. Slightly less than one-quarter of the sample (24%) had children, and about one-quarter of this group were single parents. More than half of the sample (61%) were working at the time of the interview, about one-fifth (22%) had moved across the county line in the past five years, and approximately three-quarters (71%) of the sample owned their own home.

About 1 in every 6 people in income quintile 1 were food insecure; the number drops to 1 in 10 for income quintile 2, and decreases to less than 1 in 100 for income quintile 5. Likewise, the percentage of food insecure households drops from just under 13% to 2.5% as education increases from less than high school to a college degree. As a demographic group, single mothers had the greatest percentage of individuals who were food insecure. About 1 out of 10 individuals who moved across the county line in the preceding five years was food insecure; the number drops to 1 in 16 for nonmovers. Finally, the percentage of homeowners who were food insecure was about one-third that of non-owners (4.4% and 13.3%, respectively).

Table 2. Economic and Social Characteristics of Oregon Counties: Definitions and Summary Statistics for Continuous Variables

Variable Name	Definition	Median	Minimum	Maximum
<i>Wage</i>	Average annual wage per job, 2000 (\$) ^a	26,174	16,623	43,763
<i>Unemploy_Rate</i>	Average county unemployment rate, 1999 (%) ^b	6.1	3.0	12.3
<i>Rent</i>	Median county rent (\$)	575	390	720
<i>%Rural</i>	Percent of county population that is rural (%) ^c	33.9	1.7	100.0
<i>%Mobile</i>	Percent of county population that moved in past 5 years (%) ^d	52.4	37.4	59.4
<i>%Religious</i>	Percent of county population claiming a religious affiliation (%) ^e	31.3	19.4	47.8
<i>%FoodStamp</i>	Percent of county population with income less than 185% of federal poverty line who participate in Food Stamp Program (%) ^f	44.2	18.6	51.4

Sources:

^a U.S. Bureau of Economic Analysis, Table CA-34.^b Oregon Employment Department (2002).^c U.S. Bureau of the Census, *2000 Census of the Population*; authors' calculations.^d U.S. Bureau of the Census, *2000 Census of the Population*, Table DP-2.^e Glenmary Research Center (2000).^f Oregon Department of Human Services (2003).

Oregon counties vary substantially in terms of economic opportunity, social support, county-level food stamp use, and housing affordability (see table 2 for summary statistics). The average annual wage per job varies from about \$17,000 to \$44,000, and unemployment rates range from 3% to 12.3%. The levels of social support—as measured by rurality, population mobility, and religious affiliation rates—also vary considerably. Multnomah County (with the city of Portland) has 2% of its population classified as rural, whereas there are five counties in which the entire population is rural. The measure of food stamp participation (food stamp participants as a share of county population under 185% of the federal poverty line) varies from a minimum of 19% to a maximum of 51%. And median rents in the most expensive counties are almost twice those in the least expensive counties.

The estimation results from the logit model are reported in table 3. The results support the prediction that in addition to individual and household demographics, county-level factors do play a significant role in determining the likelihood of food insecurity. The *%Rural* variable has a negative and significant effect on the probability a household is food insecure. Specifically, moving from a completely urban environment to a completely rural environment reduces the probability of food insecurity by about 5 percentage points, holding all else constant. This result suggests that characteristics unique to rural communities, perhaps in the form of social supports or other resources, play an important role in diminishing food insecurity.

