

FINANCIAL CAPABILITY AND FOOD SECURITY IN EXTREMELY VULNERABLE HOUSEHOLDS

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Food insecurity is among the most significant, nutrition-related public health issues facing the United States. Unfortunately, little is known about the determinants of food insecurity except that it is not synonymous with poverty. Many households above the poverty line are food insecure; many below are not. We investigate a lack of financial capability as a potential salient determinant of household-level food security. Using original survey data collected among food pantry clients in North Texas, we assess the impact of financial capacity on food security relying on family background as an exclusion restriction. Our results indicate a strikingly significant effect, both economically and statistically, of financial capability in general and financial behaviors in particular.

Key words: Food security, financial capability, financial literacy, poverty.

JEL codes: I12, I18.

The USDA uses the Food Security Module (FSM), an 18-question survey module, to classify households into four levels of food security: very low food secure, low food secure, marginally food secure, and high food secure.¹ Together, the first two categories comprise the group of food *insecure* households, while the final two categories comprise the group of food *secure* households.

The resulting numbers are startling and reveal a lack of food security to be one of the most pressing issues facing the United States today. Although the rise in U.S. households classified as food insecure has tapered off since the end of the Great Recession, 17.5 million households (14.3%) were still classified as food insecure in 2013, indicating the absence

of sufficient, reliable access to food due to a lack of money and/or other resources. Of these households, 6.8 million (5.6%) are classified as very low food secure. Focusing on households with children present, 3.8 million households (or 9.9%) were classified as having food insecure children in 2013. Another 360,000 households (0.9%) are classified as having children with very low food security (Coleman-Jensen, Gregory, and Singh 2014). These figures represent a significant increase above pre-recession (2007) levels, and food insecurity has been characterized as “one of the most important and high profile nutrition-related public health issues in the United States today” (Gundersen, Kreider, and Pepper 2011).

The consequences of food insecurity are relatively well known, severe, and potentially long-lasting (Gundersen, Kreider, and Pepper 2011). However, the determinants of food insecurity are less well understood (Gundersen and Gruber 2001; Gundersen, Kreider, and Pepper 2011). While the economic resources of the household are the most salient determinants of food security, substantial variation in food security status across households remains unexplained. For instance, 57.9% of households with an income below the poverty level were food *secure* in 2013, while 6.7% of households with an income exceeding 185% of the poverty

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¹ See Gundersen (2008) for a historical account of the Food Security Module. See also <https://www.ers.usda.gov/topics/food-nutrition-assistance/food-security-in-the-us/measurement/> (last accessed May 9, 2018).

line were food *insecure* (Coleman-Jensen, Gregory, and Singh 2014). Although there does exist a positive relationship between income and food security (e.g., Gundersen and Gruber 2001), the substantial fraction of poor households that are food secure and the large portion of non-poor households that are food insecure is counterintuitive and in need of explanation. Gundersen (2008) states that “research ... showed that income-based measures and other measures of well being were not highly correlated with food insecurity and hunger.”

To understand the variation in food security conditional on household economic resources, researchers have investigated other potential determinants, with much attention focused on safety net programs. However, these studies have generally failed to provide much reason for optimism concerning the ability of government nutrition programs to alleviate food insecurity. For example, Bitler, Gundersen, and Marquis (2005) argue that the impact that the Supplemental Nutrition Program for Women, Infants, and Children (WIC) has on food security is “likely minimal.” Gundersen and Kreider (2008) document the difficulty in identifying a positive causal effect of food stamps on food security. Heflin, Arteaga, and Gable (2015) obtain small effects of the Child and Adult Care Food Program on child food security. Davis and You (2011) offer one possible explanation for these small effects: safety net transfers are only designed to cover the monetary cost of food, whereas the time costs of providing a nutritious diet at home are ignored.

The aim of this study is to step back from the more narrow focus on income and government nutrition programs and assess the causal effect of *financial capability* on food security in vulnerable households. In the 2003 Financial Literacy and Education Improvement Act, financial capability is defined as “the capacity, based on knowledge, skills, and access, to manage financial resources effectively,” where such capacity is attained through “appropriate access to and understanding of financial products, services, and concepts.”² While the terms financial

capability and financial literacy are perhaps synonyms since both are used to represent *vague* notions concerning individual financial knowledge and practices, we use the term capability here as it better captures our preferred, broad empirical measure. In contrast, much of the empirical economic literature on financial literacy uses measures based exclusively on financial knowledge.

We hypothesize that financial capability may represent a pivotal, and heretofore virtually ignored, determinant of food security. Nonetheless, prior studies suggest that financial capability may represent an important missing piece in the literature. Most importantly, Gundersen and Garasky (2012) explore the association between self-assessed financial management skills and food security, but do not address potential biases stemming from measurement error and self-selection (Lusardi and Mitchell 2014). While Gundersen and Garasky’s (2012) results are not intended to be interpreted causally, they do suggest a role for financial management skills. Similarly, Fitzpatrick and Coleman-Jensen (2014) find that credit access through payday loans has a positive causal effect on food security in at-risk households. Finally, financial literacy has been shown to have significant, causal effects on a host of economic outcomes.³ Food security, though, has not been investigated.

As noted in Gundersen and Garasky (2012), examining the causal effect of financial capability on food security is difficult since there is little survey data incorporating information on both food security and financial capability (or literacy, management skills, etc.). We attempt to overcome this difficulty by using original data collected from a self-designed survey administered to 1,009 individuals *utilizing food pantries* across North Texas in 2014. While food pantry clients are clearly a nonrandom sample of the U.S. population, and hence concerns over external validity are legitimate, we believe analysis of this population is crucial for at least two reasons. First, households utilizing food pantries are likely to be the most at-risk for food insecurity. Improved understanding of the determinants of food security within this population is therefore vital. Second, if financial capability is found to be a salient

² See 20 USC Ch. 77 (available at <http://uscode.house.gov/view.xhtml?path=/prelim@title20/chapter77&edition=prelim>; last accessed May 9, 2018). The Financial Literacy and Education Improvement Act constitutes Title V of the Fair and Accurate Credit Transactions (FACT) Act of 2003 (PL 108-159), which was enacted on December 4, 2003.

³ Lusardi and Mitchell (2014) provide an excellent review of the literature.

determinant of food security, outreach programs designed to improve financial capability are perhaps more feasible since this population is already interacting with local service providers via food pantries.

Our survey includes the FSM along with detailed information on financial knowledge, behaviors, beliefs, and self-confidence. We analyze these aspects separately, as well as devise two composite indices of household financial capability using Principle Component Analysis (PCA) and an average *z*-score approach as in Kling, Liebman, and Katz (2007). Finally, we apply instrumental variable (IV) regressions—relying primarily on a respondent's self-reported assessment of his or her *parents'* financial confidence as an exclusion restriction—to estimate the causal effect of financial capability on food security in extremely vulnerable households. We also explore the sensitivity of our results to violations of the assumptions needed for consistency based on Conley, Hansen, and Rossi (2012). Finally, we explore two alternative identification strategies for robustness. The first strategy relies on heteroskedasticity rather than an exclusion restriction based on Klein and Vella (2010). The second strategy relies on alternative exclusion restrictions based on self-reported happiness and expected life expectancy.

Our results are quite striking, but must be interpreted cautiously. Financial capability is found to have a statistically significant impact on the probability of a household being food insecure. Moreover, the effect is substantial in magnitude. Specifically, our preferred estimates imply that increasing our PCA index of financial capability by one standard deviation reduces the probability of a household being food insecure by 17 percentage points. For comparison, Mabli et al. (2013) find that participation in the Supplemental Nutrition Assistance Program (SNAP) for six months reduces food insecurity by 13 percentage points.⁴ Moreover, a one standard deviation

increase in our financial capability index does not seem unattainable; moving from the 25th to the 75th percentile of the empirical distribution of financial capability in our sample corresponds to an increase of 1.4 standard deviations.

If our results hold up to scrutiny using alternative identification strategies and are externally valid, our findings imply that a nationwide one standard deviation increase in financial capability across the 17.5 million U.S. households characterized as food insecure in 2013 would have elevated roughly 2.9 million households to food secure. In other words, and assuming our results are in fact causal, a one standard deviation increase in financial capability would reduce the prevalence of food insecurity from 14.3% of households to 11.9%. However, this is likely to be an overstatement as one might expect the effects of financial capability to be largest for households with the most limited resources.

Our findings are equally stark when examining very low food security. A similar one standard deviation increase in financial capability reduces the probability of a household being very low food secure by 24 percentage points. Extrapolating to the 6.8 million U.S. households characterized as very low food secure in 2013, and again assuming that our results are causal, a nationwide one standard deviation increase in financial capability would have elevated roughly 1.6 million U.S. households to at least low food security. In other words, a one standard deviation increase in financial capability would reduce the prevalence of very low food security from 5.6% of households to 4.3%.

Lastly, while additional research utilizing alternative identification strategies is needed to confirm our findings, the results suggest that policymakers and other social service providers should begin to consider interventions related to financial capability as a means of combating food insecurity among extremely vulnerable households. However, researchers and policymakers alike should exercise caution when forming expectations about the effectiveness of such interventions based solely on the results presented here and should form expectations around whether or not one believes our underlying, identifying assumptions. Such concerns may

⁴ To reiterate, given the importance of this point, a one standard deviation increase in financial capability does more to alleviate food insecurity relative to 6 months of receiving SNAP benefits. Moreover, the accumulated human capital, in the form of financial capability, does not fully expire at the end of some predefined period. Thus, increasing one's financial human capital relative to providing short-term access to food assistance programs leads to higher levels of food security, with the opportunity for these improvements to persist over the long-run. In short, increasing financial capability teaches someone how to fish—by making the best use of limited economic resources—

while nutrition assistance simply gives them the fish for a limited duration.

be alleviated in the future if additional research corroborates our findings.

The remainder of the paper is organized as follows. First, we review the existing literature as it relates to financial literacy and food security. Second, we describe the data and empirical strategy used for the analysis. Finally, we discuss the results and conclude.

Literature Review

We first provide a brief overview of the literature on financial capability, and then turn to the literature on food security.

Financial Capability

In the current economic landscape, financial markets reach nearly all individuals and one's well-being requires understanding the implications of complex financial decisions. [Lusardi and Mitchell \(2014\)](#) succinctly describe the reach and inclusiveness of the financial system: "Financial markets around the world have become increasingly accessible to the 'small investor,' as new products and financial services grow widespread. At the onset of the recent financial crisis, consumer credit and mortgage borrowing had burgeoned. People who had credit cards or subprime mortgages were in the historically unusual position of being able to decide how much they wanted to borrow. Alternative financial services including payday loans, pawn shops, auto title loans, tax refund loans, and rent-to-own shops have also become widespread. At the same time, changes in the pension landscape are increasingly thrusting responsibility for saving, investing, and decumulating wealth onto workers and retirees . . ."

Focusing specifically on at-risk households, [Smith and Hevener \(2014\)](#) document the rise in subprime mortgages in the 1990s and early 2000s. [Bourke, Horowitz, and Roche \(2012\)](#) report that 12 million U.S. adults used payday loans in 2010, with the average borrower taking out eight loans of an average \$375 per loan at an interest rate equivalent to a 391% annual percentage rate (APR).

