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Food Insecurity and Disability

Do Economic Resources Matter?

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Food Insecurity and Disability: Do Economic Resources Matter?

This research examines the relationship between work disability and food insecurity, and tests whether the positive association between disability and food insecurity is accounted for by two mechanisms: economic resources and/or competing consumption needs. A sample (N=6,997) is chosen from the 1999 Panel Study of Income Dynamics (PSID) with over 1,200 households headed by people with disabilities. Findings support both mechanisms but depending on the levels of food insecurity and the types of family economic resources, their success at explaining the relationship of disability with food insecurity varies. In addition, we find that household assets are more effective than income in protecting people with disabilities against food insecurity. Implications for disability policy and food assistance programs are discussed.

Key words: *disability, food insecurity, income, assets, economic resources*

Food insecurity is still prevalent in the U.S. (Alaimo, Briefel, Frongillo, & Olson, 1998; Nord, Andrews, & Carlson, 2008). According to the U.S. Department of Agriculture (Bickel, Nord, Price, Hamilton, & Cook, 2000), households are food insecure if they have "limited or uncertain availability of nutritionally adequate and safe foods or limited or uncertain ability to acquire acceptable foods in socially acceptable ways" (p. 6). The latest household food insecurity report (Nord et al., 2008) shows that, at the national level, 11.1% of households (13 million households) were not able to secure their food consumption at certain points of 2007, and the prevalence of household food insecurity has remained mostly around 11% since 1998. Household food insecurity has been examined in various socio-demographic populations but very little is known about food insecurity status of people with disabilities. No information is available from the U.S. household food insecurity report regarding the prevalence rate of food insecurity in the disability population (Nord et al., 2008).

We suspect that people with disabilities are more likely to experience food insecurity. People with disabilities have relatively constrained economic resources due to their higher poverty rate and lower employment rate compared to those without disabilities (Weathers, 2005). In addition, people with disabilities have higher consumption demands for health services (Rogers & Hogan, 2001) and lower levels of access to food supplies, which may affect their food consumption (She & Livermore, 2007). Due to constrained economic resources, there may be competing needs for health costs and food consumption for families of individuals with disabilities. A possible association between disability and food insecurity is reflected in the current food assistance policies. For example, applicants to the Supplemental Security Income (SSI) program—mainly poor individuals with disabilities—are usually allowed to jointly apply for the Food Stamp Program (FSP) (Social Security Administration, 2004). A household can be categorically eligible for the FSP if all household members are the SSI recipients. In addition, the FSP has special provisions for people with disabilities regarding resource limits and medical deductions. The asset limit for households with disabled members is $1,000 more than those without (US Department of Agriculture, 2008).

This study empirically investigates the association between disability and food insecurity. Specifically, we examine the extent to which constrained economic resources and distinctive consumption needs of households with disabled members account for the association between disability and food insecurity. Our analysis considers disability status of household heads and their wives as other household members' disability status is unknown from the data. With regard to economic resources, attention is given to household assets (including net worth, liquid assets, and homeownership) in addition to household income because household assets are more stable than income and can be used for consumption smoothing at the time of unexpected income shocks (Sherraden, 1991). To account for consumption needs, we also examine household food costs and health expenditures.

Background

Determinants of food insecurity

Household food insecurity varies by individual socioeconomic characteristics and household composition. For example, food insecurity is more likely to occur among households with income below the poverty line, single-headed households with children, and African-Americans, while older adults or households without children report lower rates of food insecurity (Nord et al., 2008). Rose, Gundersen, and Oliveira (1998) find that income, household size, homeownership, educational level, household head's age, and food stamp participation are significant socio-economic determinants of food insecurity. Ribar and Hamrisk (2003) find that the income-to-needs ratio is significantly associated with transitions into and out of food insecurity, and that families with liquid constraints and limited assets are more likely to experience food hardship. In addition, several related findings demonstrate that household food insecurity is affected more by short-term income than by long-term income (Iceland & Bauman, 2007), and negative income shocks increase the possibility of experiencing food insufficiency (Bania & Leete, 2007; Gundersen & Gruber, 2001). The effects of income volatility on food insecurity suggest the importance of household assets for consumption smoothing during economic crises. Assets have a significant impact on food consumption (West & Price, 1976). Gundersen and Gruber (2001) find that household food insecurity can be a result of low initial assets and lack of savings.

Heflin and her colleagues (Heflin, Corcoran, & Siefert, 2007) further propose three mechanisms accounting for food insecurity: availability of resources, competing demands, and coping strategies. Limited financial resources discourage households from consuming sufficient food. The negative association between food insecurity and family income has been consistently documented in the existing studies (Alaimo et al., 1998; Gundersen & Gruber, 2001). In addition, competing demands over restricted economic resources may force households to make tradeoffs between food and other needs such as childcare or healthcare. In other words, for those with limited economic resources, lower levels of food costs or higher levels of expenditures on other consumption may be related to a higher risk of food insecurity. Finally, with the same financial circumstances and competing consumption needs, households with better coping strategies and financial skills may be able to manage their resources more effectively and thus lower their risk of food insecurity.

Disability and food insecurity

While household food insecurity has been examined in various populations, such as children (Dunifon & Kowalski-Jones, 2003), immigrants (Von Hook & Balistreri, 2006), and welfare

populations (Heflin et al., 2007), little is known about food insecurity among people with disabilities (She & Livermore, 2007). It is suspected that people with disabilities and their families are more vulnerable to food insecurity than their counterparts without disabilities, and the disability-related effects on household food insecurity may be explained by the three mechanisms suggested by Heflin and her colleagues (2007).

First, households with disabled members are more likely to be limited by constrained economic resources due to their low labor market participation. For example, when primary income earners—household heads—are not able to work due to disability onset, there may be a sharp decline in household income. Having a disabled member in the household may also reduce other members' labor force participation, and decrease household income (Rogers & Hogan, 2001). Defining disability as functional and activity limitations, both McNeil (2001) and Wang (2005) find that disability is highly correlated with low employment rates and income poverty, based on the Survey of Income and Program Participation (SIPP) and the Census 2000, respectively. According to the 2004 American Community Survey (Weathers, 2005), the poverty rate for any disability was 23.7% in 2003, in contrast to 7.7% for the non-disability population. In addition, compared to the employment rate of 78% for the non-disability population, only 38% of people with disabilities were employed. The high poverty rate and the low employment rate indicate that people with disabilities have fewer economic resources to meet their essential needs.

