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

by

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I. Introduction

As the extent of household food insecurity in the US has become better understood, policymakers at the federal and state levels have sought 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 choices that people make that increase the vulnerability of a household. Other look to the economic and social context in which individuals and households make their choices: the availability of jobs, local wage levels, costs of living and availability of social supports. Still others seek the causes in governmental and nongovernmental institutional responses to economic distress. This study attempts to untangle the multiple sources of food insecurity by examining the roles of household demographics, local economic and social conditions and federal food security programs in explaining the likelihood of household food insecurity in Oregon, the state with the highest hunger rate in the nation in four of the last five assessments. We believe this is the first study that has examined the role of local (county-level) contextual factors in explaining food insecurity.

There have been a number of national studies that have assessed the extent to which personal and household characteristics (i.e., race, number of family members, marital status, and income) affect food insecurity and hunger (Kasper et al., 2000; Nelson, K., Brown, M., Lurie, N, 1998; Olson & Rauschenbach, 1997; Rose, Gunderson and Oliveira, 1998; Tarasuk, 2001). An emerging literature has examined the effects of state-level contextual characteristics on individual household insecurity (Bartfeld & Dunifon, 2003; Borjas, 2001; Opsomer et al., 2003). Opsomer et al. (2003) find that living in a metropolitan area increases a household's risk of food insecurity. Borjas (2001) finds that state-level differences in availability of certain welfare benefits for immigrants affects their food insecurity. Bartfeld and Dunifon (2003) find that although personal and contextual characteristics together explain a large part of interstate differences in food security, state-level policies—the summer lunch program, the food stamp program and state and local tax and welfare policy—can also affect household food security. For those just above the poverty line, a strong labor market and a stable community can be particularly important factors in the reduction of food insecurity.

In this paper, we use the theoretical foundation of the state-level analysis and evaluate the magnitudes and causes of differential probabilities of food insecurity in one particular state, Oregon. The uniquely high hunger rates in Oregon, especially among employed families and 2-parent family households with children, make this an especially important state to examine with regard to the influence of social context and policy variables (Edwards and Weber, 2003). Edwards and Weber (2003) found that economic factors and the demographic composition of the Oregon population do not 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 such effects in other states, where such data are not currently available.

In this study, food insecurity is modeled as a function of personal characteristics and county-level contextual variables. The analyses are based on the 2000 Oregon Population Survey data, supplemented by data from the 2000 Census and other sources identified in Table 2. The Oregon Population Survey contains information on food insecurity and on personal and household 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 following is the sequence of this paper. Section II of the paper develops a theoretical foundation from which the empirical model is derived. Section III covers the statistical analysis and results. Section IV concludes and offers policy implications.

II. **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, Innes, Rausser & Zilberman

(1993), Lancaster (1966) and Rose, Gunderson and Oliveira (1998), but integrates county-level economic, social support and policy factors, all of which influence household production and consumption decisions.

Consider a utility function that is comprised of food security, FS, a vector of other goods, $\mathbf{X_O}$, and leisure, l.

$$U = U(FS, \mathbf{X_o}, l)$$

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

$$FS = f(\mathbf{X_f}, L_f, \mathbf{x}),$$

where $\mathbf{X_f}$ is a vector of food products, L_f is time spent purchasing and preparing food and $\mathbf{x}$ is a vector of characteristics that influences the environment in which production takes place. The budget constraint takes the following form:

$$\mathbf{P_f X_f} + \mathbf{P_o X_o} = V + w(T - L_f - l),$$

where $\mathbf{P_f}$ is a vector of food prices, $\mathbf{P_o}$ is a vector of non-food prices, V is non-wage income, and T is total time available to the household.

The reduced form food security equation resulting from household utility maximization can be written as the following,

$$FS = f^*(\mathbf{P_f}, \mathbf{P_o}, V, w, \mathbf{x}).$$

It is quite often the case that studies using a household production approach assume that prices are either fixed or captured by regional dummy variables and focus mainly on income and demographic components of $\mathbf{x}$. The value of the household production approach, however, is in directing what should be included in $\mathbf{x}$. In the model presented in this paper, $\mathbf{x}$, not only contains the standard demographic and income information, but also factors representing social support, local economic opportunity and social policy.