Coinciding with this shift towards a more sophisticated and inclusive financial landscape, the literature on financial knowledge and skills has developed rapidly. On the theoretical side, recent contributions have sought to better understand incentives for acquiring

financial knowledge, as well as the role that financial knowledge plays in financial decisions. On the empirical side, attention has focused on the measurement of financial knowledge and the costs of poor financial decisions. Both of these bodies of literature guide our analysis here.

The theoretical literature on financial knowledge views the attainment of such knowledge as arising endogenously through investment in human capital. [Delavande, Rohwedder, and Willis \(2008\)](#) and [Lusardi, Michaud, and Mitchell \(2011, 2017\)](#), for example, develop models where individuals can accumulate human capital by investing in financial knowledge. Though this additional investment in human capital comes at a cost, the acquisition of such knowledge endows individuals with the ability to earn higher returns by being able to identify, access, and appropriately utilize more sophisticated financial assets. Thus, investment in financial knowledge depends on costs, future returns, and the discount rate.

The empirical literature began by assessing levels of so-called financial literacy. [Lusardi and Mitchell \(2014\)](#) define financial literacy as "peoples' ability to process economic information and make informed decisions about financial planning, wealth accumulation, debt, and pensions." With this conceptual backdrop, measurement has focused on three core financial skills: (a) the numerical ability to do calculations related to discounting, (b) an understanding of prices and inflation, and (c) an understanding of the risk associated with diversification ([Lusardi and Mitchell 2014](#)). To empirically measure this particular set of knowledge, and examine their relationship to various financial behaviors, [Lusardi and Mitchell \(2008, 2011b\)](#) create three questions that have been implemented in surveys administered in the United States and abroad.

These three questions were first added to the 2004 Health and Retirement Study, which was administered to a representative sample of U.S. individuals who were aged 50 and older. [Lusardi and Mitchell \(2011a\)](#) report that, on average, this population of older adults is fairly financially illiterate. As noted in [Lusardi and Mitchell \(2014\)](#), these three questions have been added to other surveys including the 2007–2008 National Longitudinal Survey of Youth ([Lusardi, Mitchell, and Curto 2010](#)), the RAND American Life Panel ([Lusardi and Mitchell](#)

2017), and the 2009 and 2012 National Financial Capability Study (Lusardi and Mitchell 2011b). In each of these studies, the authors confirm that the level of financial literacy in the U.S. is astonishingly low.

In light of the recent financial crisis and this newfound evidence of a lack of financial literacy, researchers have turned their attention to the costs incurred as a result of a lack of financial knowledge. On the investment side, a lack of knowledge is shown to lead to additional costs and poor savings decisions (Calvet, Campbell, and Sodini 2007; French 2008; Choi, Laibson, and Madrian 2011). It is also shown to be related to U.S. homeowners suboptimally refinancing their homes, engaging in poor credit card behavior, and leveraging high cost forms of borrowing such as cash advances and payday loans (Ernst, Farris, and King 2004; Campbell 2006; Lusardi and Tufano 2015).

In sum, the literature on financial literacy, while still in its relative infancy, provides guidance on how to measure individual financial knowledge. Moreover, the literature highlights the fact that financial knowledge should be viewed no differently than other forms of human capital. It results from an investment undertaken by individuals after assessing the benefits and costs. However, in our analysis, we follow several recent studies and broaden the scope to include not only knowledge, but also financial behaviors, beliefs, and self-confidence (e.g., Xiao, Chen, and Sun 2015; Xiao and O'Neill 2016; Lusardi, Oggero, and Yakoboski 2017; Xiao and Porto 2017).

Food Security

The existing literature on food security is equally compelling. Millions of households in the United States are food insecure. The most recent USDA report (Coleman-Jensen, Gregory, and Singh 2014) indicates that although the number of U.S. households classified as food insecure has declined slightly over the past few years—from 14.9% of all households in 2011 to 14.3% in 2013—it remains substantially higher than prior to the Great Recession. In 2000, 10.5% of households were food insecure. In terms of individuals affected, 49.1 million individuals resided in food insecure households in 2013 (up from 33.2 million in 2000); 17.1 million individuals resided in households with very low food security in 2013 (up from 8.5 million in 2000).

The consequences of a lack of food security are known to be severe and non-transitory,

and as such the number of households classified as food insecure represents a serious public health concern (Gundersen 2013). Among children, an insufficient, unreliable source of food is associated with a litany of health and educational problems (e.g., Gundersen, Kreider, and Pepper 2011; Gundersen 2013; Turney 2015). For adults, the impacts include lower levels of nutrient uptake (Kirkpatrick and Tarasuk 2008), nutritional deprivation during pregnancy and lower newborn birth weights (Bozzoli and Quintana-Domeque 2014), and increased physical and mental health problems (Seligman, Laraia, and Kushel 2009). Elderly adults lacking food security face these same issues, as well having a higher probability of facing impediments regarding basic, daily activities (Ziliak, Gundersen, and Haist 2008).

In light of these well-known consequences, a growing body of literature has emerged attempting to understand the underlying determinants of food security. The most well-established factors associated with food security are, perhaps not surprisingly, socioeconomic and demographic measures. As reported in Gundersen, Kreider, and Pepper (2011) and Coleman-Jensen, Gregory, and Singh (2014), higher levels of food insecurity are associated with households having incomes at or below the federal poverty line and households headed by single parents, African-American and Hispanic individuals, renters, and less-educated individuals. Food insecurity is also more prevalent in large cities and rural areas relative to suburban areas and areas on the periphery of large cities.

However, the puzzle that arises from the empirical studies to date is that variation in food security is not well explained by current household economic resources. Using the 2009 Supplement for the Current Population Survey, Gundersen (2013) shows that many households below the poverty line are food secure, while a large number of households above the poverty line are not. The data in Coleman-Jensen, Gregory, and Singh (2014) indicate that 38.9% and 16.7% of households with an income less than 130% of the federal poverty line were food insecure and very low food secure, respectively, in 2013. Thus, 61.1% of households with an income less than 130% of the federal poverty line were food secure. However, 9.1% and 3.1% of households with an income exceeding 130% of the federal poverty line were food insecure and very low food secure, respectively.

This article seeks to understand if the ability of many households at or near the poverty line to be food secure, while others much above the poverty line are not, is attributable to differences in financial capability. The existing literature on financial literacy discussed earlier suggests this may be the case. Additional indirect evidence is found in other studies. Gundersen and Gruber (2001) find that household income averaged over a two-year window is a better predictor of food security than current income. Moreover, liquid assets are also found to be a crucial determinant of food security. Similarly, Ribar and Hamrick (2003) find that assets and income volatility are important determinants of food security. Furthermore, their theoretical model may be extended to allow for financial capability to affect food consumption through a loss in household resources. Leete and Bania (2010) find that liquidity constraints are a critical predictor of food security. Fitzpatrick and Coleman-Jensen (2014) find that credit access through payday loans allows at-risk households to reduce the likelihood of experiencing food insecurity. Finally, Gundersen and Garasky (2012) explore the association between self-assessed financial management skills and food security and document an economically and statistically significant relationship between an individual's use of specific financial management practices and food security, as well as between a respondent's level of confidence in their financial management skills and food security. However, the ability to interpret this finding as causal is not clear as the authors do not address the potential measurement error and endogeneity issues associated with measures of financial management skills.⁵

Empirics

We begin by discussing the data and then turn to the empirical model.

Data

NTFB survey. As noted in Gundersen and Garasky (2012), obtaining survey data with information on both food security and

financial capability is extremely challenging. Furthermore, with observational data, one needs additional information on individuals to allow for identification of the causal effect of financial capability since financial capability is not randomly assigned, nor is it measured without error given the abstract quality of its definition. Thus, we collected original data focusing on extremely vulnerable households using an interviewer-administered survey.⁶ Specifically, we surveyed individuals at randomly selected food pantries served by the North Texas Food Bank (NTFB) across North Texas from March to September 2014.⁷ Respondents were selected with the goal of achieving a random sample of roughly 1,000 individuals from the population frequenting NTFB pantries. In the end, our final sample includes 1,009 individuals from 38 pantries. The [supplementary appendix](#) online provides details regarding the survey administration and representativeness of the sample.

The data contain a wealth of information at the individual and household level, including information on basic demographics, household composition, economic resources, safety net utilization, self-reported health status, and educational backgrounds. Of particular relevance, we included the FSM to measure food security over the preceding 12 months according to the USDA's official classification, along with many detailed questions regarding financial capability.

Measurement of food insecurity. We use two outcomes in our study. The first is a binary indicator denoting whether the household is food insecure. The second is a binary indicator denoting whether the household is very low food secure. These classifications, following the official USDA definitions, are based on the 18-question FSM, the first ten of which pertain to all households (specifically, any household with an adult), while the final eight questions only pertain to households with children under the age of 18. All questions relate to conditions and behaviors reflecting difficulty in meeting food needs. Depending on the household composition and number of affirmative responses,

⁵ See Lusardi and Mitchell (2014) for a complete discussion related to the measurement error and endogeneity problems associated with measures of financial literacy.

⁶ Respondents had the option of having the survey administered in English or Spanish. See the [supplementary appendix](#) online for a copy of the survey in English.

⁷ In fiscal year 2014, the NTFB provided access to some 62 million meals through a network of more than 1,000 programs and 262 partner agencies. Available at: <http://www.ntfb.org>.

households are classified as high food secure, marginally food secure, low food secure, or very low food secure. Together, low and very low food secure comprise the food insecure households.

In our sample, 5% of the respondents' households are classified as high food secure, 12% are classified as marginally food secure, 83% are classified as low or very low food secure, with 46% classified as very low food secure (see [table 1](#)). Thus, not surprisingly, the respondents predominantly find themselves in a very tenuous situation with regard to their food security. Nonetheless, there is variation in the degree of food security within the sample of pantry-going individuals.

Measurement of financial capability. Our covariate of primary interest relates to financial capability, or one of its components. To measure aspects of financial capability, we relied heavily on existing questionnaire designs. Specifically, we first ask questions to measure financial knowledge; ten questions designed to measure understanding of interest rates, inflation, taxes and withholdings, and personal credit. Two of these questions are borrowed from the 2004 Health and Retirement Study mentioned above, one comes from additional questions incorporated in the 2009 National Financial Capability Study, and one comes from the 2009 RAND American Life Panel (survey 64).⁸ The remaining six questions come from the National Endowment for Financial Education (NEFE) Financial Evaluation Toolkit.⁹ Out of the 1,009 respondents, only 12 (0.99%) were able to answer all 10 questions correctly. Additionally, only 48% were able to answer more than five of the 10 questions correctly. The modal score, representing 16% of the sample, is six correct responses. Further, since the underlying financial knowledge questions vary in difficulty and in the capacity to discriminate between individuals' latent abilities, we utilize a two-parameter Item Response Theory (IRT) model to construct an individual-level IRT scale score from the underlying item responses.¹⁰ It is this IRT

scale score that we use as our measure of financial knowledge.