Second, disability itself may create competing demands, and services required by disabled members (such as medical care, medical equipments and supplies, and home and transportation modification) can be expensive. Out-of-pocket health expenditures for people with disabilities are three times higher than those for people without disabilities (Clark & Drake, 1994; Fujiura, Roccoforte, & Braddock, 1994; Leonard, Brust, & Sapienza, 1992; Olin & Dougherty, 2006; She & Livermore, 2007). As a result, households with disabled members have higher odds of trading-off between essential food consumption and disability-related expenses. Finally, disability is also related to household coping ability with food insecurity. Some individuals with disabilities may lack budgeting skills, due to their limited access to education, relatively low-skill job experiences, or cognitive impairments. Even nondisabled members may not be able to pay adequate attention to household budgeting and food preparation due to the burden and stress resulted from caring for members with disabilities (Cummins, 2001; Power & Dell Orto, 2004).

Few studies have used all three mechanisms–availability of resources, competing demands, and coping strategies—to examine the role of disability in food insecurity. Using the SIPP 1996 panel, She and Livermore (2007) examine the extent to which working-age people with disabilities go through material hardship and whether disability is a significant determinant of material hardship. Using a definition of work disability as having "a physical, mental, or other health condition that limited the kind or amount of work" that an individual can do (p. 975), this study suggests that disability is a significant predictor of all types of hardship (including food insecurity), and that the odds of any hardship experience for people with disabilities are 40% to 200% higher. From 1996 to 1999, 50% of low-income individuals who reported food insecurity experienced disabilities at some point; for those who experienced severe food insecurity, 62% reported disabilities (She & Livermore, 2007). Using the same work disability measure used by She and Livermore (2007), Ribar and Hamrisk (2003) find that disability status is associated with a greater likelihood of entering food insecurity. A study by Meyers, Lukemeyer, and Smeeding (1998) examines the effects of the cost of caring for children with disabilities in poor families. Their findings show that household food

insecurity is significantly associated with having a child with a severe disability and the number of children with disabilities in a household.

Aims of the study

The current study extends previous research by investigating the dynamic relationship between disability, economic resources, and food insecurity. Specifically, we test two mechanisms—resource availability and competing demands—that may account for food insecurity. Due to the lack of measures of coping strategies in the data, this study will not be able to examine the third mechanism, coping strategies, proposed by Heflin and colleagues (2007).

To understand the mechanism of resource availability in food insecurity, we pay equal attention to household assets and income. Few studies have empirically examined the independent role of household assets in food insecurity, although they have been considered an important protecting factor against food insecurity (Ribar & Hamrick, 2003; Rose, Gundersen, & Oliveira, 1998). In addition, the effects of household assets on food insecurity may vary by the liquidity of different types of assets (Gundersen & Gruber, 2001) because assets with high liquidity can be conveniently converted to cash during an economic crisis. Therefore, three asset categories—net worth, liquid assets, and home ownership—are examined in the current study. Net worth is a general measure of household wealth with total assets net of debts, regardless of the liquidity of different asset types. The measure of liquid assets indicates the total amount of assets with high liquidity. Homeownership, the type of household asset that has been studied in the food insecurity literature (Rose, Gundersen, & Oliveira, 1998), signifies both the accessibility of home equity and the stability of the living arrangement.

The mechanism of competing demands, however, has not been examined on the disability population in previous studies. A direct consequence of competing demands in many households is the reallocation of resources previously allocated to food consumption. In this study, we use household food costs to indicate food consumption. We also take into account out-of-pocket health expenditures as people with disabilities usually have greater needs for health services, a demand that competes with food consumption for constrained family resources.

Data and Method

Data and sample

We use the 1999 family level data from the Panel Study of Income Dynamics (PSID). The PSID collected demographic information and socioeconomic characteristics from a national representative sample of individuals and their families annually from 1968-1997 and biennially thereafter. The 1999 PSID is selected for this study as it includes a standardized scale of household food insecurity and other variables of interest, such as disability, family economic resources, and expenditures.

Measures

The dependent variable, *household food insecurity*, is measured by a standardized 18-item scale designed by the USDA (Bickel et al., 2000). This scale measures severity of household food insecurity in the previous 12 months through 18 risk indicators, such as "We worried whether our food would run out before we got money to buy more," and "The food that we bought just didn't last and we didn't

have money to get more." As a continuous interval-level measure ranging on a continuum from 1 to 13.1, this scale is developed based on the one-parameter Item Response Theory (IRT) model (Bickel et al., 2000). Higher scale values indicate more severe food insecurity but technically this scale cannot identify household food insecurity status if none of the 18 risk items is given a positive response by a household. In the PSID, these households are coded as -6, meaning "fully food secure." The intervals between -6 and higher scores are unknown. Accordingly, special consideration is advised for the model employing household food insecurity as a continuous variable (Bickel et al., 2000; Dunifon & Kowalski-Jones, 2003; Van Hook & Balistreri, 2006).

In addition, this continuous measure of household food insecurity can be converted into a three-level categorical measure with "absence of food insecurity," "food insecurity," and "severe food insecurity" by the two thresholds (3.1 and 6.2) on the continuum (Bickel et al., 2000). The current study uses the categorical measure of household food insecurity to test the robustness of the results based on the continuous measure.

The main independent variables of this study include disability, family economic resources, and household expenditures. A dichotomous disability variable is created, respectively, for household heads and their wives (if household heads are male and married), depending on the response to the question "Do you have a physical or nervous condition that limits the type of work or the amount of work you can do?" Although this one-item measure of disability is limited to capture diverse phenomena of disability (such as severity and type), it is consistent with how disability is measured in several other nationally representative surveys, such as the Current Population Survey (CPS) and the SIPP. Existing studies discussed above (Ribar & Hamrisk, 2003; She & Livermore, 2007) also use this definition of work disability.

In addition, this study uses a variable indicating disability status change for household heads from 1997 to 1999 (the PSID collects data biennially), and examines how disability status change affects food insecurity. For the variable of disability status change, there are four possible categories: disability in both years, 1997 only, 1999 only, and no disability in both years.