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 moderate the relationship between income inequality and health (Kawachi, Kennedy, Lochner, and Prothrow-Stith, 1997; Kreuter, Lezin and Koplan, 1998; Martin et al., 2004; Sampson, Raudenbush, and Earls, 1997). Social supports in the context of food insecurity can also directly affect food security by providing access to food and other resources to reduce the probability of food insecurity.

Also included in the theoretical model are measures related to economic opportunity—county wages and the county unemployment rate. Both 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.

In terms of policy, the United States Department of Agriculture's Food and Nutrition services administers 15 domestic food and nutrition assistance programs. The purpose of these programs is to reduce food insecurity and improve the nutrition of adults and children in the United States. Among the most widely-used programs are the Food Stamp Program and the School Lunch Program. Approximately 1 out of every 4 food insecure households use the Food Stamp Program and 1 out of every 3 use the National School Lunch Program (Nord, Andrews & Carlson, 2003). Our model incorporates measures of county utilization of these two programs which provide a window with which to view the program's reach into the community.

III. Empirical Model

Food security was measured in the 2000 Oregon Population Survey (OPS) using the 6-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 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) Details about the derivation of this measure are in Appendix A.

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 that "the food [they] bought didn't last and [they] didn't have money to get more" and that they "couldn't afford to eat balanced meals." Those with a greater level of food insecurity indicated that 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 percent 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 percent 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 (13.7 percent). The Oregon Population Survey estimate is less than the CPS estimate for two reasons: (1) the questionnaire design screened out potentially food insecure/hungry households that were not screened out in the CPS survey (the OPS screened them out if they said that they had enough of the kinds of food they wanted in the previous 12 months in the screening question; the CPS applied this screen only to households with incomes above 185 percent of the poverty line and asked all households with incomes below that level the food security questions; (2) 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 they are less likely to have telephones. Thus we believe that the OPS underestimates rates of prevalence of food insecurity and hunger. However, we believe that the cross-county variations in food insecurity and hunger are likely to be reliable. We expect some small cross-county bias in sampling rates due to random digit dialing. Only 1.6 percent of households didn't have telephones in 2000; however, 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 percent). Given the small sample sizes in rural counties, however, this variation is not expected to affect the results in any appreciable way.

We use logistic regression to assess the various contributions of local economic opportunity, social supports, food security programs, and household and personal demographic characteristics to the likelihood of food insecurity. In our model, the probability of food insecurity, FI, for individual i is the following:

$$P(FI = 1) = \frac{e^{\beta' \mathbf{x}}}{1 + e^{\beta' \mathbf{x}}} \text{ where}$$

x is a vector of independent variables and **β** is a vector of parameters that reflect the impact of changes in **x** on the probability of food insecurity. The vector of independent variables can be separated into the following groups: **D** denotes a vector of household and personal demographic characteristics. **S** denotes a vector of social support variables. **E** denotes a vector of characteristics related to local economic opportunity. **P** denotes a vector of characteristics related to food security policy, and **A** is a vector of characteristics related to affordability.

The analytic sample is 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. The individual characteristics modeled in this paper are those of the respondent. The demographic variables include household composition, household income, race, disability status, and age. The household composition variables specify whether an individual 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 & Carlson, 2003; Olson, Rauschenbach, 1997; Rose, Gunderson, & Oliveria, 1998).

The dataset used in this analysis did not allow for inclusion of wages and non-wage 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 & Carlson, 2003; Olson, Rauschenbach, 1997; Rose, Gunderson, & Oliveria, 1998). In

[1] The OPS collected information on income bands, rather than a continuous measure of household income. Estimated household income was imputed as a continuous measure of income using techniques outlined by Bhat (1994) and Stewart (1983).

addition, there is also an indirect impact on the ability to procure transportation on a permanent and transitory basis—lack of transportation is one reason individuals have cited for not acquiring enough food (Briefel and Woteki, 1992). In many communities public transportation is limited. Small urban and rural communities often lag behind in adequate public transportation. Approximately 41 percent have no access to transit and another 25 percent live in areas with below-average transit services[2] (Community Transportation Association) and studies have shown that low-income households are less likely to own a car than other households due to the prohibitive cost of purchasing, insuring, and maintaining a car (U.S. Federal Highway Admin, 2003).