The next two questions relate to self-assessed financial confidence and the financial confidence of one's parents during childhood. Own and parental confidence were reported on a Likert-type scale from one to five, with five representing very confident. The median (and modal) response when individuals were asked about their own level of confidence is three out of five, which represents 32% of the sample. When asked to rate their parent's level of confidence, the median response, representing 25% of the sample, is four out of five, with the modal response, representing 35% of the sample, being five out of five.

The next set of eight questions ask individuals about their current financial behaviors, such as using a checking account to pay bills, reviewing bills for accuracy, paying bills on time, setting personal financial goals, using a budget and tracking spending, looking for ways to decrease spending, and reviewing income before making large purchases. These questions are taken from the NEFE Financial Evaluation Toolkit and [Gundersen and Garasky \(2012\)](#). Each question permitted answers on a scale from zero to five, with five corresponding to engaging in the behavior all the time. Aggregating scores across the eight questions yields a total possible score of 40. The median aggregate score is 27 out of 40 (4% of the sample), with the modal score being 30 out of 40 (7% of the sample).

Finally, we ask respondents four questions designed to measure beliefs related to the importance of savings and budgeting, keeping track of spending, and establishing an emergency savings fund. These questions are again taken from the NEFE Financial Evaluation Toolkit. Responses correspond to a standard, five-point Likert scale. Aggregating scores across the four questions yields a total possible score of 20. The median aggregate score is 17 out of 20 (11% of the sample), with the modal score being 16 out of 20 (21% of the sample).

Since the two-parameter model is nested in the three-parameter model, we conduct a likelihood ratio test to compare the competing models. We fail to reject the null that the two-parameter model is appropriate relative to the three-parameter model. We also compare the one-parameter model, which only allows items to vary in their difficulty while fixing the discrimination parameter to the two-parameter model and rejecting the null that the one-parameter model is appropriate relative to the two-parameter model.

⁸ Available at: <https://alpdata.rand.org/index.php?page=data&p=showsurvey&syid=64>; last accessed May 9, 2018.

⁹ Available at: <http://toolkit.nefe.org/Portals/0/Toolkit-Manual.pdf>; last accessed May 9, 2018.

¹⁰ The two-parameter IRT model includes discrimination and difficulty parameters that are allowed to vary across items, but not a guessing parameter (as in the three-parameter IRT model).

Table 1. Descriptive Statistics

Variables	N	Mean	SD	Minimum	Maximum
<i>Outcomes</i>					
Food Security, Food Insecure (1 = yes)	1,009	0.826	0.380	0	1
Food Security, Low (1 = yes)	1,009	0.365	0.482	0	1
Food Security, Very Low (1 = yes)	1,009	0.461	0.499	0	1
<i>Financial Capability</i>					
Index (PCA)	988	0	1	−4.053	2.213
Index (Average z-score)	988	0.009	0.662	−2.650	1.504
Knowledge (z-score)	1,009	0	1	−2.184	1.631
Behavior (z-score)	994	0	1	−3.214	1.726
Beliefs (z-score)	1,003	0	1	−4.691	1.184
Confidence (z-score)	1,008	0	1	−1.981	1.476
<i>Instrument</i>					
Parents' Financial Confidence (1 = not at all, 5 = very)	856	3.603	1.378	1	5
<i>Covariates</i>					
Age (years)	994	47.764	14.281	16	86
Gender (1 = male)	1,009	0.208	0.406	0	1
White (1 = yes)	1,009	0.286	0.452	0	1
Black (1 = yes)	1,009	0.383	0.486	0	1
Hispanic (1 = yes)	1,009	0.274	0.446	0	1
Other Race (1 = yes)	1,009	0.032	0.175	0	1
US Born (1 = yes)	1,008	0.777	0.417	0	1
Education (1 = No High School)	1,009	0.102	0.303	0	1
Education (1 = Some High School)	1,009	0.195	0.397	0	1
Education (1 = High School Degree)	1,009	0.346	0.476	0	1
Education (1 = Some College)	1,009	0.189	0.392	0	1
Education (1 = Post-Secondary, Non-degree Award or Associate's Degree)	1,009	0.101	0.302	0	1
Education (1 = Bachelor's Degree or More)	1,009	0.057	0.233	0	1
Married (1 = yes)	1,009	0.321	0.467	0	1
Divorced (1 = yes)	1,009	0.225	0.418	0	1
Separated (1 = yes)	1,009	0.096	0.295	0	1
Widowed (1 = yes)	1,009	0.093	0.291	0	1
Primary Language (1 = English)	1,009	0.772	0.420	0	1
Total HH Size	991	3.162	2.029	1	17
Total HH Size Under 18 Years Old	983	1.271	1.591	0	10
HH Income, Past Month, < \$200 (1 = yes)	1,009	0.071	0.258	0	1
HH Income, Past Month, \$200-399 (1 = yes)	1,009	0.047	0.211	0	1
HH Income, Past Month, \$400-599 (1 = yes)	1,009	0.056	0.231	0	1
HH Income, Past Month, \$600-799 (1 = yes)	1,009	0.178	0.383	0	1
HH Income, Past Month, \$800-999 (1 = yes)	1,009	0.106	0.308	0	1
HH Income, Past Month, \$1,000-1,249 (1 = yes)	1,009	0.172	0.378	0	1
HH Income, Past Month, \$1,250-1,499 (1 = yes)	1,009	0.126	0.332	0	1
HH Income, Past Month, \$1,500-1,999 (1 = yes)	1,009	0.121	0.326	0	1
HH Income, Past Month, Missing (1 = yes)	1,009	0.042	0.200	0	1
HH Debt, Total, <\$200 (1 = yes)	1,009	0.283	0.451	0	1
HH Debt, Total, \$200-999 (1 = yes)	1,009	0.089	0.285	0	1
HH Debt, Total, \$1,000-1,999 (1 = yes)	1,009	0.083	0.276	0	1
HH Debt, Total, \$2,000-4,999 (1 = yes)	1,009	0.133	0.340	0	1
HH Debt, Total, \$5,000-9,999 (1 = yes)	1,009	0.101	0.302	0	1
HH Debt, Total, \$10,000-19,999 (1 = yes)	1,009	0.084	0.278	0	1
HH Debt, Total, Missing (1 = yes)	1,009	0.078	0.269	0	1
HH Assets, Total, <\$50 (1 = yes)	1,009	0.725	0.446	0	1
HH Assets, Total, \$50-99 (1 = yes)	1,009	0.060	0.238	0	1
HH Assets, Total, >\$100 (1 = yes)	1,009	0.048	0.213	0	1

Continued

Table 1. continued

Variables	N	Mean	SD	Minimum	Maximum
HH Income, Past Month Relative to “Typical” (1 = worse)	1,009	0.282	0.450	0	1
HH Income, Past Month Relative to “Typical” (1 = same)	1,009	0.606	0.489	0	1
HH Income, Past Month Relative to “Typical”, Missing (1 = yes)	1,009	0.013	0.113	0	1
<i>Covariates</i>					
HH Food Source, Super Store (1 = yes)	1,009	0.722	0.448	0	1
HH Food Source, Grocery Store (1 = yes)	1,009	0.774	0.418	0	1
HH Food Source, Convenient Store (1 = yes)	1,009	0.105	0.307	0	1
HH Food Source, Neighborhood Store (1 = yes)	1,009	0.159	0.365	0	1
HH Food Source, Garden (1 = yes)	1,009	0.029	0.167	0	1
HH Food Source, Religious Center (1 = yes)	1,009	0.081	0.273	0	1
HH Food Source, Pantry/Charity (1 = yes)	1,009	0.817	0.387	0	1
HH Food Source, Family (1 = yes)	1,009	0.076	0.266	0	1
HH Food Source, Friends/Neighbors (1 = yes)	1,009	0.044	0.204	0	1
HH Income, Public Cash Transfers (1 = yes)	1,009	0.042	0.200	0	1
HH Income, SNAP (1 = yes)	1,009	0.518	0.500	0	1
HH Income, WIC (1 = yes)	1,009	0.155	0.362	0	1
HH Income, SSI (1 = yes)	1,009	0.244	0.430	0	1
HH Coverage, Medicare (1 = yes)	1,009	0.320	0.467	0	1
HH Coverage, Medicaid (1 = yes)	1,009	0.582	0.494	0	1
HH Coverage, Alternative Subsidized Health Insurance (1 = yes)	1,009	0.265	0.441	0	1
HH Coverage, Medicare, Missing (1 = yes)	1,009	0.007	0.083	0	1
HH Coverage, Medicaid, Missing (1 = yes)	1,009	0.017	0.129	0	1
Mental Disability (1 = yes)	1,009	0.091	0.288	0	1
Current Health (1 = Excellent)	1,009	0.063	0.244	0	1
Current Health (1 = Very Good)	1,009	0.127	0.333	0	1
Current Health (1 = Good)	1,009	0.298	0.458	0	1
Current Health (1 = Fair)	1,009	0.361	0.480	0	1
Current Health (1 = Poor)	1,009	0.150	0.357	0	1
Current Health (1 = Missing)	1,009	0.001	0.031	0	1
Treated by a Doctor, Past Month (1 = no)	1,009	0.562	0.496	0	1
Injured or Ill but not Treated, Past Month (1 = no)	1,009	0.675	0.469	0	1
HH, Someone Requires Medication (1 = yes)	1,009	0.705	0.456	0	1
HH, Someone Requires Mental/Physical Therapy (1 = yes)	1,009	0.258	0.438	0	1

Notes: HH = household; PCA = principal components analysis; HH = household; SNAP = Supplemental Nutrition Assistance Program; WIC = Women, Infants, and Children; SSI = Supplemental Security Income.

To construct a single measure of financial capability, we utilize two algorithms. First, we begin with four variables: (i) IRT scale score, (ii) self-assessed own financial confidence (out of five), (iii) aggregate score regarding current financial behaviors (out of 40), and (iv) aggregate score regarding current financial beliefs (out of 20). Using these four variables, we utilize PCA to create a single index of financial capability. The index is then standardized to have mean zero and unit variance. [Vyas and Kumaranayake \(2006\)](#) discuss the advantages of PCA in index

construction. Our second index follows [Kling, Liebman, and Katz \(2007\)](#). After each of the four variables listed above are standardized to have mean zero and unit variance, the index is equal to the equally-weighted mean of these four standardized variables. We also examine the four standardized variables in isolation.

Description of the sample. In addition to our covariate of interest measuring financial capability, an extensive array of control variables are also used in the analysis. Summary

statistics for the outcomes and all covariates are provided in [table 1](#).¹¹ Here we provide a brief description of the sample.

The age range of the sample varies from 16 to 86 years old, with the average age around 48 years old. The majority of the sample is female (nearly 80%). The racial breakdown is fairly uniform; 29% identify as white, non-Hispanic, 38% identify as black, non-Hispanic, and 27% identify as Hispanic. Nearly 80% of the sample is US born; the vast majority of those born abroad are from Mexico. This is also reflected in the primary language spoken in the households of the respondents; English is the primary language in nearly 80% of the sample; Spanish accounts for nearly all of the remainder. Related to household composition, 32% of the sample is married, while 26% of the sample has never been married. The remainder are either divorced, separated, or widowed. Finally, 43% of the sample currently resides with either a spouse or partner. The average household size is 3.2, with 1.3 members being below the age of 18 on average.