Further, we find high county-level rent is significantly related to food insecurity. Recall that the *Rent* variable indicates residence in a county ranking in the top quartile of the county rent distribution. In model 1, the coefficient on *Rent* is positive and significant, which suggests residing in a high-rent county increases the likelihood of food insecurity. In model 2, the *Rent* variable is interacted with the income dummy variables

Table 3. Logit Model Results: Household Food Insecurity, Oregon Population Survey, 2000

Variable ^a	MODEL 1			MODEL 2
	Coefficient	Marginal Effects ^b		Coefficient
		Std. Deviation	Min to Max ^c	
Personal/Demographic Characteristics:				
Quintile1	4.954***	0.120		4.608***
Quintile2	4.130***	0.100		3.849***
Quintile3	3.900***	0.095		3.761***
Quintile4	2.896***	0.070		2.817***
Married_w / Kids	0.536	0.013		0.501
Married_No_Kids	-0.112	-0.003		-0.122
Single_Mother	0.890***	0.022		0.869***
Single_Father	-0.710	-0.017		-0.715
Black	0.471***	0.011		0.485***
Hispanic	0.362	0.009		0.356
<HighSchool	-0.013	-0.000		0.009
Some_College	-0.043	-0.001		-0.032
College_Degree +	-0.668*	-0.016		-0.633*
Age31-64	-0.027	-0.001		-0.072
Age65+	-1.340**	-0.033		-1.416**
Disabled	0.865***	0.021		0.874***
Social Support:				
Employed	-0.183	-0.004		-0.192
Mobile	0.399*	0.010		0.400**
Homeowner	-0.240	-0.006		-0.224
Volunteer	-0.124	-0.003		-0.134
%Rural	-0.023***	-0.001	-0.046	-0.024***
%Mobile	-0.018	-0.000	-0.007	-0.021*
%Religious	0.001	0.000	0.001	0.002
Policy:				
%FoodStamp	-0.008	-0.000	-0.007	-0.008
Economic Opportunity:				
Wage	-0.029	-0.001	-0.013	-0.029
Unemploy_Rate	0.060	0.001	0.015	0.063
Housing Affordability:				
Rent (= 1 if median county rent is > \$633)	0.330***	0.008		-0.468
Rent * Quintile1				1.277***
Rent * Quintile2				0.846

Note: Single, double, and triple asterisks (*) denote statistical significance where $p < 10\%$, $< 5\%$, and $< 1\%$, respectively.

^aThe reference category is: *Quintile5*, *Single_No_Kids*, *White*, *HighSchool*, *Age 18-30*.

^bMarginal effects are calculated with continuous variables at their median value.

^c"Min to Max" denotes the change in predicted probability as the continuous independent variable changes from its minimum to its maximum.

Table 4. Logit Model Results: Marginal Interaction Effects in Detail, Oregon Population Survey, 2000

Interactions	Mean	Standard Deviation	Minimum Interaction Effect	Maximum Interaction Effect
<i>Rent</i> * <i>Quintile1</i>	0.118	0.068	-0.078	0.386
Standard Error	0.049	0.025	0.006	0.168
z-Score	2.685	1.415	-1.073	6.436
<i>Rent</i> * <i>Quintile2</i>	0.048	0.080	-0.177	0.381
Standard Error	0.060	0.034	0.002	0.197
z-Score	0.720	1.256	-5.845	3.372

Notes: *Rent* is a dummy variable denoting residence in a county that is in the top quartile of the state median rent distribution. *Quintile1* and *Quintile2* are dummy variables indicating household income in the bottom two quintiles of the household income distribution.

Quintile1 and *Quintile2*. In this second model, the coefficient on the *Rent* variable is negative and insignificant; however, the interaction between *Rent* and *Quintile1* is positive and significant. As implied by this result, simply living in a high-rent county does not significantly influence food insecurity. It is the interplay between low income and rent that increases the probability of food insecurity. Although the coefficient on the interaction term between *Rent* and *Quintile2* is positive and significant only at the 17% level, the interaction effect is significant at the standard levels for some observations (see table 4).⁶ None of the other county-level measures are significantly different from zero.

Most personal characteristics had the expected sign (table 3). As other studies have shown, increases in household income are significantly associated with decreases in the likelihood of food insecurity. The estimated marginal effect of being in quintile 1 versus quintile 5 is an increase of 12 percentage points in the probability of food insecurity, holding all else constant. The increase drops to 10 points for quintiles 2 and 3, and 7 points for quintile 4. Being over age 65 and having a college degree are personal characteristics that are individually significantly associated with decreases in the likelihood of food insecurity. Personal characteristics found to be significantly associated with increases in the probability of food insecurity are single motherhood (*Single_Mother*), race (*Black*), moving across county lines in the past five years (*Mobile*), and the presence of a disability (*Disabled*).