We anticipate that race is a significant contributing factor to household food insecurity (Rose, Gunderson, & Oliveria, 1998). Household food insecurity is more than two times as prevalent among African-American and Hispanic households than non-Hispanic White households (Carlson, Andres, Bickel, 1999; Nord, Andrews, Carlson, 2003).

We anticipate that individuals who are part of families that have one or more adults who are disabled are more likely to be food insecure; research has shown that longstanding heath 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[3], 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 are greater than the marginal benefit—a 2000 survey of Americans with Disabilities reported that thirty percent of respondents with disabilities reported difficulty in accessing transportation, compared to 10 percent of respondents without a disability, (National Organization on Disability). It may also be the case that additional resources are needed to manage the disability, thus 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. DOE, 1994; Lou Harris and Associates, 1987), which in turn means lower wages and possibly higher rates of food insecurity.

[2] Small-urbanized population is between 50,000 and 200,000. A Rural area population is less than 50,000.
[3] In December, 2002, 78,984 Oregon residents received DI benefits (Social Security Administration, Master Beneficiary Record, 100 percent data).

Recent research has indicated that older individuals experience significantly lower rates of food insecurity (Nord, Andrews and Carlson, 2003). Not only are individuals over 65 more likely to draw on social security and their retirement savings, but also they are more likely to experience lower housing expenditures. Together, these events increase the amount of income that is available for the purchase of food. Furthermore, older individuals have greater experience in terms of preparing and shopping for food. The relationship is complicated, however, by the fact that many older individuals face transportation problems. According to an AARP survey, 16 percent of respondents over age 75 do not have a driver's license and 25 percent of licensed drivers report not having driven even once during the previous month (Ritter, Straight, Evans, 2002). Additionally, many older individuals have difficulty accessing public transportation due to physical limitations (U.S. GAO, 2003) and are less likely to self-identify as food insecure due to lower food needs and reduced hunger sensation (Rolls, 1993).

Education level is expected to affect food insecurity directly through greater knowledge about cooking and nutrition and indirectly through higher wage levels (Olson & Rauschenbach, 1997; Rose, Gunderson, & Oliveria, 1998). Furthermore, it could be argued that individuals with greater education have an easier time navigating the array of community services available to circumvent food insecurity

Social support factors include the following: percent of county population living in rural areas, percent of county population affiliated with a religious congregation, and percent of households in the county that moved in the past five years. Existing research provides little information regarding the relationship between the urban/rural status of the community and food insecurity at the state level (Opsomer et al., 2003). Those living in rural areas could have 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 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 R, 1995; Mechanic, D, 1998; McGuire, WJ, 1974) and a decrease in the success of heath promotion and disease prevention programs (Kreuter, Young, Lezin, 1998). Data at the national level suggests that there is a higher prevalence rate 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 percent of the county considered rural under the Census Bureau definition of rural[4]. With this measure, we are able to capture small incremental differences in "rurality" that can not 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, Ellison. 1998).

Social support is also represented at the individual level. Dummy variables indicating home ownership, whether an individual has moved in the past 5 years, whether an individual volunteered more than 100 hour a year in the past year and whether an individual is employed are included in the empirical model. Research indicates that individuals who perceive themselves to be socially isolated are more likely to report food insecurity with moderate or sever hunger (Tarasuk, 2001)[5]. That said, our expectation is that individuals who have committed to living in a community by buying a home and/or volunteering are more connected to his or her neighbors and less likely to experience food insecurity (Calabrese & Shumer, 1986; Gunderson, & Oliveria, 1998; Rose, Gunderson, & Oliveria, 1998; Safrit, D. & King, J, 1994). Although some researchers have argued that home ownership can also serve as a proxy for asset wealth and possible liquidity level (Blaylock, 1991; Rose, 1999; Rose, Gunderson, & Oliveria, 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

[4] "Rural" households are those living in open country and settlements of less than 2,500. The 2000 Census defines a household as "rural" if it is outside of (1) *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 minimym residential population of at least 50,000 people") and (2) *urban clusters* ("a densely settled territory that has at least 2,500 people but fewer than 50,000").

[5] In the Tarasuk (2002) study, the perception of social isolation is not associated with single parenthood.