In terms of educational background, 30% of the sample reports either not attending high school at all (10%) or attending but not graduating (20%). Thirty-five percent of the sample possess a high school diploma or GED and 19% attended college, but did not complete a degree. Five percent of the sample has obtained a postsecondary award or certificate (such as hairstylist license) and another 5% has earned an associate's degree. Finally, 6% of the sample reports having completed at least a four-year college degree.

Total household income and household debt from the prior month are measured. We find that 18% of the sample reports a combined household income of less than \$600; 7% less than \$200. The modal response, representing 18% of the sample, is an income between \$600 and \$799. For household debt, the modal response, representing 28% of the sample, is a debt level below \$200. However, 23% of the sample report a debt level between \$2,000 and \$9,999 and another 23% of the sample report a debt level in excess of \$10,000.

Estimation

Model

We are interested in the causal effect of financial capability on food insecurity and very low food security, controlling for economic and other attributes of the households. To that end, we first estimate

$$(1) \quad y_i = \gamma F_i + \mathbf{X}_i \beta + \varepsilon_i, \quad i = 1, \dots, N$$

using an IV approach implemented via Generalized Method of Moments (GMM). In the model, y is equal to one if individual i is classified as either food insecure or very low food secure and zero otherwise, F is our scalar index of financial capability, \mathbf{X} is a $1 \times K$ vector of covariates (including an intercept), γ is the coefficient of primary interest, and ε is a mean zero error term. The IV approach utilizes an instrument, Z , for identification.

Prior to discussing identification, note that estimating [equation \(1\)](#) via GMM treats the dependent variable as continuous. Despite the popularity of this practice, strict conditions must hold to obtain consistent estimates if a binary outcome is treated as continuous ([Horrace and Oaxaca 2006](#)). Thus, we also estimate an IV Probit model via maximum likelihood.¹² In particular, we estimate

$$(2) \quad y_i = \mathbb{I}(\gamma F_i + \mathbf{X}_i \beta + \varepsilon_i > 0), \quad i = 1, \dots, N$$

$$F_i = \mathbf{X}_i \pi_1 + \pi_2 Z_i + \nu_i$$

where $\mathbb{I}(\cdot)$ is the indicator function, $(\varepsilon, \nu) \sim \mathbb{N}(0, \Sigma)$, and everything else is as defined previously. Average partial effects of the average structural function, $\Phi(\gamma F + \mathbf{X} \beta)$, are computed as in [Lin and Wooldridge \(2015\)](#).¹³

Identification

Identification of the causal effect of financial capability on food insecurity in the absence of experimental interventions is quite challenging. Estimation of [equations \(1\)](#) or (2) assuming F is exogenous is not likely to yield a consistent estimate of γ for two reasons. (see, e.g., [Lusardi and Mitchell 2014](#)). First, as financial capability is a nebulous concept, any

¹¹ Note that not all 1,009 respondents answered every question. Thus, we report the sample size along with each measure.

¹² Estimation is performed using the `-ivprobit-` command in Stata.

¹³ Formally, $APE_F^{(ASF)} = \gamma \mathbb{E}[\varphi(\gamma F + \mathbf{X} \beta)]_{F,X}$.

empirical measure is necessarily subject to measurement error. Second, because individuals self-select into different levels of financial capability, unobserved individual attributes such as innate ability or mental health are likely to be correlated with financial capability and food security. Moreover, food insecurity may impact financial capability as poor nutrition and poverty have been shown to impede cognitive function (Mani et al. 2013).

In an attempt to overcome both of these econometric challenges, we estimate equations (1) and (2) in our baseline specifications using the respondent's perception of his or her parents' confidence related to financial matters as an instrument, Z . The spirit of this instrument follows from the financial literacy literature and the literature on the role of family background in educational attainment more generally (Lusardi 2003; Van Rooij, Lusardi, and Alessie 2011). As stated previously, financial knowledge can be viewed as a form of human capital, requiring investment to acquire. As such, factors affecting the costs of this investment, but not impacting food security conditional on financial capability, represent valid exclusion restrictions. Parental financial confidence may impact the acquisition of financial human capital during childhood as parents are a readily available source of information (Grohmann, Kouwenberg, and Menkhoff 2015). For example, Björklund and Salvanes (2011) posit a model of general human capital investment whereby a child's human capital, H^c , is given by $H^c = H(H^p, A^c, S^c)$, where H^p is parental human capital, A^c is child's innate ability, and S^c represents investments in the child's human capital. If $\partial H / \partial H^p \neq 0$, then our instrument will satisfy the first-stage requirement.

However, to be valid, our instrument must also be uncorrelated with unobserved determinants of the respondent's food security. Two potential threats to this requirement exist. First, parental financial confidence may be correlated with the respondent's innate ability, A^c , if parental financial confidence and cognitive ability are correlated, cognitive ability is correlated across generations, and cognitive ability impacts food security. More generally, parental financial confidence would be an invalid instrument if it is simply capturing family-level fixed effects in the structural equation. In effect, our identification strategy needs to preclude the possibility of family-level unobservables that are

correlated with both own food security and parental financial confidence conditional on own financial capability. Second, parental financial confidence may directly impact the respondent's food security if the respondent resides with, or otherwise shares resources with, his or her parents.

Admittedly, these threats to validity are real. Nonetheless, given the importance of food security and the absence of randomized control trials (RCTs) at this point, we feel our analysis represents a substantial step forward in understanding food security. Moreover, we take several steps to address possible concerns over our identification strategy as well as explore alternative strategies.

To begin, we vary the covariates, \mathbf{X} . Specifically, we estimate six specifications of equations (1) and (2), where the specifications differ based on \mathbf{X} . Specification 1 only includes an intercept. Specification 2 adds ZIP Code fixed effects (28 ZIP code dummy variables). Specification 3 adds controls for basic individual and household demographics (age, gender, race, U.S.-born, education, marital status, household size and composition, income, debt, and assets). Specification 4 adds controls for food sources. Specification 5 adds controls for social assistance utilization. Finally, specification 6 adds controls for mental and physical health status. We add the controls in steps for two reasons. First, exploring the sensitivity of point estimates to the inclusion of additional covariates can be informative (Altonji, Elder, and Taber 2005). If our GMM estimates are stable across the various specifications, then this should engender confidence in our results. Second, many of the covariates beyond the basic demographic attributes are arguably endogenous. Thus, we add sets of covariates sequentially.

Next, we abandon the use of traditional IV estimation and instead rely on an identification strategy derived from a parametric implementation of the estimator proposed in Klein and Vella (2009, 2010) and expanded upon in Farré, Klein, and Vella (2013). The estimator exploits heteroskedasticity in the outcome and/or endogenous covariate for identification. The model estimated is now given by

$$(3) \quad y_i = \gamma F_i + \mathbf{X}_i \beta_1 + \beta_2 Z_i + \varepsilon_i$$

$$F_i = \mathbf{X}_i \pi_1 + \pi_2 Z_i + \nu_i$$

where the same set of covariates, \mathbf{X} and Z , appear in both the first- and second-stage

equations. Thus, there is no exclusion restriction in the traditional sense. Instead, we assume that the errors have the following structure:

- (4) $\varepsilon_i = S_\varepsilon(\mathbf{W}_i)\varepsilon_i^*$
- (5) $\nu_i = S_\nu(\mathbf{W}_i)\nu_i^*$
- (6) $S_\varepsilon(\mathbf{W}_i)/S_\nu(\mathbf{W}_i)$ varies across i
- (7) $E[\varepsilon_i^*\nu_i^*] = \rho$

where ε_i^* and ν_i^* are homoskedastic errors and $\mathbf{W} \subseteq \mathbf{X}$. Thus, at least one of the errors are required to be heteroskedastic in such a way that the ratio $S_\varepsilon(\mathbf{W}_i)/S_\nu(\mathbf{W}_i)$ varies across observations. However, the conditional correlation, ρ , between the underlying homoskedastic portion of the errors must be fixed. Note that while the heteroskedasticity terms— $S_\varepsilon(\mathbf{W}_i)$ and $S_\nu(\mathbf{W}_i)$ —are written as a function of the same set of covariates, \mathbf{W} , this need not be the case. There are no restrictions on which variables may enter each of these terms. Klein and Vella (2010) give some examples of DGPs satisfying these assumptions. Klein and Vella (2009) offer an interpretation of the data structure in a somewhat similar context (the causal effect of schooling on wages). One can think of ν_i^* as capturing the individual's endowment of innate ability or mental health. The attributes in \mathbf{W} then scale up or down the impact of ν^* on F . The structural error, ε_i^* , is a linear function of this endowment; its effect of food security is scaled up or down by \mathbf{W} as well. The correlation between ε^* and ν^* reflects the assumed correlation due to this unobserved endowment.

To estimate the model, we parameterize $S_\varepsilon(\mathbf{W}_i)$ and $S_\nu(\mathbf{W}_i)$ as

$$(8) \quad S_\varepsilon(\mathbf{W}_i) = \exp\left(\frac{\mathbf{W}_i\theta_\varepsilon}{2}\right)$$

$$(9) \quad S_\nu(\mathbf{W}_i) = \exp\left(\frac{\mathbf{W}_i\theta_\nu}{2}\right).$$

With this setup, equation (3) may be rewritten as

$$(10) \quad y_i = \gamma F_i + \mathbf{X}_i\beta_1 + \beta_2 Z_i + \rho \frac{S_\varepsilon(\mathbf{W}_i)}{S_\nu(\mathbf{W}_i)} \nu_i + \tilde{\varepsilon}_i$$

where $\rho \frac{S_\varepsilon(\mathbf{W}_i)}{S_\nu(\mathbf{W}_i)} \nu_i$ is a control functions and $\tilde{\varepsilon}_i$ is a well-behaved error term. Given the

functional form assumptions in equations (8) and (9), equation (10) can be estimated by nonlinear least squares (NLS) in a number of ways. We follow the algorithm detailed in Millimet and Roy (2016).

Third, we return to identification based on traditional exclusion restrictions, but now utilize four instruments related to the mental state of the respondent. The first three instruments are derived from a question about the respondent's expectation regarding his or her life expectancy. Life expectancy should impact decisions to invest in human capital, such as financial literacy, as longevity increases the returns to such investments. Moreover, self-reported life expectancy has been shown to be quite insightful (Perozek 2008). Because this question went unanswered by about 35% of the sample, we replace life expectancy with the sample average if it is missing, create an indicator if it is missing, and interact life expectancy with the missing indicator.¹⁴ This leads to our first three instruments.

The final instrument is the Subjective Happiness Scale developed in Lyubomirsky and Lepper (1999). The scale is based on the answers to four questions concerning the respondent's general level of happiness. The scale has been used extensively in psychological and economic studies. We expect subjective well-being to influence decisions regarding investments in human capital. Lyubomirsky and Lepper (1999) and Angner et al. (2010) find the measure to be positively correlated with verbal ability and so-called health literacy, respectively.

Instruments based on the subjective happiness and expected longevity of respondents may also not be valid. The most likely threat to validity arises from possible reverse causation; food security may directly impact one's mental state. However, as discussed in Di Tella and MacCulloch (2006), prior evidence suggests that individuals adapt to their economic situation, leaving subjective happiness unchanged in the long-run.