Following the multivariate logit analysis, a predicted probability of food insecurity for each observation was calculated using the coefficients generated in the logit model and the values of the other independent variables for that observation. The predictions are computed for all observations that do not have missing values for the variables in the model. The mean predicted probability for all observations, which is the predicted prevalence of food insecurity as determined by model 1, is 7.4%. As noted in the introduction, the level of food insecurity reported in the 2000 Oregon Population Survey was 7.9% (for the 12 months preceding the survey).

⁶ As noted in the empirical model discussion, the magnitudes and significance of the interaction effect do vary by observation.

Table 5. Multivariate Logit Analysis Results: Probability of Food Insecurity for Demographically Profiled Low-Income Single Mothers Across the Urban-Rural Continuum, Oregon Population Survey, 2000

Percent Rural (%)	Oregon County	Probability of Food Insecurity	95% Confidence Interval
1.7	Multnomah	0.271	(0.157, 0.425)
19.0	Lane	0.199	(0.120, 0.311)
34.0	Polk	0.150	(0.088, 0.243)
76.0	Tillamook	0.062	(0.025, 0.147)
100.0	Wallowa	0.037	(0.011, 0.118)

Notes: Using the coefficients generated in model 1, predicted probabilities were calculated for different values of "rurality." Independent variables were set to: *Single_Mother*, *Quintile2*, *White*, *HighSchool*, *Age18-30*, *Not_Disabled*, *Employed*, *Renter*, *Low_Volunteer*, *Non-Mobile*, and residence is not located in high-rent county. Continuous variables were held at their median values.

Table 5 further explores the effects of rurality on food insecurity. Using the coefficients generated in the logit model, predicted probabilities of food insecurity were calculated for low-income single mothers with particular demographic characteristics who did not reside in a high-rent county. This table highlights the protective effect of living in a rural area. Other things equal, low-income single mothers living in a completely rural county have an 11 percentage point lower probability of being food insecure than those living in a county with 34% of its population classified as rural (the state average).

Conclusion

This study has examined the factors that affect food insecurity in Oregon. Much of the prior research on food insecurity and hunger has focused on the contribution of demographic characteristics, such as income, race, and marital status, at the individual and household levels. These factors, although significant, do not entirely explain why some households have difficulty acquiring enough food and others do not. Recently, researchers have turned their attention to the extent to which state-level characteristics, such as unemployment and poverty rates, independently affect state-level food insecurity and hunger rates (Bartfeld and Dunifon, 2004; Tapogna et al., 2004). Bartfeld and Dunifon, in fact, have suggested that "states vary greatly in the extent to which their risk of food insecurity can be explained by their particular demographics. In Oregon, for instance, there is only a modest decrease in state-specific odds of food insecurity once household characteristics are controlled for" (p. 23).

In this study, we assess the extent to which characteristics unique to counties influence household food security status. Results from the empirical analyses reveal that high county-level housing costs play an important role in determining food security status, especially for low-wage workers. Our findings suggest policy initiatives related to housing affordability may have an indirect effect on food security. Notwithstanding the difficulty in regulating the private housing market, city and county planners have mechanisms to affect the availability of adequate numbers of housing units at price ranges and rent levels which are commensurate with the financial capabilities of

households. Housing affordability is affected by city and county zoning policies which include limitations on apartment buildings or other multifamily housing, manufactured housing, and government-assisted housing units.