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 is captured by the inclusion of county wages and the county unemployment rate. Our expectation is that individuals living in counties with higher average wages will have a lower probability of food insecurity for two reasons. First, wealthier communities experience more charitable giving (Schervish, P. & Havens, J., 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 more likely to be wealthy themselves. Admittedly, it may be the situation that a small percentage of the population earns substantially more money than the rest 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.

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.

We captured the effects of local county-level food security programs and policies by incorporating variables that proxy the capacity of the local public food security system to reach eligible populations—the Food Stamp program use and Free- and reduced-price-Lunch program use.[6] We believe that program use is indicative of how successful community programs are at targeting those in need. Given that local factors that might affect the demand for these programs (household income, local unemployment rates, etc.) are controlled in the model, these policy and program variables can be considered reasonable indicators of the success of such programs in supplying services, high use rates being indicative of more successful targeting efforts.

As this analysis is a static analysis, specific measures of P_f and 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

[6]Information regarding individual food stamp and free lunch use was not available; In the event that individual data had been available, we would have had to employ methods that take into account the endogeneity of program use (Gunderson & Oliveira, 2001 Huffman & Jensen, 2003;)

(RENT) that indicates whether a household is located in a county that is in the top quartile of the state median rent distribution is included. Although research indicates that increases in state-level housing costs are associated with increases in household food insecurity (Bartfeld & Dunifon, 2004), at a county level, rent may not have the same effect. We anticipate that households located in a high rent counties, within the state of Oregon, will be less likely to be food insecure, but that low-income households located in these high rent counties will be more likely to be food insecure. Simply put, we believe that the interaction between an individual's income and the county rent is key to understanding a household's food security status. To further explore this relationship, two interaction variables are included in the model; the rent dummy variable is interacted with bottom two income quintile dummy variables.

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 in Norton, Wang & Ali (2004), there are four main difficulties that researchers face when including these interaction terms in logit models. "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 indicating the sign of the interaction effect." (p. 3). Thus, the size and significance of the interaction effect must be calculated for each observation. When the interaction variables are both dummy variables, the marginal effects of the interaction terms can be correctly calculated by taking the discrete double difference. In general notation,

$$F = \Pr(Y = 1),$$

$$Interaction\ Effect = \frac{\partial^2 F}{\partial x_1 x_2}$$

$$Interaction\ Effect = [F(x_1 = 1, x_2 = 1) - F(x_1 = 1, x_2 = 0)] - [F(x_1 = 0, x_2 = 1) - F(x_1 = 0, x_2 = 0)]$$

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.

IV. Results

Of the 4,725 individuals in the sample, about three-fifths (64%) were between 31 and 64 years of age; one-quarter (21%) were over 65 and the remainder (15%) were under 30 (See Table 1). Almost nine-tenths of the sample is white (89%). Just under one-third (30%) had a high school degree but no college, and over half (61%) had some college experience. Just under one quarter of the sample (24%) have children; about one-quarter (24%) of this group were single parents. More than half of the sample was working (61%) at the time of the interview; about one-fifth (22%) had moved across the county line in the past 5 years and about three-quarters (71%) of the sample owned their own home.

About one in every 5 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. As a demographic group, single mothers had the greatest percentage of individuals who were food insecure. Likewise, the percent food insecure drops from just under 13% to 2.5% as education increases from less than high school to a college degree. About 1 out of 10 individuals who moved across the county line in the preceding 5 years was food insecure; the number drops to 1 in 16 for non movers. Lastly, the percentage of homeowners who were food insecure was about 1/3rd that of non-owners (4.4% and 13.3%, respectively).

Results from the logit models are shown in Table 3. Most personal characteristics had the expected sign (Model 1). 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 11 percentage points in the probability of food insecurity, holding all else constant. The increase drops to 9 points for quintiles 2 and 3, and 6 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 that are significantly associated with increases in the probability of food insecurity are single motherhood, race (Black), moving in the past five years and the presence of a disability.

Controlling for individual and household demographics, local economic conditions (local wages and unemployment) have a significant effect on the likelihood that a given household will be food insecure. Specifically, a 1 percentage point increase in the local unemployment rate increases the probability of a household being food insecure by 0.3 percentage points, other things equal. And a $1000 increase in county-level average annual wages decreases the probability of food insecurity by .1 percentage points.