A benefit of the Klein and Vella (2010) approach and the usage of an alternative set of instruments based on the respondent's mental state is that we can add our original instrument—parental financial confidence—to the

¹⁴ 37 respondents gave an expected life expectancy in excess of 100, ranging from 101–150. We top-coded any answers above 100 at 100.

model for food security as shown in (3). This allows us to test the exclusion restriction for this variable (conditional on these alternative identification strategies being valid). As discussed in the next section, doing so indicates that if parental financial confidence has a direct impact on food security, it does so in the expected direction (i.e., greater parental confidence lowers the probability of being food insecure). As a result, our final step is to implement the method proposed in [Conley, Hansen, and Rossi \(2012\)](#) to assess the sensitivity of our baseline point estimates to violations of the excludability of our parental financial confidence instrument. Specifically, we now define the structural equation for food security as in [equation \(3\)](#), where $\beta_2 = 0$ is not assumed. However, if β_2 were known, then Z may still be used as an instrument to identify the parameter of interest, γ , by applying IV estimation to the following model

$$(11) \quad \tilde{y}_i(\beta_2) \equiv y_i - \beta_2 Z_i = \gamma F_i + \mathbf{X}_i \beta_1 + \varepsilon_i.$$

Since β_2 is unknown, but likely negative, we perform a grid search over a feasible range of values for β_2 and assess the corresponding GMM estimates (and confidence intervals) of γ , denoted as $\gamma(\beta_2)$. This highlights exactly what can be learned about the causal effect of financial capability on food security when using parental financial confidence as an instrument.

Results

We begin by discussing the results from the baseline models using parental financial confidence as an exclusion restriction and then turn to the alternative specifications.

Baseline Models

Results from our baseline model are presented in [tables 2–5](#). [Tables 2](#) and [4](#) define the outcome, y , as one if the household is food insecure (i.e., either low or very low food secure) and zero otherwise. [Tables 3](#) and [5](#) define the outcome, y , as one if the household is very low food secure, and zero otherwise. In [tables 2](#) and [3](#), the measure of financial capability is the standardized PCA-based index. In [tables 4](#) and [5](#), we consider alternative measures of financial capability. Within each table, we report OLS, GMM, and IV Probit

estimates, where the latter are converted to average partial effects for comparability. Finally, for the GMM estimates, we include relevant specification tests.

Food insecurity. Turning to the primary results for food insecurity ([table 2](#)), we obtain four key findings. First, the effect of financial capability obtained via OLS is negative, small, and only statistically significant in specifications (1) and (2). Because the index of financial capability is normalized to have unit variance, the OLS estimates in these specifications indicate that a one standard deviation improvement in financial capability is associated with a 2.9 percentage point decline in the probability of being low food secure. Adding observed covariates in the remaining specifications reduces the association to roughly 1.7 percentage points.

Second, our parental financial confidence instrument is not weak. In all specifications, the underidentification test rejects the null hypothesis that the model is not identified ($p < 0.01$) and the Kleibergen-Paap F -statistic is large ($F > 24$ in all cases).

Third, addressing measurement error and/or unobserved heterogeneity matters. The IV regressions produce much larger effects of financial capability in absolute value as compared to the OLS regressions; exogeneity is always rejected ($p < 0.05$ in all cases). While perhaps surprising, the attenuation witnessed under OLS is consistent with the prior literature examining the effects of financial capability on other outcomes. [Lusardi and Mitchell \(2014\)](#) state that “Interestingly, in all these cases, the IV financial literacy estimates always prove to be larger than the ordinary least squares estimates ... It might be that people affected by the instruments have large responses, or there is severe measurement error, but on the other hand, it seems clear that the noninstrumented estimates of financial literacy may underestimate the true effect.”

Finally, we find that the GMM and IV Probit estimates are very similar and stable across the specifications. Generally, we obtain an estimated marginal effect of financial capability on whether a household is food insecure of -0.17 (GMM) and -0.18 (Probit). This is highly statistically significant according to both the usual, heteroskedasticity-robust standard errors and the Anderson-Rubin weak instrument robust test for statistical significance. Conditional on our

Table 2. Marginal Effects of Financial Capability on Food Insecurity

	(1)			(2)			(3)		
	OLS	GMM	IV Probit	OLS	GMM	IV Probit	OLS	GMM	IV Probit
<i>Covariate of Interest</i>									
Financial Capability	−0.029 ^b (0.013)	−0.163 ^c (0.057)	−0.158 ^c (0.048)	−0.029 ^b (0.014)	−0.210 ^c (0.070)	−0.190 ^c (0.047)	−0.020 (0.016)	−0.194 ^b (0.082)	−0.187 ^c (0.064)
<i>Controls</i>									
Zip Code FEs	no	no	no	yes	yes	yes	yes	yes	yes
HH & Individual	no	no	no	no	no	no	yes	yes	yes
Food Source	no	no	no	no	no	no	no	no	no
Social Assistance	no	no	no	no	no	no	no	no	no
Health	no	no	no	no	no	no	no	no	no
Under Id. (p-value)	–	0.000	–	–	0.000	–	–	0.000	–
Endog. (p-value)	–	0.005	–	–	0.002	–	–	0.024	–
Kleibergen-Paap (robust F-Stat)	–	51.15	–	–	38.01	–	–	24.80	–
Anderson-Rubin (p-value)	–	0.002	–	–	0.001	–	–	0.009	–
Observations	988	839	839	988	839	839	942	799	799
(4)									
		GMM	IV Probit		GMM	IV Probit		GMM	IV Probit
<i>Covariate of Interest</i>									
Financial Capability	−0.021 (0.016)	−0.179 ^b (0.080)	−0.176 (0.066)	−0.022 (0.016)	−0.170 ^b (0.076)	−0.172 ^c (0.064)	−0.017 (0.016)	−0.166 ^b (0.076)	−0.177 ^c (0.061)
<i>Controls</i>									
Zip Code FEs	yes	yes	yes	yes	yes	yes	yes	yes	yes
HH & Individual	yes	yes	yes	yes	yes	yes	yes	yes	yes
Food Source	yes	yes	yes	yes	yes	yes	yes	yes	yes
Social Assistance	no	no	no	yes	yes	yes	yes	yes	yes
Health	no	no	no	no	no	no	yes	yes	yes
Under Id. (p-value)	–	0.000	–	–	0.000	–	–	0.000	–
Endog. (p-value)	–	0.037	–	–	0.043	–	–	0.040	–
Kleibergen-Paap (robust F-Stat)	–	25.73	–	–	27.69	–	–	28.10	–
Anderson-Rubin (p-value)	–	0.015	–	–	0.017	–	–	0.019	–
Observations	942	799	799	942	799	799	942	799	799

Note: Dependent variable is one if household is food insecure, and zero otherwise. Measure of financial capability is the principal component index. Exclusion restriction is the respondent's perception of parental confidence as it relates to financial matters. Average partial effects reported for IV probit model. Robust standard errors appear in parenthesis. FE = fixed effects, superscript ^a = p<0.10, ^b = p<0.05, and ^c = p<0.01.

Table 3. Marginal Effects of Financial Capability on Very Low Food Security

	(1)				(2)				(3)			
	OLS	GMM	IV Probit		OLS	GMM	IV Probit		OLS	GMM	IV Probit	
<i>Covariate of Interest</i>												
Financial Capability	-0.010 (0.016)	-0.144 ^a (0.076)	-0.130 ^b (0.055)		-0.013 (0.016)	-0.183 ^b (0.089)	-0.157 ^b (0.056)		-0.020 (0.019)	-0.304 ^c (0.117)	-0.235 ^c (0.053)	
<i>Controls</i>												
Zip Code FEs	no	no	no		yes	yes	yes		yes	yes	yes	
HH & Individual	no	no	no		no	no	no		yes	yes	yes	
Food Source	no	no	no		no	no	no		no	no	no	
Social Assistance	no	no	no		no	no	no		no	no	no	
Health	no	no	no		no	no	no		no	no	no	
Under Id. (p-value)	-	0.000	-		-	0.000	-		-	0.000	-	
Endog. (p-value)	-	0.048	-		-	0.032	-		-	0.007	-	
Kleibergen-Paap (robust F-Stat)	-	51.15	-		-	38.01	-		-	24.80	-	
Anderson-Rubin (p-value)	-	0.046	-		-	0.028	-		-	0.003	-	
Observations	988	839	839		988	839	839		942	799	799	
	(4)				(5)				(6)			
	OLS	GMM	IV Probit		OLS	GMM	IV Probit		OLS	GMM	IV Probit	
<i>Covariate of Interest</i>												
Financial Capability	-0.018 (0.019)	-0.287 ^b (0.113)	-0.225 ^c (0.056)		-0.018 (0.019)	-0.260 ^b (0.106)	-0.216 ^c (0.057)		-0.011 (0.020)	-0.239 ^b (0.102)	-0.206 ^c (0.059)	
<i>Controls</i>												
Zip Code FEs	yes	yes	yes		yes	yes	yes		yes	yes	yes	
HH & Individual	yes	yes	yes		yes	yes	yes		yes	yes	yes	
Food Source	yes	yes	yes		yes	yes	yes		yes	yes	yes	
Social Assistance	no	no	no		yes	yes	yes		yes	yes	yes	
Health	no	no	no		no	no	no		yes	yes	yes	
Under Id. (p-value)	-	0.000	-		-	0.000	-		-	0.000	-	
Endog. (p-value)	-	0.007	-		-	0.012	-		-	0.015	-	
Kleibergen-Paap (robust F-Stat)	-	25.73	-		-	27.69	-		-	28.10	-	
Anderson-Rubin (p-value)	-	0.004	-		-	0.007	-		-	0.011	-	
Observations	942	799	799		942	799	799		942	799	799	

Note: Dependent variable is one if household is very low food secure, and zero otherwise. Superscript ^a=p<0.10, ^b=p<0.05, and ^c=p<0.01. See table 2 for further details.

Table 4. Marginal Effects of Alternative Financial Capability Measures on Food Insecurity

	Alternative Index				Knowledge				Behaviors				Beliefs				Confidence			
	OLS		GMM		IV Probit		OLS		GMM		IV Probit		OLS		GMM		IV Probit		OLS	
	OLS	GMM	IV Probit	OLS	GMM	IV Probit	OLS	GMM	IV Probit	OLS	GMM	IV Probit	OLS	GMM	IV Probit	OLS	GMM	IV Probit	OLS	GMM
<i>Covariate of Interest</i>																				
Financial Capability	-0.026 (0.024)	-0.248 ^b (0.113)	-0.266 ^c (0.091)	0.013 (0.016)	-0.667 (0.566)	-0.350 ^c (0.044)	-0.010 (0.015)	-0.242 ^b (0.122)	-0.233 ^c (0.065)	-0.002 (0.015)	-0.441 (0.281)	-0.304 ^c (0.051)	-0.036 ^c (0.013)	-0.122 ^b (0.053)	-0.133 ^c (0.048)					
<i>Controls</i>																				
Zip Code FEs	yes	Yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
HH & Individual	yes	Yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Food Source	yes	Yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Social Assistance	yes	Yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Health	yes	Yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Under Id. (p-value)	-	0.000	-	-	0.163	-	-	0.000	-	-	0.035	-	-	0.000	-	-	0.000	-	-	-
Endog. (p-value)	-	0.040	-	-	0.016	-	-	0.024	-	-	0.023	-	-	0.108	-	-	0.108	-	-	-
Kleibergen-Paap (robust F-Stat)	-	28.736	-	-	1.647	-	-	12.471	-	-	3.753	-	-	37.631	-	-	37.631	-	-	-
Anderson-Rubin (p-value)	-	0.019	-	-	0.019	-	-	0.019	-	-	0.019	-	-	0.019	-	-	0.019	-	-	-
Observations	942	799	799	942	799	799	942	799	799	942	799	799	942	799	799	942	799	799	942	799

Note: Dependent variable is one if a household is food insecure, zero otherwise. Exclusion restriction is the respondent's perception of parental confidence as it relates to financial matters. Average partial effects are reported for IV probit model. Robust standard errors appear in parenthesis. FE = fixed effects. Superscript ^a= p<0.10, ^b= p<0.05, and ^c= p<0.01.