Unlike the state-level studies, we did not find that contextual residential mobility, as measured by the percentage of the county population who had moved in the past five years, affected food insecurity. However, these households were identified as more likely to be food insecure. This finding could suggest that moving by a household reduces the amount of resources available to purchase food, or that short housing tenure has an effect on community ties, and thus food insecurity.⁷

This study also does not confirm Bartfeld and Dunifon's (2004) earlier findings regarding the role played by wages and unemployment with respect to food insecurity. Unlike their state-level results, our results suggest that cross-county variations in average wages and unemployment do not significantly affect household food security. The results do, however, strongly support our conjecture that households in rural communities are more food secure, when demographics and economic conditions are controlled. Households in rural communities may have more extensive social networks, which include both familial and nonfamilial members, than their urban counterparts. While we withhold judgment on such speculations, an argument might conceivably be made that households in rural communities have greater opportunities to grow their own foods, and therefore are less likely to experience periods of food insecurity. Due to data limitations, it was not possible to explore other characteristics unique to rural communities which might contribute to the lower rates of food insecurity. Clearly, this is a research area in need of further exploration.

Our results confirm that food insecurity is much more than a problem arising from individual choices. The *local* community food security infrastructure, which includes housing and social supports, significantly affects the likelihood of families experiencing food insecurity. Local actions undertaken to strengthen this infrastructure may be expected to have more pronounced effects in states like Oregon, where the influence of contextual factors is relatively strong. While recognizing that local contextual factors are not easy to change, we argue that successful efforts to reduce local housing costs for low-income households, for example, may be expected to decrease local household food insecurity.

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⁷ It could also be, however, that food insecurity influences residential mobility decisions. Edwards and Weber (2003), using Current Population Survey data, found an association between within-county moves of a household and household food insecurity. This is consistent with either an endogenous or a unidirectional relationship.

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Appendix:
Short Form Questionnaire
of the 12-Month Food Security Scale

*I'm going to read you two statements that people have made about their food situation. Please tell me whether the statement was **OFTEN**, **SOMETIMES**, or **NEVER** true for (you/you or the other members of your household) in the last 12 months.*

1. The first statement is, "The food that (I/we) bought just didn't last, and (I/we) didn't have money to get more." Was that often, sometimes, or never true for (you/your household) in the last 12 months?

[1] Often true
[2] Sometimes true
[3] Never true
[DK, R]

2. "(I/we) couldn't afford to eat balanced meals." Was that often, sometimes, or never true for (you/your household) in the last 12 months?

[1] Often true
[2] Sometimes true
[3] Never true
[DK, R]

3. In the last 12 months, since [date 12 months ago] did (you/you or other adults in your household) ever cut the size of your meals or skip meals because there wasn't enough money for food?

[1] Yes
[2] No (Go to question 5)
[DK, R] (Go to question 5)

4. **[Ask only if #3 = YES]** How often did this happen—almost every month, some months but not every month, or in only 1 or 2 months?

[1] Almost every month
[2] Some months but not every month
[3] Only 1 or 2 months
[DK, R]
[X] Question not asked because of negative or missing response to question 3

5. In the last 12 months, did you ever eat less than you felt you should because there wasn't enough money to buy food?

[1] Yes
[2] No
[DK, R]

6. In the last 12 months, were you ever hungry but didn't eat because you couldn't afford enough food?

[1] Yes
[2] No
[DK, R]

Questionnaire Scaling Instructions:

Items 1 and 2 are scored as affirmative if response is [1] “often true” or [2] “sometimes true.” They are scored as negative if response is [3] “never true.”

Items 3, 5, and 6 are scored as affirmative if response is [1] “yes,” and negative if response is [2] “no.”

Item 4 is scored as affirmative if response is [1] “almost every month” or [2] “some months but not every month.” It is scored as negative if response is [3] “only 1 or 2 months” or [X] (question not asked because of negative or missing response to question 3).

Households affirming zero or one item are classified as *food secure*. Households affirming 2, 3, or 4 items are classified as *food insecure with no hunger evident*.

Households affirming 5 or 6 items are classified as *food insecure with hunger evident*.

Note: For interview surveys, DK (don’t know) and R (refused) are not presented as response options, but are marked if volunteered. For self-administered surveys, DK is presented as a response option.