Family economic resources include household income and assets. Following Ridar and Hamrisk (2003) and Van Hook and Balistreri (2006), we use the *family income-needs ratio* (the 1998 annual family income divided by the USDA needs standard) as an indicator of household income. It is considered more appropriate for this study than the direct income measure because the USDA needs standard takes into account a household's annual food needs (Mayer, 1997). Our measures of household assets—net worth, liquid assets, and home ownership—allow us to examine effects of various types of assets (Conley, 2001; Nam & Huang, 2009). *Net worth* is defined as the sum of eight asset types net of debt value,[1] and *liquid assets* refers to the sum of savings in bank accounts and stocks/mutual funds/investment trust. *Home ownership* is measured by a dichotomous variable with "1" indicating home owners and "0" otherwise. Home ownership is used rather than home equity because, regardless of the value of the home, home ownership by itself suggests the consumption of housing services.

[1] The eight asset types are farm or business, savings in bank accounts, home equity, real estate other than main home, stock (or mutual funds and investment trust), values on wheels (like cars, trucks, a motor home, a trailer, or a boat), and other savings or assets (such as bonds, rights in a trust or estate).

Two household expenditure variables are included to test the mechanism of competing demands: *Weekly food cost* is a measure of the total dollar amount of weekly food consumption adjusted by family size, and *out-of-pocket health expenditure* measures the level of family health cost for doctors, outpatient surgeries, and dental services. The transformation of the natural logarithm is applied to all the continuous measures of family economic resources (income-needs ratio, net worth, and liquid assets) and health expenditures in order to address the skewed distributions. The non-positive values on these variables are coded as "1" before the transformation.

A number of individual and household characteristics identified by previous studies as main predictors of food insecurity (e.g., Rose, Gundersen, & Oliveira, 1998) are controlled for in the analyses. These characteristics include age, gender (Male=1, Female=0), race (Black=1, Otherwise=0), marital status (Married=1, Otherwise=0), completed years of schooling, total working hours, number of children in household, and food stamp participation (Yes=1, No=0).

Analytical strategies

This study includes three sets of analyses, involving different disability measures. The first set, focusing on the dichotomous disability measure of household heads, is a two-part model conducted on the continuous measure of household food insecurity. As discussed above, the food insecurity scale value is unidentified for households that affirm none of the risk items on the scale (=-6). To address this issue, two previous studies (Dunifon & Kowalski-Jones, 2003; Van Hook & Balistreri, 2006) regress the scale score on all the independent and control variables, plus a dummy variable indicating whether the household food insecurity status is unidentified or not. Then the regression coefficient of the dummy variable is used as a corrected score for those affirming none of the items on the food insecurity scale. While this is a useful strategy for analysis, the value of the adjusted scores relies more or less on the original score assigned to these unidentified households (e.g., it is -6 in the PSID and 0 in the Survey of Program Dynamics). In this study, a two-part model instead is used for data analysis, given the food insecurity distribution which is heavily concentrated on -6 (about 86% of households affirm no risk items, see Table 1). The first part uses logistic regression to model the probability of confirming at least one risk item on the scale (the full sample), and the second part uses OLS regression to model the expected food insecurity scale value in a subsample consisting of those having at least one positive item (the risk sample). Therefore, the first part is to model the probability of being at *risk of food insecurity* (if a household has any positive responses on the scale), while the second examines *severity of food insecurity* (how severe it is). The first part uses a dichotomous variable with 0 being "no positive items" and 1 indicating "otherwise." The second uses the food insecurity scale value (log-transformed) as the dependent variable. Six two-part models are tested (See Tables 2 and 3). The basic model includes household head's disability status and the control variables (Model 1). In order to test the mechanism of resource availability, family resources variables (income, net worth, liquid assets and homeownership) are then added to the basic model hierarchically (Models 2, 3, and 4). Model 5 is an extension of Model 4 by adding the interaction terms of disability status and family economic resources (income-needs ratio, liquid assets, and homeownership). To test the mechanism of competing demands, Model 6 further explores the impacts of food and health expenditures on food insecurity.

In the second set of analyses, we explore the relationship between food insecurity and disability status of other family members by adding wives' disability status to Model 6. Since wives' disability status is available only for households headed by married males, the second set has a smaller sample

size, and thus its findings can be generalized only to a typical family type—households with married couples. The third set of analyses investigates the association between head's disability status change and food insecurity. As suggested by previous studies (Bania & Leete, 2007), household food insecurity may be a consequence of negative events including income shocks and health problems. The onset of disability can be one such event. Specifically, disability status change is used to replace the dichotomous measure of disability status in Model 6 (the first set).

Finally, the robustness of the two-part analysis is tested. First, we use the categorical measure to replace the continuous measure of household food insecurity used in the first set of analyses. A multinomial logit model is applied to the categorical measure of food insecurity—absence of food insecurity, food insecurity, and severe food insecurity—on the full sample. Second, the first set of analyses is applied to three subsamples: (1) the *working-age sample* with household heads older than 64 years being removed from the full sample; (2) the *older adult sample* including only household heads 65 and above; and (3) the *low-income sample* comprised of households with income below 200% of the poverty threshold. All analyses in this study are weighted using the 1999 PSID family weight variable.

Results and Discussion

Descriptive statistics

Table 1 displays the sample characteristics, and compares disabled and nondisabled household heads regarding their food insecurity status, economic resources, household expenditures, and other control variables. Nearly 20% of household heads in the sample reported work limitation disabilities. Among households headed by married males (n=3,584), about 16% had a disabled wife. Households headed by individuals with disabilities differ significantly from their non-disability counterparts on most variables except race, net worth, liquid assets, homeownership, and out-of-pocket health expenditure. Households headed by people with disabilities are at higher risk of food insecurity (20% vs. 13%), and have higher food insecurity scale values (4.69 vs. 3.76), compared with those headed by people without disabilities. When the categorical measure of food insecurity is employed, about 13% of households headed by people with disabilities have food insecurity or severe food insecurity in the previous 12 months, which is significantly higher than their counterparts without disabilities (about 7%).[2] Household heads with disabilities are more likely to be older, female, unmarried, less educated, have fewer children, and work fewer hours. They also have significantly higher rates of food stamp participation (11% vs. 4%) and a lower household income-needs ratio (3 vs. 4). Interestingly, the two groups do not differ in terms of the distributions of the asset measures. This is in part because wealth variables usually have large variances, making it difficult to find statistical differences between the two groups. Somewhat surprisingly, the mean of liquid assets for household heads with disabilities is higher than that of their counterparts ($65,745 vs. $43,862), which is due to a few cases that have extremely high liquid assets in households headed by people with disabilities. The medians of liquid assets for the two groups are the same ($1,000). On average, households headed by people with disabilities have significantly lower weekly food costs than those without ($58 vs. $74), but have larger out-of-pocket health expenditures ($728 vs. $684). Out-of-