Also, whether one lives in a rural or urban environment matters greatly. 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. The county food stamp level is also significant determinant of food insecurity. Increases in the percent of the county receiving food stamps are associated with a reduced probability of individual food insecurity. A 1 percentage point increase in the county Food Stamp participation rate is associated with a 0.1 percentage point decrease in the likelihood of household food insecurity.

The empirical analysis does not suggest that high county-level rent is associated with a significantly higher probability of food insecurity. The coefficient on the rent dummy variable although positive, is not significant. Evidence does suggest, however, that very low-income households (income quintile one) located in high-rent counties have an increased probability of food insecurity (Model 2). As noted in the empirical model section above and as shown in Table 4, the magnitudes and significance of the interaction effect does vary by observation. Also included in Model 2 is the interaction between the income quintile-two variable and the rent variable. Although the coefficient is positive and significant only at the twenty percent level, the interaction effect is significant at the standard levels for some observations.

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).

Tables 5 thru 7 further explore the effects of selected variables. Using the coefficients generated in Model 1, predicted probabilities were calculated for different values of the independent variables. One finding that consistently emerges in all scenarios is the protective effect of living in a rural area. Specifically, incremental increases in the percent of households in the county that is considered rural protects against food insecurity (Table 5). Another example of this rural protection is shown in Table 6. Increases in the percent of the county receiving food stamps reduce the probability of food insecurity; however, at all levels of food stamp receipt, food insecurity was almost twice as prevalent in urban as in rural settings. As shown in Table 7, this protection extends to increases in the unemployment rate as well.

Conclusion

In this paper, we have attempted to explain an individual household's food insecurity as the outcome of a utility maximizing process in which the choices are constrained by previous personal decisions, by the economic opportunities available in the locality, by the household's and community's social networks and by the effectiveness of public food security programs. This study provides evidence to support findings of earlier studies that food insecurity is affected by one's given demographics (age, gender, race/ethnicity, disability) and life decisions (marriage, child bearing, education, place of residence, work).

This study builds on the results of earlier studies, generally confirming the findings of Bartfeld and Dunifon (2003) regarding the importance of contextual factors in explaining individual household food insecurity, suggesting that many of these factors are important at the local level. Like their state-level results, our results suggest that local variations in food security policy, wages and unemployment affect household food

security and confirm that households in rural communities are more food secure, when demographics and economic conditions are controlled.

Like Bartfeld and Dunifon, we found that housing costs for very low-income households, affects household food insecurity. Unlike Bartfeld and Dunifon, we did not find that contextual residential mobility affected food insecurity. We did, however, find that a household that had moved in the last five years was more likely to be food insecure.

Untangling the factors that affect food insecurity is an enormously difficult undertaking. Our analysis provides some evidence that personal demographics, previous personal choices, existing social networks, local economic forces and social policy and programs all play a role in determining the food security status of a household. Perhaps most importantly, they suggest that household food insecurity in Oregon is not determined only or even primarily by household demographics. This is consistent with the findings about Oregon in the Bartfeld and Dunifon study. According to the authors of that study, "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.18)

Our results suggest food insecurity is much more than a problem with individual choices. It is the case that that the *local* community food security infrastructure (broadly defined in Bartfeld and Dunifon to include food stamp outreach, wages and employment opportunities and housing costs) significantly affects the likelihood that families will be food insecure. Local actions that strengthen this infrastructure may be expected to have stronger effects in states like Oregon where the influence of contextual factors is relatively strong. This is not to suggest, of course, that local contextual factors are easy to change, but it is to say that successful efforts to change food stamp outreach, local job conditions and housing costs may be expected to reduce local household food insecurity.