Table 5. Marginal Effects of Alternative Financial Capability Measures on Very Low Food Security

	Alternative Index				Knowledge				Behaviors				Beliefs				Confidence			
	OLS	GMM	IV Probit		OLS	GMM	IV Probit		OLS	GMM	IV Probit		OLS	GMM	IV Probit		OLS	GMM	IV Probit	
<i>Covariate of Interest</i>																				
Financial Capability	-0.023 (0.030)	-0.356 ^b (0.151)	-0.310 ^c (0.090)		-0.002 (0.020)	-0.957 (0.791)	-0.354 ^c (0.036)		0.010 (0.018)	-0.347 ^b (0.165)	-0.248 ^c (0.056)		0.012 (0.019)	-0.633 (0.401)	-0.306 ^c (0.044)		-0.050 ^c (0.017)	-0.175 ^b (0.069)	-0.163 (0.048)	
<i>Controls</i>																				
Zip Code FEs	Yes	yes	yes		yes	yes	yes		yes	yes	yes		yes	yes	yes		yes	yes	yes	
HH & Individual	Yes	yes	yes		yes	yes	yes		yes	yes	yes		yes	yes	yes		yes	yes	yes	
Food Source	Yes	yes	yes		yes	yes	yes		yes	yes	yes		yes	yes	yes		yes	yes	yes	
Social Assistance	Yes	yes	yes		yes	yes	yes		yes	yes	yes		yes	yes	yes		yes	yes	yes	
Health	Yes	yes	yes		yes	yes	yes		yes	yes	yes		yes	yes	yes		yes	yes	yes	
Under Id. (p-value)	-	0.000	-		-	0.163	-		-	0.000	-		-	0.035	-		-	0.000	-	
Endog. (p-value)	-	0.017	-		-	0.012	-		-	0.009	-		-	0.010	-		-	0.063	-	
Kleibergen-Paap (robust F-Stat)	-	28.736	-		-	1.647	-		-	12.471	-		-	3.753	-		-	37.631	-	
Anderson-Rubin (p-value)	-	0.011	-		-	0.011	-		-	0.011	-		-	0.011	-		-	0.011	-	
Observations	942	799	799		942	799	799		942	799	799		942	799	799		942	799	799	

Note: Dependent variable is one if a household is very low food secure, zero otherwise. Superscript ^a= p<0.10, ^b= p<0.05, and ^c= p<0.01. See table 4 for further details.

exclusion restriction being valid, the estimates imply that a one standard deviation increase in financial capability results in an approximate 17 percentage point decrease in the probability of a household being classified as food insecure.

Very low food insecure. Our assessment of very low food security (table 3) yields similar results. The GMM and probit estimates are large (in absolute value), statistically significant, and stable across specifications. Moreover, the instrument continues to be strong (as the first-stage is identical) and we continue to reject exogeneity of financial capability ($p < 0.05$ in all cases). Finally, we obtain an estimated marginal effect of financial capability on whether a household is very low food secure of roughly -0.21 (Probit) to -0.24 (GMM). Thus, we estimate at least a 21 percentage point decrease in the probability of being classified as very low food secure given a one standard deviation increase in financial capability. These estimates are statistically significant using either heteroskedasticity-robust standard errors or the Anderson-Rubin weak instrument robust test. Again, these results hinge on the validity of our exclusion restriction.

Alternative measures of financial capability. Tables 4 and 5 present the results using alternative measures of financial capability.¹⁵ We utilize an alternative index based on equally-weighted z-scores, as well as standardized measures of each of the four components of our indices (knowledge, behaviors, beliefs, and confidence). The analysis yields several insights. First, the specification using the alternative index produces nearly identical results. While the point estimates are larger in absolute value relative to the corresponding estimates in tables 2 and 3, the marginal effects of a one standard deviation increase in each index are virtually the same. Moreover, the instrument continues to be strong when using the alternative index. Second, when assessing the measures of financial knowledge and financial beliefs, the instruments are weak. Thus, while the point estimates continue to be negative and sometimes marginally statistically significant, the results should be viewed with extreme caution. Third, the instrument works well for the measures of financial behaviors and financial confidence. In both cases, the estimates are negative and

statistically significant, but the marginal effects are larger for financial behaviors. A one standard deviation improvement in financial behaviors leads to at least a 23 (25) percentage point decline in the probability of being food insecure (very low food secure).

Alternative Specifications

Klein and Vella estimator. Table 6 presents our results utilizing the Klein and Vella (2010) estimator and adding parental financial confidence as a covariate in the structural model for food security.¹⁶ Three main findings emerge. First, the point estimates are predominantly negative, but smaller in magnitude relative to the previous results. Nonetheless, a one standard deviation increase in our primary index of financial capability is estimated to reduce food insecurity by seven percentage points. The impact on very low food security is essentially zero. Second, while the impact of the individual components of our index of financial capability have similar effects on food insecurity, there is meaningful heterogeneity in their effects on very low food security. Specifically, the point estimate of the effect of financial knowledge is found to be very close to zero, whereas the point estimates on the other three components are very similar around -0.09 .

Third, owing to the greater demands placed on the data for identification, the estimates are much more imprecise and never statistically significant at the $p < 0.10$ confidence level. Thus, these estimates must be viewed very cautiously as exploiting heteroskedasticity to identify the parameter of interest can be quite difficult in practice. Finally, our exclusion restriction in the baseline IV estimates—parental financial confidence—is always found to have a negative association with food insecurity or very low food security. However, the point estimates are only significant at the $p < 0.10$ confidence level in four of twelve models, and never when using the aggregate indices of financial capability.

Exclusion restrictions based on mental state. Table 7 presents results using our four instruments based on the respondent's mental

¹⁵ For brevity, we only present results from specification (6), including the full set of controls.

¹⁶ Heteroskedasticity in ν is modeled as a function of marital status, race, education, income, and debt. Heteroskedasticity in ε is modeled as a function of education (for food insecurity only) and the number of household members under the age of 18 (for both food insecurity and very low food security).

Table 6. Effects of Alternative Financial Capability Measures on Food Insecurity: Klein and Vella Estimator

	Index		Alternative Index		Knowledge		Behaviors		Beliefs		Confidence	
	FI	VLFS	FI	VLFS	FI	VLFS	FI	VLFS	FI	VLFS	FI	VLFS
<i>Covariates of Interest</i>												
Financial Capability	-0.073 (0.097)	0.002 (0.121)	-0.070 (0.144)	0.062 (0.199)	-0.115 (0.150)	-0.015 (0.089)	-0.115 (0.226)	-0.095 (0.138)	-0.058 (0.086)	-0.092 (0.112)	-0.166 (0.130)	-0.099 (0.150)
Parental Confidence	-0.013 (0.017)	-0.022 (0.015)	-0.022 (0.023)	-0.037 (0.022)	-0.012 (0.017)	-0.022 ^a (0.012)	-0.021 (0.024)	-0.026 ^a (0.015)	-0.020 ^a (0.011)	-0.005 (0.024)	-0.026 ^a (0.014)	-0.013 (0.031)
<i>Controls</i>												
Zip Code FEs	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
HH & Individual	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Food Source	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Social Assistance	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Health	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Observations	799	799	799	799	799	799	799	799	799	799	799	799

Note: See text for estimation details. FI = dependent variable is one if household is food insecure, zero otherwise. VLFS = dependent variable is one if a household is very low food secure, zero otherwise. Robust standard errors in parenthesis. FE = fixed effects. Superscript ^a = $p < 0.10$, ^b = $p < 0.05$, and ^c = $p < 0.01$.

Table 7. Effects of Alternative Financial Capability Measures on Food Insecurity: Alternative Instruments

	Index		Alternative Index		Knowledge		Behaviors		Beliefs		Confidence	
	FI	VLFS	FI	VLFS	FI	VLFS	FI	VLFS	FI	VLFS	FI	VLFS
<i>Covariates of Interest</i>												
Financial Capability	-0.192 ^b (0.082)	-0.515 ^c (0.146)	-0.283 ^b (0.123)	-0.765 ^c (0.218)	0.074 (0.080)	0.161 (0.108)	-0.231 ^b (0.106)	-0.617 ^c (0.206)	-0.438 (0.294)	-0.978 ^a (0.586)	-0.122 ^c (0.045)	-0.315 ^c (0.073)
Parental Confidence	0.006 (0.014)	0.039 (0.027)	0.006 (0.015)	0.039 (0.027)	-0.021 ^b (0.010)	-0.035 ^c (0.014)	0.002 (0.014)	0.026 (0.028)	0.001 (0.019)	0.017 (0.041)	0.002 (0.012)	0.028 (0.020)
<i>Controls</i>												
Zip Code FEs	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
HH & Individual	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Food Source	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Social Assistance	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Health	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Under Id. (p-value)	0.000	0.000	0.000	0.000	0.000	0.000	0.003	0.003	0.349	0.349	0.000	0.000
Over Id. (p-value)	0.165	0.306	0.140	0.233	0.007	0.000	0.190	0.373	0.217	0.164	0.222	0.341
Endog. (p-value)	0.019	0.000	0.024	0.000	0.476	0.140	0.011	0.000	0.041	0.000	0.056	0.000
Kleibergen-Paap (robust F-Stat)	7.885	7.885	8.125	8.125	7.902	7.902	4.329	4.329	0.942	0.942	17.543	17.543
Anderson-Rubin (p-value)	0.011	0.000	0.011	0.000	0.011	0.000	0.011	0.000	0.011	0.000	0.011	0.000
Observations	794	794	794	794	794	794	794	794	794	794	794	794

Note: Estimation by GMM. Exclusion restrictions include the subjective happiness scale, life expectancy, an indicator for missing life expectancy, and an interaction between life expectancy and the missing indicator. FI = dependent variable is one if household is food insecure, zero otherwise. VLFS = dependent variable is one if household is very low food secure, zero otherwise. Robust standard errors in parenthesis. FE = fixed effects. Superscript a= p<0.10, b= p<0.05, and c= p<0.01.