[2] The weighted prevalence of "food insecurity" and "severe food insecurity" for the whole sample is about 8% which is lower than the prevalence rate estimated from the Current Population Survey in 1998 (11.8%) (Cohen, Parry, Yang, & Nord, 2002). The unweighted prevalence (10.0%), however, is closer to the CPS prevalence rate.

pocket health expenditures, however, do not appear to be statistically different for these two groups, possibly due to the fact that the health expenditure variable is measured at the household level rather than the individual level.

Table 1. Sample Characteristics (Weighted)

	Full Sample		Disability Group		Non-disability Group	
Variables	Mean	SD	Mean	SD	Mean	SD
Household Head Disability Status						
Disability in 1999 (Yes)	.196	.397				
Disability Changes						
No disability in both years	.759	.428				
Disability in 1997 only	.045	.208				
Disability in 1999 only	.063	.242				
Disability in both years	.114	.317				
Household Wife Disability Status[a]						
Disability in 1999 (Yes) ***	.157	.364	.344	.475	.122	.327
Household Food Insecurity Scale						
Continuous Measure						
No risk indicators***	.856	.352	.798	.402	.870	.336
Scale value***	4.022	2.254	4.692	2.555	3.759	2.082
Categorical Measure***						
Without food insecurity	.920	.271	.874	.332	.932	.251
Food insecurity	.058	.233	.075	.263	.053	.223
Severe food insecurity	.022	.147	.051	.221	.015	.122
Household Head's Characteristics						
Race (black)	.124	.330	.140	.347	.120	.325
Age***	47.87	17.21	59	17.81	45.21	15.91
Gender (male)***	.711	.453	.615	.487	.733	.433
Marital status (married)***	.524	.499	.438	.496	.544	.498
Number of children***	.656	1.062	.377	.889	.724	1.089
Education (completed years)***	12.884	2.877	11.906	3.153	13.122	2.755
Annual working hours***	1655.033	1084.959	798.320	1077.461	1866.971	979.844
Food stamp participation (Yes)***	.054	.226	.105	.307	.042	.201
Economic Resources and Expenditures						
Income-needs ratio***	3.768	4.544	2.934	4.626	3.973	4.512
Net worth	208904.4	834836.9	178843.7	740315.0	216538.7	858810.7
Liquid assets	48046.93	393714.1	65745.19	677507.2	43862.38	286178.2
Homeownership (Yes)	.639	.480	.630	.483	.642	.479
Weekly household food cost***	71.248	50.244	57.710	45.513	74.382	50.716
Out-of-pocket health expenditure	690.380	1390.091	727.754	1437.003	683.911	1382.148
Unweighted frequency	6997		1216		5735	

a. There are 3,538 households with household wives in the sample.
*p<.05, **p<.01, *** p<.001 (comparison between the disability and non-disability groups)

Table 2. Risk of Food Insecurity (First Part): Disability of Household Heads, Economic Resources, and Expenditures

Variables	Model 1		Model 2		Model 3		Model 4		Model 5		Model 6[a]	
Major Independent Variables												
Disability (yes)	0.675***	(0.133)[b]	0.663***	(0.133)	0.628***	(0.136)	0.612***	(0.136)	0.507*	(0.224)	0.396ψ	(0.239)
Income-needs ratio			-0.199***	(0.033)	-0.164***	(0.033)	-0.133***	(0.034)	-0.174***	(0.043)	-0.149***	(0.044)
Net worth					-0.099***	(0.012)						
Liquid assets							-0.163***	(0.014)	-0.148***	(0.015)	-0.149***	(0.015)
Homeownership							-0.311**	(0.117)	-0.313*	(0.129)	-0.408**	(0.137)
Disability*income-needs ratio									0.143*	(0.071)	0.135ψ	(0.074)
Disability*liquid assets									-0.065*	(0.031)	-0.067*	(0.034)
Disability*homeownership									-0.015	(0.251)	0.107	(0.268)
Food expenditures											-0.000	(0.003)
Health expenditures											0.011	(0.019)
Head's Characteristics												
Race (black)	0.546***	(0.113)	0.491***	(0.115)	0.361**	(0.118)	0.248*	(0.119)	0.227ψ	(0.120)	0.224ψ	(0.129)
Age	-0.046***	(0.004)	-0.044***	(0.004)	-0.034***	(0.004)	-0.028***	(0.004)	-0.027***	(0.004)	-0.025***	(0.005)
Male	-0.205	(0.135)	-0.214	(0.137)	-0.168	(0.139)	-0.157	(0.138)	-0.160	(0.138)	-0.185	(0.147)
Marital status (yes)	-0.495***	(0.137)	-0.407**	(0.139)	-0.275ψ	(0.142)	-0.277ψ	(0.143)	-0.278ψ	(0.144)	-0.207	(0.147)
Number of children	0.220***	(0.047)	0.199***	(0.047)	0.222***	(0.047)	0.211***	(0.046)	0.208***	(0.046)	0.169***	(0.047)
Education	-0.213***	(0.017)	-0.195***	(0.018)	-0.181***	(0.018)	-0.152***	(0.018)	-0.151***	(0.018)	-0.149***	(0.020)
Working hours	-0.000**	(0.000)	-0.000*	(0.000)	-0.000	(0.000)	-0.000*	(0.000)	-0.000*	(0.000)	-0.000*	(0.000)
Food stamp participation	1.012***	(0.166)	0.935***	(0.166)	0.770***	(0.171)	0.745***	(0.171)	0.750***	(0.171)	0.813***	(0.185)
Weighted N	5769		5769		5769		5769		5769		5298	
Unweighted N	6615		6615		6615		6615		6615		6084	
Pseudo R-squared	0.19		0.20		0.22		0.25		0.25		0.25	

a. Model 6 has fewer observations because of missing values on food cost and health expenditures. In order to compare the results of Model 6 with those of other models, we also run Model 1-5 using the sample for Model 6, and no major difference has been found.