Table 1: Demographic and Economic Characteristics of Oregon Households Summary Statistics Oregon Population Survey (2000)		
	Percent of Sample	Within Variable Percent Food Insecure
Income Quintile 1	20.00	17.33
Income Quintile 2	20.00	9.25
Income Quintile 3	20.00	5.81
Income Quintile 4	20.00	2.24
Income Quintile 5	20.00	.11
Married w/kids	18.51	7.08
Married no kids	35.97	3.94
Single Mother	4.15	24.38
Single father	1.73	3.24
Single no kids	39.64	7.95
Black	1.85	13.92
Hispanic	6.94	13.84
White	88.66	6.34
Less than High School	8.58	12.88
High School	29.93	8.98
Some College	32.36	7.34
College Degree +	29.12	2.46
Age 18-30	15.36	10.45
Age 31-64	63.68	7.14
Age 65+	20.96	3.72
Disabled	11.51	16.26
Not Disabled	88.49	5.74
Employed	60.92	5.95
Not employed	39.08	8.51
Moved in last 5 years	21.96	10.12
Not Moved in last 5 years	78.04	6.05
Home Owner	71.17	4.36
Does not own home	28.83	13.31
Volunteer > 100 hours	14.16	4.22
Volunteer < 100 hours	85.84	7.40

Table 2: Economic and Social Characteristics of Oregon Counties Summary Statistics: Median, Minimum, Maximum for Continuous Variables			
	Median	**Minimum**	**Maximum**
Average annual wage per job, 2000 ($)[7]	26,174	16,623	43,763
Average county unemployment rate, 1999 (%)[8]	6.1	3.0	12.3
Median county rent ($)	575	390	720
Percent Rural: Percent of county population that is rural (%)[9]	33.9	1.74	100
Percent moved: Percent of county population that moved in past 5 years (%)[10]	52.4	37.4	59.4
Percent Religious Affiliation: Percent of county population claiming a religious affiliation (%)[11]	31.3	19.4	47.8
Percent Food Stamp: Percent of county population participating in Food Stamp Program (%)[12]	13.6	4.9	16.5
Percent Free Lunch: Percent of children in county receiving free and reduced-price school lunch (%)[13]	43.7	23.5	65.6

[7] Bureau of Economic Analysis Table CA-34 http://www.bea.doc.gov/bea/regional/reis/drill.cfm
[8] Oregon Employment Department, Resident Labor Force, Unemployment and Employment 1999, (2001 Benchmark), April 2002
[9] US Bureau of the Census, Census 2000, author calculations.
[10] US Bureau of the Census, Census 2000, Table DP-2
[11] Glenmary Research Center, Religious Concregations and Memberships 2000, http://ext.nazarene.org/rcms/
[12] Oregon Department of Human Services, January 2003 Public Assistance Data, http://www.dhs.state.or.us/assistance/data/papage.htm in S. Bowman et al., *Poverty and Food Assistance in Oregon,* Oregon State University Extension Service EM 8842-E, November 2003.
[13] Oregon Department of Education, Child Nutrition Programs, 2002-2003 school participation data as of October 21, 2002 in S. Bowman et al., *Poverty and Food Assistance in Oregon,* Oregon State University Extension Service EM 8842-E, November 2003.

Table 3 – Logit Model: Food Insecurity

Oregon Population Survey (2000)

	Model 1				Model 2	
			Marginal Effects			
	Coefficient		Standard[b]	Min to Max[c]	Coefficient	
Personal Characteristics[a]						
Income Quintile 1	4.958	***	.110		4.615	***
Income Quintile 2	4.134	***	.092		3.856	***
Income Quintile 3	3.901	***	.086		3.764	***
Income Quintile 4	2.895	***	.064		2.817	***
Married w/kids	.535		.012		.500	
Married w/o kids	-.114		-.003		-.124	
Single mother	.895	***	.020		.865	***
Single father	-.705		-.016		-.710	
Black	.470	***	.010		.483	***
Hispanic	.370		.008		.364	
Less than High School	-.013		-.000		.009	
Some College	-.044		-.001		-.033	
College Degree +	-.670	*	-.015		-.635	*
Age 31 to 64	-.020		-.001		-.064	
Age 65+	-1.340	**	-.030		-1.413	**
Disabled	.869	***	.019		.876	***
Employed	-.184		-.004		-.192	
Moved	.399	*	.009		.400	**
Home owner	-.241		-.006		-.225	
Volunteer	-.123		-.003		-.134	
Social Support						
Percent Rural	-.027	***	-.001	-.048	-.027	***
Percent Moved	-.009		-.000	-.003	-.013	
Percent Religious Affiliation	.005		.000	.003	.003	
Policy						
Percent Food Stamp	-.048	*	-.001	-.014	-.047	*
Percent Free Lunch	-.010		-.000	-.009	-.009	
Economic Opportunity						
Average Wages (000)	-.035	**	-.001	-.014	-.034	**
Average Unemployment Rate	.149	*	.003	.041	.148	*