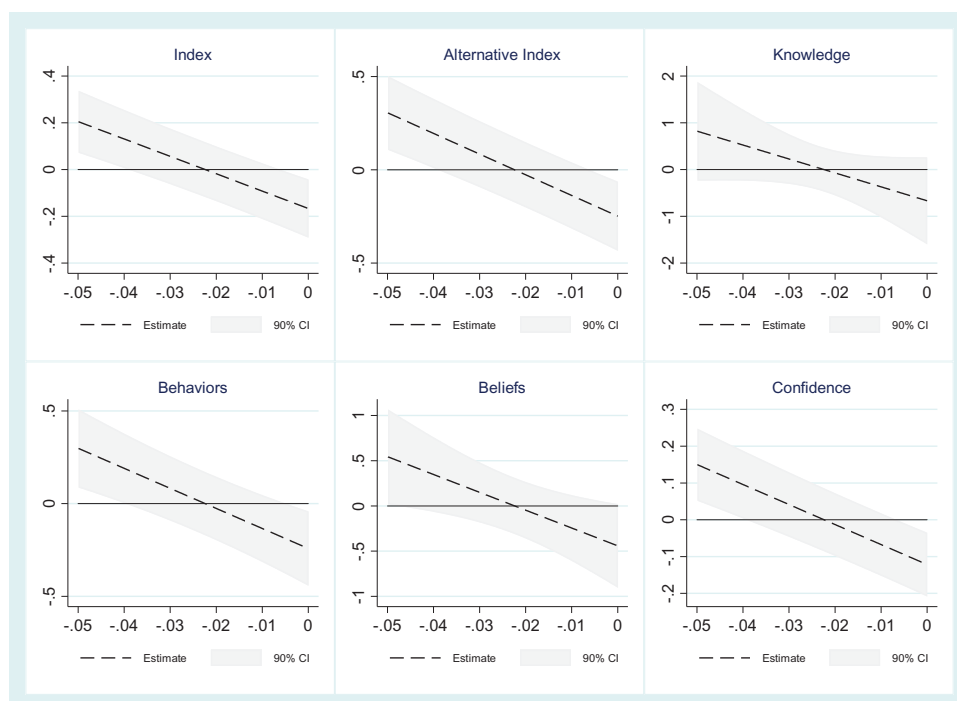


Figure 1. Sensitivity of Marginal Effects of Alternative Financial Capability Measures on Food Insecurity

Notes: Dependent variable is one if household is food insecure, zero otherwise. Exclusion restriction is the respondent's perception of parental confidence as it relates to financial matters. Vertical axis corresponds to the marginal effect. Horizontal axis corresponds to the imposed coefficient (β_2) on the exclusion restriction in the structural equation (Equation 11). See text for further details.

state. Because the model is overidentified, we also display results of Hansen's (1982) test of overidentifying restrictions. While there are also reasonable threats to the validity of these instruments, the findings indicate that the instruments are reasonably strong for most measures of financial capability, pass the test of overidentification in most models, and point to similar (or even greater) effects of financial capability on food security. The exceptions occur when either financial knowledge or financial beliefs is the endogenous covariate; in the former the instruments fail the overidentification test and in the latter the instruments are very weak. Moreover, our preferred instrument—parental financial confidence—is never a statistically significant determinant of food security except in the model for financial knowledge where the new instruments fail the overidentification test. Thus, while we do not wish to put too much stock in these results, it is comforting that the pattern of results supports our choice of instruments in the baseline model and produces similar estimates of the impact of financial capability on food security.

Allowing for deviations from instrument validity. Our final analysis is based on a proposal in Conley, Hansen, and Rossi (2012). As the models in tables 6 and 7 suggest some evidence that there may be a negative direct effect of parental financial confidence on food insecurity and very low food security, we conduct a grid search over β_2 in equation (11) and assess how $\gamma(\beta_2)$ varies with β_2 . Because the estimated coefficients on parental financial confidence in tables 6 and 7 are negative and often around -0.02 when statistically significant, we conduct a grid search from zero to -0.05 in increments of -0.0001. The corresponding estimates of $\gamma(\beta_2)$ and 90% confidence intervals are displayed in figures 1 and 2. Note that the point estimates and confidence intervals when $\beta_2 = 0$ correspond to the baseline estimates in tables 2–6.

The figures yield two main findings. First, as one allows for parental financial confidence to have a direct, negative effect on food insecurity or very low food security, the estimated impact of financial capability first diminishes in absolute value and then turns positive. This

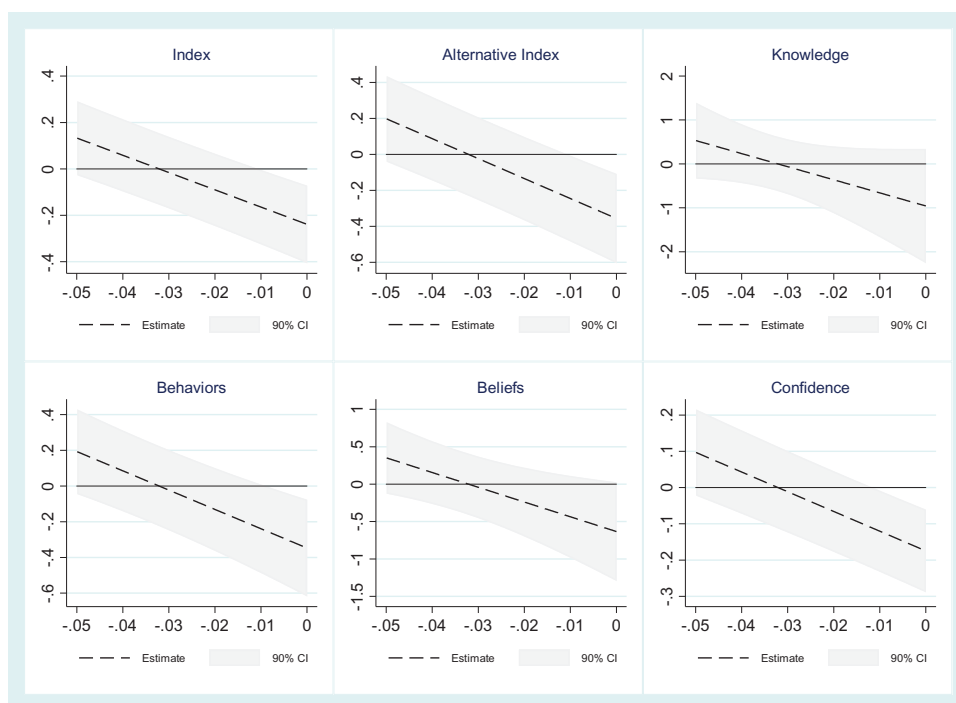


Figure 2. Sensitivity of Marginal Effects of Alternative Financial Capability Measures on Very Low Food Security

Notes: Dependent variable is one if household is very low food secure, zero otherwise. See Figure 1 for further details.

follows from the strong, positive association between the instrument and our financial capability measures. Second, the direct effect of parental financial confidence must be around -0.02 for the point estimate to be zero (although smaller than this in absolute value for the confidence interval to include zero). To put this value in perspective, $\beta_2 = -0.02$ implies that a one standard deviation *ceteris paribus* increase in parental financial confidence reduces the probability of being food insecure or very low food secure by approximately three percentage points.

In the end, the sensitivity analysis based on Conley, Hansen, and Rossi (2012) clarifies what can be learned about the impact of financial capability on food security when using parental financial confidence as an instrument if excludability is violated. In particular, moderate deviations from instrument validity preclude one from excluding zero from the 90% confidence interval.

Discussion

The fact that the correlation between income and food security is lower than most

researchers expect is puzzling. Our analysis suggests that financial capability may play a role in this puzzle. Financial capability in general, and financial behaviors in particular, are found to be a significant determinant of food security in vulnerable households. Moreover, controlling for unobserved heterogeneity and/or measurement error appears to be critical as we find that OLS yields estimates biased toward zero. This bias toward zero is consistent with prior studies on the effects of financial capability on other outcomes.

While our findings must be interpreted cautiously given the assumptions required for identification, the magnitude of the effects of financial capability that we find within our sample of vulnerable households is dramatic and suggests that additional research is warranted. In terms of food insecurity, our preferred GMM estimates in table 2 indicate a marginal effect of about 17 percentage points. This implies that an intervention that improves the financial capability of all households in the United States by one standard deviation—where a

standard deviation is defined with respect to the empirical distribution of financial capability in our sample—could potentially reduce the number of food insecure households in the United States from 17.5 million to 14.6 million (based on 2013 figures). To place a one standard deviation increase in context, moving from the 25th to the 75th percentile of the empirical distribution of financial capability in our sample corresponds to an increase of approximately 1.4 standard deviations.

Performing the same exercise for very low food security and using an estimated marginal effect of 24 percentage points, we find that a one standard deviation improvement in the financial capability of all households in the United States could potentially reduce the number of very low food secure households in the United States from 6.8 million to 5.2 million (based on 2013 figures). Of course, the extrapolations above assume that the estimates for the pantry-going population in North Texas are externally valid.

To further assess what a one standard deviation increase in our financial capability index entails, we calculate the improvement in each of the four components of the index required to improve an individual's overall PCA-based index by one standard deviation. Setting the other three components at the sample average, an individual's financial knowledge component would have to be raised by seven points on the IRT scale (or 3.9 standard deviations) in order for the overall index to improve by one standard deviation. An individual's financial beliefs component would have to be raised by eight points on a 0–20 point scale (or 3.0 standard deviations) in order for the overall index to improve by one standard deviation. An individual's financial confidence component would have to be raised by four points on a 1–5 scale (or 3.5 standard deviations) in order for the overall index to improve by one standard deviation. Lastly, an individual's financial behaviors component would have to be raised by 19 points on a 0–40 point scale (or 2.4 standard deviations) in order for the overall index to improve by one standard deviation. Thus, in terms of standard deviations, improving financial behaviors requires the smallest increase and, as noted when we analyze the effects of each component on food insecurity separately, the strongest evidence for a causal effect on food insecurity is also for this component.

Conclusion

While food insecurity is a significant public health issue, addressing it is hampered by the fact that there exists substantial variation in food security across households conditional on economic resources. The factors accounting for this residual variation remain a puzzle. Using original data collected from a self-designed survey administered to 1,009 individuals utilizing food pantries across North Texas in 2014, we assess the role played by financial capability in this puzzle. Addressing issues related to measurement error and unobserved heterogeneity through the use of IV estimation, our results point to a statistically significant and meaningful relationship between financial capability on the probability of a household being food insecure.

Because our identification strategies are not without criticism, additional research is clearly warranted to corroborate our conclusions before policy conclusions can be made. Further, policymakers should temper expectations with respect to how much of an impact improving financial capabilities would have on household-level food security until such further research can be conducted. However, it is noteworthy that current research into methods of improving financial capability and practices is ongoing. For example, [Bertrand, Mullainathan, and Shafir \(2004\)](#) discuss numerous options for increasing the savings and banking behavior among the “unbanked” population, such as establishing direct deposit for welfare benefits and Earned Income Tax Credit refunds and having bank employees solicit the formation of new accounts at venues such as food pantries. More recently, [Postmus, Hetling, and Hoge \(2015\)](#) analyze data on survivors of domestic abuse and find that financial education interventions can lead to improvements in self-reported financial knowledge, behavior, and well-being, and that such improvements persist over time. [Bracha and Meier \(2015\)](#) document the ability of monthly text messages to alter the financial behavior of low income individuals in Boston, resulting in improved credit scores. Finally, [Moulton et al. \(2015\)](#) show that first-time home buyers who complete a financial planning module and are contacted quarterly by a financial coach are less likely to default or become delinquent on their mortgages.