b. Robust standard errors in parentheses

*** p<0.001, ** p<0.01, * p<0.05, ψ p<0.1

Table 3. Severity of Food Insecurity (Second Part): Disability of Household Heads, Economic Resources, and Expenditures

Variables	Model 1		Model 2		Model 3		Model 4		Model 5		Model 6[a]	
Major Independent Variables												
Disability (yes)	0.207***	(0.058)[b]	0.207***	(0.058)	0.200***	(0.059)	0.204***	(0.058)	0.274**	(0.085)	0.249**	(0.087)
Income-needs ratio			0.005	(0.020)	0.012	(0.020)	0.012	(0.020)	0.026	(0.023)	0.035	(0.026)
Net worth					-0.013*	(0.005)						
Liquid assets							-0.013ψ	(0.007)	-0.014ψ	(0.008)	-0.012	(0.008)
Homeownership							-0.066	(0.050)	-0.073	(0.055)	-0.124*	(0.056)
Disability*income-needs ratio									-0.053	(0.037)	-0.056	(0.036)
Disability*liquid assets									0.003	(0.018)	0.005	(0.017)
Disability*homeownership									0.026	(0.107)	0.070	(0.109)
Food expenditures											0.003**	(0.001)
Health expenditures											0.006	(0.008)
Head's Characteristics												
Race (black)	-0.034	(0.050)	-0.032	(0.051)	-0.041	(0.052)	-0.041	(0.051)	-0.040	(0.051)	-0.041	(0.051)
Age	-0.003	(0.002)	-0.003	(0.002)	-0.002	(0.002)	-0.002	(0.002)	-0.002	(0.002)	0.000	(0.002)
Male	0.062	(0.060)	0.062	(0.060)	0.063	(0.060)	0.060	(0.059)	0.061	(0.059)	0.064	(0.060)
Marital status (yes)	-0.178**	(0.063)	-0.180**	(0.063)	-0.161*	(0.063)	-0.166**	(0.064)	-0.170**	(0.064)	-0.187**	(0.062)
Number of children	0.021	(0.020)	0.022	(0.020)	0.024	(0.020)	0.025	(0.020)	0.028	(0.020)	0.021	(0.018)
Education	-0.011	(0.008)	-0.011	(0.008)	-0.011	(0.008)	-0.009	(0.008)	-0.009	(0.008)	-0.011	(0.008)
Working hours	-0.000	(0.000)	-0.000	(0.000)	-0.000	(0.000)	-0.000	(0.000)	-0.000	(0.000)	-0.000	(0.000)
Food stamp participation	-0.003	(0.057)	-0.000	(0.057)	-0.015	(0.059)	-0.009	(0.058)	-0.017	(0.058)	0.108ψ	(0.064)
Weighted N	935		935		935		935		935		847	
Unweighted N	1201		1201		1201		1201		1201		1091	
R-squared	0.05		0.05		0.06		0.06		0.07		0.08	

a. Model 6 has fewer observations because of missing values on food cost and health expenditures. In order to compare the results of Model 6 with those of other models, we also run Model 1-5 using the sample for Model 6, and no major difference has been found.

b. Robust standard errors in parentheses

*** p<0.001, ** p<0.01, * p<0.05, ψ p<0.1

Two-part model using the continuous measure of food insecurity

Tables 2 and 3 report findings from the first set of analyses using the continuous measure of household food insecurity. In this analysis, disability status of household heads (in 1999) is included while that of wives is not. Results of logistic regression (the first part) are reported in the Table 2 of *risk of food insecurity*, while results for OLS regression (the second part) are summarized in the Table 3 of *severity of food insecurity*.

Risk of food insecurity. In the first part of analyses (weighted N=5,769), the control variables all have expected signs.[3] Household heads' disability status significantly contributes to the risk of food insecurity. In the basic model (Model 1) with none of the family economic resource variables, the odds of affirming any risk items for households headed by individuals with disabilities is about two times that for those without disabilities. The three groups of family economic resources variables in Models 2, 3, and 4 have significantly negative relationships with risk of food insecurity. Including household net worth in the model (Model 3) reduces the regression coefficient of the income-needs ratio by nearly 20%. When net worth is replaced by liquid assets and homeownership (Model 4), the magnitude of the regression coefficient of income-needs ratio becomes even smaller. If the constraint of economic resources is the major mechanism causing food insecurity, there would be a sharp decrease in the coefficient of disability status with the addition of family economic resources in the model. Surprisingly, the inclusion of family economic resources does not noticeably change the coefficient of disability status. With this finding, it seems that the mechanism of resource availability cannot fully explain why households headed by individuals with disabilities have a higher probability of food insecurity risk. Even when given the same level of economic resources, households headed by individuals with disabilities still have a higher risk of food insecurity. In other words, to have the same level of food consumption as that of their non-disabled counterparts, people with disabilities need to have higher levels of family economic resources to cancel out the negative effects of experiencing disabilities. This suggests that the protecting effects of economic resources against food insecurity may differ for people with and without disabilities.