Table 3 – Logit Model: Food Insecurity

Oregon Population Survey (2000)

	Model 1				Model 2	
			Marginal Effects			
	Coefficient		Standard[b]	Min to Max[c]	Coefficient	
Affordability						
Rent (= 1 if median county rent > $633)	.076		.002		-.706[d]	
Rent * Income Quintile 1					1.269	***
Rent * Income Quintile 2					.840	

[a]Reference Category is quintile 5, single no kids, white, high school, age 18-30

[b]Marginal effects are calculated with continuous variables at their median value

[c]The change in predicted probability as the continuous independent variable changes from its minimum to maximum

[d]The coefficient is significant at the 11 percent level.

***p<.01, **p<.05, *p<.1

Table 4 – Logit Model, Interaction Effects in Detail

Variable	Mean	Standard Deviation	Minimum Interaction Effect	Maximum Interaction Effect
Rent*Quintile 1	.095	.052	-.020	.336
Standard Error	.044	.023	.003	.223
z - score	2.203	.675	-.270	4.23
Rent*Quintile 2	.031	.062	-.122	.329
Standard Error	.057	.032	.001	.205
z - score	.443	.776	-3.378	3.031

Table 5 – Probability of Food Insecurity across the Urban-Rural Continuum
Multivariate Logit Analysis
Oregon Population Survey (2000)

Percent Rural	Oregon County	Probability of Food Insecurity	95% Confidence Interval
1.7	Multnomah	.280	(.164, .434)
19.0	Lane	.197	(.118, .309)
34.0	Polk	.141	(.082, .234)
76.0	Tillamook	.051	(.019, .127)
100.0	Wallowa	.028	(.008, .095)

Note: Using the coefficients generated in Model 1, predicted probabilities were calculated for different values of "Rurality". Independent variables were set to: single mother, quintile 2, white, high school graduate, 18-30, not disabled, employed, renter, low volunteer effort, did not move in past 5 years and not residing in high rent county. Continuous variables were held at their median values.

Table 6 – Probability of Food Insecurity: Food Stamp Variation
Multivariate Logit Analysis
Oregon Population Survey (2000)

County-Level Food Stamp Participation Rate	Probability of Food Insecurity Overall	Probability of Food Insecurity Urban Setting	Probability of Food Insecurity Rural Setting
5	.200	.266	.157
7	.185	.247	.144
9	.171	.230	.133
12	.151	.205	.117
15	.133	.182	.103

Note: Using the coefficients generated in Model 1, predicted probabilities were calculated for different values of "Percent of County Population Receiving Food Stamps". Independent variables were set to: single mother, quintile 2, white, high school graduate, 18-30, not disabled, employed, renter, low volunteer effort, did not move in past 5 years and not residing in high rent county. Continuous variables were held at their median values. Percent rural in urban setting is set to 20%; Percent rural in a rural setting is set to 45%.

Table 7 – Probability of Food Insecurity: Unemployment Rate Variation
Multivariate Logit Analysis
Oregon Population Survey (2000)

County-Level Unemployment Rate	Probability of Food Insecurity Overall	Probability of Food Insecurity Urban Setting	Probability of Food Insecurity Rural Setting
2	.082	.115	.062
4	.108	.149	.082
6	.140	.190	.108
8	.179	.240	.140
10	.228	.300	.180

Note: Using the coefficients generated in Model 1, predicted probabilities were calculated for different values of "County-Level Unemployment Rate". Independent variables were set to: single mother, quintile 2, white, high school graduate, 18-30, not disabled, employed, renter, low volunteer effort, did not move in past 5 years and not residing in high rent county. Continuous variables were held at their median values. Percent rural in urban setting is set to 20%; Percent rural in a rural setting is set to 45%.

Appendix A

Short Form of the 12-month Food Security Scale - Questionnaire
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
   (D, 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
   (D, 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 5)
   (D, R) (GO TO 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
   (D, 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
   (D, 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
(D, R)

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.

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