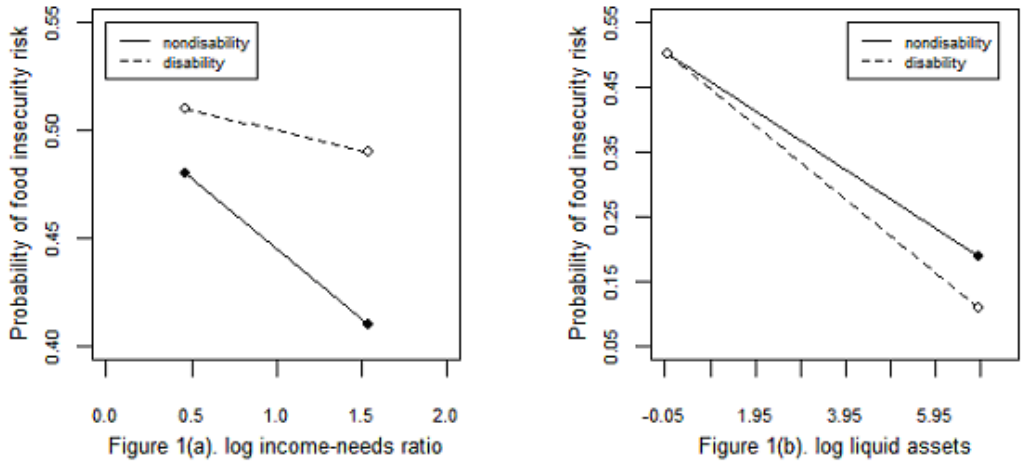
The distinct effects of family economic resources are further examined in Model 5 by including the interaction terms of disability status and the three family economic resources variables (income, liquid assets, and homeownership).[4] Results show that the interaction term of disability and income-needs ratio is positive and significant, indicating that the protecting effect of income is smaller for people with disabilities than for those without. Figure 1(a) displays the interaction effects of income and disability when the log-transformed income-needs ratio increases from the first quartile to the third quartile while the other variables in the model are fixed to 0. The figure shows that increases in household income only slightly change the likelihood of food insecurity risk for households headed by people with disabilities (2%). In contrast, given the same income increases, the likelihood of food insecurity risk for households headed by people without disabilities reduces by nearly 8%. The

[3] Model 1 shows a positive relationship between food insecurity and food stamp participation, which could be caused by the sample selection problem (Von Hook & Balistreri, 2006; Wilde, 2007). The same direction of the association between food insecurity and food stamp participation has been founded in several other studies (Gibson-Davis & Foster, 2006; Gundersen & Oliveira, 2001).

[4] The model with the interaction term between disability status and net worth is tested as well, but is not reported in Table 2. The interaction between disability status and net worth has negative sign, but is not significant at the .05 level.

interaction term of disability and liquid assets, however, is negatively related to the dependent variable at the .05 significance level, suggesting that, given the same level of liquid assets, people with disabilities are more protected from food insecurity than their nondisabled counterparts with similar characteristics. People with disabilities may feel higher levels of security when these accumulated assets are used to buffer income loss due to disability. As shown in Figure 1(b), an increase in liquid assets from the first quartile to the third quartile decreases the probability of food insecurity risk by 40% for households headed by people with disabilities, and by nearly 30% for households headed by people without disabilities.

Figure 1. Interaction effects of income and liquid assets



Given the significance of disability status in food insecurity even when controlling for family resources (see Models 2-5), a possible explanation can perhaps be found in the mechanism of competing demands. The household consumption pattern may be very different between disabled and non-disabled populations due to their different consumption demands. This can hardly be explained by economic resources alone. Hence, two expenditure variables, the weekly food cost and the out-of-pocket health expenditure, are considered in Model 6 to test the mechanism of competing demands. Results show that neither of them is statistically significant. The inclusion of expenditure variables does not significantly change the regression coefficients of economic resources, but reduces the effect of disability status on food insecurity by about 20%. In addition, the disability status is only significant at the 0.1 level in Model 6, which seems to support the above supposition that households with a disabled member have a consumption pattern different from those without. In sum, both mechanisms of resource availability and competing demands account for higher levels of food insecurity risk for people with disabilities.

Severity of food insecurity. Using the risk sample (N=935) with each household having at least one confirmed risk item on the food insecurity scale, the second part of the analysis examines severity of food insecurity (see Table 3). Similar to the results in the first part, experiencing disability contributes to the severity of food insecurity, and the estimated coefficient of disability status exhibits consistent significance across all of the models. Family income becomes nonsignificant while net worth has a statistically negative association with the food insecurity scale score. Liquid assets are significant at the .1 level in Models 4 and 5, and homeownership is significant at the .05

level in Model 6. This confirms the importance of household assets in smoothing consumption. As the risk sample is more likely to experience income loss, which increases the severity of food insecurity, household assets seem more important than income in protecting households against food insecurity. All the interaction terms of disability status and family economic resources in Model 5 turn out to be nonsignificant. In Model 6, the estimated coefficient of food cost indicates an unexpectedly positive relationship between food expenditures and severity of food insecurity (significant at the .01 level). The different reference periods for food insecurity status (previous 12 months) and the weekly food cost (previous week) may account for this because households could learn to adjust their food expenditures after experiencing food insecurity. For example, if a household encountered food insecurity three months before the interview, they might increase their food expenditures after this hardship. Nonetheless, this needs further exploration. The second part of the analysis shows that neither of the two mechanisms, resource availability and competing demands, can explain why disability status is a significant determinant of severity of food insecurity.

In sum, the first set of analyses demonstrates that the household head's disability status is highly related to the risk of food insecurity. Experiencing disability has significant impacts on household food insecurity even when controlling for family economic resources and household consumption, particularly in the second part of the analysis. In terms of family economic resources, household assets (net worth, liquid assets, and homeownership) seem to be a better protective factor against food insecurity than income for people with disabilities.

Disability status of household wives and food insecurity

The first set of analyses primarily focuses on the relationship between food insecurity and household heads' disability status. It is suspected that other family members' disability status may have similar impacts on food insecurity. Table 4 reports the results of Model 6 with disability status of household wives included.[5] In the first part of analysis examining risk of food insecurity (weighted N=3,124), household wives' disability status is highly significant. In households headed by married males, the odds of food insecurity risk for those with a disabled wife are 2.3 times of those without, with all the other variables being held constant. Comparing with the equivalent Model 6 in Table 2, disability status of household heads is no longer significant when that of wives is taken into account, whereas other results do not change substantially.

In the second part of analyses examining severity of food insecurity (weighted N=361), however, household wives' disability status is not statistically significant. What is more, household heads' disability status, which is positively related to food insecurity at the .01 level in the equivalent Model 6 shown in Table 3, loses its significance in this analysis. While it is possible that the small sample size of this analysis may lead to less reliable results, neither disability status variable (for household heads and wives, respectively) is significant, suggesting that family composition and family functions may better explain food insecurity in households with disabled members.

As household wives generally assume more responsibility for food preparation (Kemmer, 1999), household wives' disability may substantially affect family function in food preparation. The association between household heads' disability and food insecurity as shown in both parts of the

[5] The variables of household heads' gender and marital status had been dropped from the model because of the lack of variation.

first set of analyses (see Table 2 and 3), to some extent, depends on how disability affects family function in meeting food needs. This may explain why household heads' disability status is no longer significant when wives' disability status is considered (Table 4). From a different perspective, this analysis suggests the significance of the mechanism of coping strategies as wives' disability status may proxy family coping ability in food preparation.

Table 4. Disability Status of Household Wives and Food Insecurity

Variables	First Part (risk of food insecurity)		Second Part (severity of food insecurity)	
Major Independent Variables				
Heads' disability in 1999	0.532	(0.492)	0.103	(0.172)
Wives' disability in 1999	0.832***	(0.210)	0.070	(0.084)
Income-needs ratio	-0.210*	(0.102)	-0.012	(0.050)
Liquid assets	-0.165***	(0.022)	-0.007	(0.011)
Homeownership	-0.502**	(0.204)	-0.067	(0.072)
Disability*income-needs ratio	0.010	(0.157)	0.016	(0.067)
Disability*liquid assets	-0.090ψ	(0.051)	0.023	(0.022)
Disability*homeownership	0.259	(0.426)	0.010	(0.158)
Food expenditure	-0.003	(0.006)	0.003	(0.002)
Health expenditure	0.006	(0.027)	-0.001	(0.012)
Head's Characteristics				
Race (black)	0.208	(0.221)	0.093	(0.083)
Age	-0.026**	(0.008)	-0.000	(0.001)
Number of children	0.162*	(0.067)	0.035	(0.025)
Education	-0.156***	(0.028)	-0.026	(0.009)
Working hours	-0.000*	(0.000)	0.000	(0.000)
Food stamp participation	1.258***	(0.361)	0.158	(0.104)
Weighted N	3124		361	
Unweighted N	3458		430	
Pseudo R-squared/R-squared	0.28		0.12	

*** p<0.001, ** p<0.01, * p<0.05, ψ p<0.1. Robust standard errors in parentheses.

Change of disability status and food insecurity

Disability is a dynamic process, and the transition into or out of disability status can be significant in relation to food insecurity, because a change in status indicates other changes in work capability, employability, and economic resources. We further examine the relationship between household heads' disability status change and food insecurity in the third set of analyses. Instead of using household head's disability status in 1999, we include household head's disability status for 1997 and 1999 in Model 6. The interaction terms of disability status and economic resources are no longer included in order to achieve parsimony. Households headed by individuals with disabilities in both years (long-term disability) are left out as the reference group; and dummy variables are created for the other three groups, disability in 1997 only, 1999 only, and neither year (see Table 5).

The signs of the estimated coefficients of the three disability dummy variables indicate that household heads with long-term disabilities are most vulnerable to food insecurity. Compared to those with disabilities in both years, household heads transitioning out of disability are better off in

the model of severity of food insecurity, but not in the model of risk of food insecurity, indicating that removal of disability may be associated with improved food consumption. Household heads with disability onset in 1999 do not show any significant difference in the risk or severity of food insecurity. In other words, disability onset may be a significant life event associated with some undesirable outcomes, such as income fluctuation, poverty, and health problems, all of which may lead to food insecurity.

Table 5. Change of Disability Status of Household Heads and Food Insecurity

Variables	First Part (risk of food insecurity)		Second Part (severity of food insecurity)	
Major Independent Variables				
Without disability in both years	-0.581***	(0.171)	-0.195**	(0.071)
With disability in 1997	0.056	(0.292)	-0.232*	(0.112)
With disability in 1999	0.060	(0.246)	-0.012	(0.094)
Income-needs ratio	-0.111**	(0.035)	0.016	(0.022)
Liquid assets	-0.163***	(0.014)	-0.011	(0.007)
Homeownership	-0.381**	(0.124)	-0.104*	(0.051)
Food expenditure	0.000	(0.003)	0.003*	(0.001)
Health expenditure	0.009	(0.019)	0.006	(0.008)
Head's Characteristics				
Race (black)	0.256*	(0.128)	-0.040	(0.052)
Age	-0.027***	(0.005)	0.000	(0.002)
Male	-0.187	(0.147)	0.060	(0.060)
Marital status (yes)	-0.202	(0.146)	-0.179**	(0.062)
Number of children	0.177***	(0.047)	0.017	(0.018)
Education	-0.150***	(0.020)	-0.011	(0.008)
Working hours	-0.000*	(0.000)	-0.000	(0.000)
Food stamp participation	0.789***	(0.185)	0.115$^{\psi}$	(0.065)
Weighted N	5299		847	
Unweighted N	6089		1091	
Pseudo R-squared/R-squared	0.25		0.08	

*** p<0.001, ** p<0.01, * p<0.05, $^{\psi}$ p<0.1. Robust standard errors in parentheses.

Robustness tests

Our robustness tests utilize the specification of Model 6 in the first set of analyses as presented in Table 6. Using the three subsamples—the working-age sample, the older adult sample, and the low-income sample—these robustness tests generate essentially consistent results with those in Tables 2 and 3, and therefore, are not discussed in detail here. The multinominal model also demonstrates expected findings. Using households without food insecurity as a comparison group, the model shows that households headed by individuals with disabilities are significantly more likely to experience severe food insecurity (See the first column of Table 6). Household assets (liquid assets and homeownership) are the most important protecting factors in the model. The predicted probability of having food insecurity for the disability group (.03) is about 1.5 times that of the nondisability group (.02); the predicted probability of having severe food insecurity for the disability group (.016) is three times that of the nondisability group (.005).

Table 6. Major Results of Robustness Tests

Variables	Categorical Measure[a]		Working-age Sample		Old adult Sample		Low-income Sample	
	food insecurity	severe food insecurity	risk of food insecurity	severity of food insecurity	risk of food insecurity	severity of food insecurity	risk of food insecurity	severity of food insecurity
Household heads' disability (yes)	0.354	1.110**	0.466	0.234*	0.453	-0.135	0.417ϕ	0.248**
	(0.285)	(0.366)	(0.283)	(0.102)	(0.662)	(0.310)	(0.238)	(0.087)
Income-needs ratio	-0.058	-0.102ϕ	-0.150**	0.040	-0.117	-0.307*	-0.128**	0.033
	(0.056)	(0.060)	(0.046)	(0.024)	(0.154)	(0.150)	(0.043)	(0.026)
Liquid assets	-0.167***	-0.164***	-0.146***	-0.007	-0.185***	-0.021	-0.144***	-0.011
	(0.026)	(0.046)	(0.016)	(0.008)	(0.049)	(0.021)	(0.016)	(0.008)
Homeownership	-0.521**	-0.792*	-0.430**	-0.132*	-0.301	0.208	-0.399**	-0.123*
	(0.193)	(0.365)	(0.141)	(0.058)	(0.596)	(0.191)	(0.136)	(0.056)
Disability*income-needs ratio	-0.008	0.067	0.089	-0.070	0.130	0.272ϕ	0.126ϕ	-0.054
	(0.088)	(0.086)	(0.098)	(0.047)	(0.167)	(0.148)	(0.074)	(0.036)
Disability*liquid assets	-0.005	-0.069	-0.047	-0.008	-0.075	0.058*	-0.070*	0.005
	(0.054)	(0.077)	(0.037)	(0.021)	(0.078)	(0.026)	(0.034)	(0.017)
Disability*homeownership	0.550	0.108	0.147	0.062	-0.114	-0.198	0.113	0.068
	(0.362)	(0.542)	(0.300)	(0.121)	(0.740)	(0.283)	(0.267)	(0.109)
Food expenditure	0.001	0.008	-0.001	0.003**	0.002	0.002	0.000	0.003**
	(0.004)	(0.006)	(0.003)	(0.001)	(0.010)	(0.002)	(0.003)	(0.001)
Health expenditure	0.026	0.094*	0.008	0.005	-0.000	0.018	0.011	0.007
	(0.026)	(0.045)	(0.020)	(0.009)	(0.055)	(0.023)	(0.019)	(0.008)
Weighted N	5298		4518	766	780	81	4838	846
Unweighted N	6084		5280	1007	804	84	5603	1089

a. the comparison group is households without food insecurity.

*** p<0.001, ** p<0.01, * p<0.05, ϕ p<0.1. Robust standard errors in parentheses.

Conclusion

This study contributes to the scant literature on food insecurity among people with disabilities, but several limitations should be noted. First, as mentioned above, the weighted prevalence rate of food insecurity in the 1999 PSID is lower than the estimates from other data sources, such as the CPS and the SIPP. Therefore, any inference based on our findings should be made with caution. Second, the dummy measure of disability status in a cross-sectional format is not able to capture the dynamics of the disability phenomenon. Unlike some fixed characteristics (e.g., gender and race), an individual's disability status is time-varying. Also, within the disability category, there is wide disability-related variation, such as the time of disability onset, severity, duration, and type of disability, all of which cannot be captured by a cross-sectional measure of disability status. The association between disability and food insecurity cannot be fully understood without knowing these characteristics. In addition, this study takes into account only disability status of household heads and their wives due to the unavailability of disability status of other family members. Some households categorized into the non-disability group households in our study may in fact have another member (e.g., a child) with a disability. For this reason, the estimated difference in food insecurity between the disability and non-disability groups may be biased downward.

Third, food insecurity is usually transient (Ribar & Hamrick, 2003), and can happen anytime during a 12-month reference period. There may be a temporal problem if food insecurity is encountered before some covariates in models are measured. The positive relationship between food cost and food insecurity to a large extent reflects this limitation. Fourth, the disability status variable could be endogenous in the model. Some unobserved and omitted factors, such as health problems, could correlate with or even cause both disability and food insecurity. The relationship between food stamp participation and food insecurity status may be a result of this sample selection bias. Finally, various impacts of public program participation on food insecurity are not examined.

Despite these limitations, this study shows several consistent findings. First, both mechanisms of resource availability and competing demands account for food insecurity of people with disabilities. In addition, the extent to which the association between disability and food insecurity can be explained by these two mechanisms depends on the type of family economic resources. For instance, none of the economic resource variables provides a satisfying explanation for the severity of food insecurity when wives' disability status is included (see Table 4). This suggests that various interventions in addition to economic assistance should be considered in the current public disability programs (i.e., cash support, health services, and food assistance) for the population experiencing severe food insecurity. Another finding with policy implications is that household assets may play a more important role than income in protecting people with disability against food insecurity. Our results show that income is less protective for people with disabilities than for those without disabilities, whereas liquid assets provide significant support for disability households against food insecurity (Model 5 in Table 2). Furthermore, given the effects of assets on smoothing consumption, asset accumulation can be used as a coping strategy to help people with disabilities avoid food insecurity. Household assets can reduce the risk of food insecurity if people with disabilities experience negative income shocks. Given the fact that major public programs for disability and food assistance programs (such as SSI, Medicaid, and Food Stamp) are means-tested with asset limit criteria, policy makers, researchers, and practitioners need to expand attention to the importance of assets and innovative asset-building policy for people with disabilities. For instance, asset building programs (i.e., Individual Development Accounts) have been proposed by the National Council of

Disability (NCD) to bridge with the current means-tested programs and to allow public program recipients with disabilities to accumulate assets (NCD, 2004).

This study also shows that disability status of household heads is positively associated with the food insecurity score even after controlling for family economic resources and expenditure variables in the first set of analyses (Table 2 and 3). A number of reasons may explain the unique effect of disability status on food insecurity. Perhaps disabled people's coping strategies for food hardship partly account for it. In addition, the unexplained effect of disability on food insecurity may suggest that people with disabilities face various barriers (e.g., transportation) to accessing food supplies. As indicated by Table 4, disability status of other family members should also be considered. When household wives' disability status is controlled for in the analysis, household heads' disability status becomes unrelated to food insecurity. It is likely that disability status of different household members is related to different dimensions of family functions and the division of domestic tasks. For example, disability status of household heads is more associated with a family's earning capability and economic resources, while that of household wives may affect such family functions as food preparation, all of which are linked to household food insecurity. These issues need to be addressed in future research in order to better understand the association between disability and food insecurity and to better serve people with disabilities in meeting their food needs.

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