Moreover, the federal government already has the infrastructure in place to provide

education programs to the low-income population in the United States through the USDA's SNAP-Ed program. The SNAP-Ed program allocates federal money to states to fund programs designed to improve nutrition and reduce obesity among low-income individuals. The stated goal of SNAP-Ed is "to improve the likelihood that persons eligible for SNAP will make healthy food choices within a limited budget and choose physically active lifestyles . . ." ¹⁷ However, while an assessment of the SNAP-Ed program is beyond the scope of this paper, programs funded under SNAP-Ed are precluded from deviating too far from topics directly related to food and food budgeting. In addition, total funds allocated under SNAP-Ed in FY2017 were \$440 million compared to a total budget for SNAP of \$82 billion. ¹⁸ As such, if additional research verifies our findings regarding the importance of financial capability to food security, then additional funding to and breadth of SNAP-Ed programs seems like a logical policy recommendation.

Supplementary Material

Supplementary material are available at *American Journal of Agricultural Economics* online.

References

- Altonji, J.G., T.E. Elder, and C.R. Taber. 2005. Selection on Observed and Unobserved Variables: Assessing the Effectiveness of Catholic Schools. *Journal of Political Economy* 113: 151–84.
- Angner, E., M.J. Miller, M.N. Ray, K.G. Saag, and J.J. Allison. 2010. Health Literacy and Happiness: A Community-based Study. *Social Indicators Research* 95: 325.
- Bertrand, M., S. Mullainathan, and E. Shafir. 2004. A Behavioral-economics View of Poverty. *American Economic Review* 94: 419–23.
- Bitler, M., C. Gundersen, and G.S. Marquis. 2005. Are WIC Nonrecipients at Less Nutritional Risk Than Recipients? An application of the Food Security Measure. *Review of Agricultural Economics* 27: 433–8.
- Björklund, A., and K.G. Salvanes. 2011. Education and Family Background: Mechanisms and Policies. In *Handbook of the Economics of Education*, ed. Eric A. Hanushek, Stephen J. Machin, Ludger Woessmann vol. 3, 201–47. Amsterdam, North Holland: Elsevier.
- Bourke, N., A. Horowitz, and T. Roche. 2012. *Payday Lending in America: Who Borrows, Where They Borrow, and Why*. Pew Charitable Trust Report. http://www.pewtrusts.org/~media/legacy/uploadedfiles/pes_assets/2012/pewpaydaylendingreportpdf.pdf; last accessed May 9, 2018.
- Bozzoli, C., and C. Quintana-Domeque. 2014. The Weight of the Crisis: Evidence from Newborns in Argentina. *Review of Economics and Statistics* 96: 550–62.
- Bracha, A., and S. Meier. 2015. Nudging Credit Scores in the Field: The Effect of Text Reminders on Creditworthiness in the United States. WP 15-02, Federal Reserve Bank of Boston.
- Calvet, L.E., J.Y. Campbell, and P. Sodini. 2007. Down or Out: Assessing the Welfare Costs of Household Investment Mistakes. *Journal of Political Economy* 115: 707–47.
- Campbell, J.Y. 2006. Household Finance. *Journal of Finance* 61: 1553–604.
- Choi, J.J., D. Laibson, and B.C. Madrian. 2011. \$100 Bills on the Sidewalk: Suboptimal Investment in 401 (k) Plans. *Review of Economics and Statistics* 93: 748–63.
- Coleman-Jensen, A., C. Gregory, and A. Singh. 2014. Household Food Security in the United States in 2013. Washington DC: U.S. Department of Agriculture, Economic Research Service, Economic Research Report No. 173.
- Conley, T.G., C.B. Hansen, and P.E. Rossi. 2012. Plausibly Exogenous. *Review of Economics and Statistics* 94: 260–72.
- Davis, G.C., and W. You. 2011. Not Enough Money or Not Enough Time to Satisfy the Thrifty Food Plan? A Cost Difference Approach for Estimating a Money–time Threshold. *Food Policy* 36: 101–7.

¹⁷ Available at: <https://snaped.fns.usda.gov/snap/Guidance/FY2018SNAP-EdPlanGuidance.pdf>; last accessed May 9, 2018.

¹⁸ Available at: <https://www.obpa.usda.gov/budsum/fy17budsum.pdf>; last accessed May 9, 2018, <https://snaped.fns.usda.gov/snap/Guidance/SNAP-EdBudgetAllocationFY2017.pdf>; last accessed May 9, 2018.

- Delavande, A., S. Rohwedder, and R.J. Willis. 2008. Preparation for Retirement, Financial Literacy and Cognitive Resources. Working Paper 2008-190, University of Michigan Retirement Research Center.
- Di Tella, R., and R. MacCulloch. 2006. Some Uses of Happiness Data in Economics. *Journal of Economic Perspectives* 20 (1): 25–46.
- Ernst, K., J. Farris, and U. King. 2004. *Quantifying the Economic Cost of Predatory Payday Lending*. Durham, NC: Center for Responsible Lending.
- Farré, L., R. Klein, and F. Vella. 2013. A Parametric Control Function Approach to Estimating the Returns to Schooling in the Absence of Exclusion Restrictions: An Application to the NLSY. *Empirical Economics* 44: 111–33.
- Fitzpatrick, K., and A. Coleman-Jensen. 2014. Food on the Fringe: Food Insecurity and the Use of Payday Loans. *Social Service Review* 88: 553–93.
- Grohmann, A., R. Kouwenberg, and L. Menkhoff. 2015. Childhood Roots of Financial Literacy. *Journal of Economic Psychology* 51: 114–33.
- Gundersen, C. 2013. Food Insecurity Is an Ongoing National Concern. *Advances in Nutrition* 4: 36–41.
- . 2008. Measuring the Extent, Depth, and Severity of Food Insecurity: An Application to American Indians in the USA. *Journal of Population Economics* 21: 191–215.
- Gundersen, C., and S.B. Garasky. 2012. Financial Management Skills Are Associated with Food Insecurity in a Sample of Households with Children in the United States, 2. *Journal of Nutrition* 142: 1865–70.
- Gundersen, C., and J. Gruber. 2001. The Dynamic Determinants of Food Insufficiency. In *Second Food Security Measurement and Research Conference*. Food Assistance and Nutrition Research Report, vol. 2, pp. 11–2.
- Gundersen, C., and B. Kreider. 2008. Food Stamps and Food Insecurity What Can Be Learned in the Presence of Nonclassical Measurement Error? *Journal of Human Resources* 43: 352–82.
- Gundersen, C., B. Kreider, and J. Pepper. 2011. The Economics of Food Insecurity in the United States. *Applied Economic Perspectives and Policy* 33: 281–303.
- Hansen, L.P. 1982. Large Sample Properties of Generalized Method of Moments Estimators. *Econometrica* 50: 1029–54.
- Heflin, C., I. Arteaga, and S. Gable. 2015. The Child and Adult Care Food Program and Food Insecurity. *Social Service Review* 89: 77–98.
- Horrace, W.C., and R.L. Oaxaca. 2006. Results on the Bias and Inconsistency of Ordinary Least Squares for the Linear Probability Model. *Economics Letters* 90: 321–7.
- Kirkpatrick, S.I., and V. Tarasuk. 2008. Food Insecurity is Associated with Nutrient Inadequacies among Canadian Adults and Adolescents. *Journal of Nutrition* 138: 604–12.
- Klein, R., and F. Vella. 2010. Estimating a Class of Triangular Simultaneous Equations Models without Exclusion Restrictions. *Journal of Econometrics* 154: 154–64.
- . 2009. Estimating the Return to Endogenous Schooling Decisions via Conditional Second Moments. *Journal of Human Resources* 44: 1047–65.
- Kling, J.R., J.B. Liebman, and L.F. Katz. 2007. Experimental Analysis of Neighborhood Effects. *Econometrica* 75: 83–119.
- Leete, L., and N. Bania. 2010. The Effect of Income Shocks on Food Insufficiency. *Review of Economics of the Household* 8: 505–26.
- Lin, W., and J.M. Wooldridge. 2015. On Different Approaches to Obtaining Partial Effects in Binary Response Models with Endogenous Regressors. *Economics Letters* 134: 58–61.
- Lusardi, A., 2003. Planning and Saving for Retirement. Working paper, Dartmouth College.
- Lusardi, A., P.C. Michaud, and O.S. Mitchell. 2017. Optimal Financial Knowledge and Wealth Inequality. *Journal of Political Economy* 125: 431–77.
- . 2011. Optimal financial literacy and saving for retirement. Working Paper 2011-20, Wharton School Pension Research Council.
- Lusardi, A., and O.S. Mitchell. 2008. Planning and Financial Literacy: How Do Women Fare? *American Economic Review* 98: 413–7.
- . 2011a. Financial Literacy and Planning: Implications for Retirement Well-being. In *Financial Literacy:*

- Implications for Retirement Security and the Financial Marketplace*, 17–9. Oxford University Press.
- . 2011b. The Outlook for Financial Literacy. In *Financial Literacy: Implications for Retirement Security and the Financial Marketplace*, 1–15. Oxford University Press.
- . 2014. The Economic Importance of Financial Literacy: Theory and Evidence. *Journal of Economic Literature* 52: 5–44.
- . 2017. How Ordinary Consumers Make Complex Economic Decisions: Financial Literacy and Retirement Readiness. *Quarterly Journal of Finance* 7: 1–31.
- Lusardi, A., O.S. Mitchell, and V. Curto. 2010. Financial Literacy among the Young. *Journal of Consumer Affairs* 44: 358–80.
- Lusardi, A., N. Oggero, and P.J. Yakoboski. 2017. The TIAA Institute-GFLEC Personal Finance Index: A New Measure of Financial Literacy. New York, NY: TIAA Institute.
- Lusardi, A., and P. Tufano. 2015. Debt Literacy, Financial Experiences, and Overindebtedness. *Journal of Pension Economics & Finance* 14: 332–68.
- Lyubomirsky, S., and H.S. Lepper. 1999. A Measure of Subjective Happiness: Preliminary Reliability and Construct Validation. *Social Indicators Research* 46: 137–55.
- Mabli, J., J. Ohls, L. Dragoset, L. Castner, and B. Santos. 2013. Measuring the Effect of Supplemental Nutrition Assistance Program (SNAP) Participation on Food Security. Prepared by Mathematica Policy Research for the U.S. Department of Agriculture, Food and Nutrition Service.
- Mani, A., S. Mullainathan, E. Shafrir, and J. Zhao. 2013. Poverty Impedes Cognitive Function. *Science* 341: 976–80.
- Millimet, D.L., and J. Roy. 2016. Empirical Tests of the Pollution Haven Hypothesis When Environmental Regulation is Endogenous. *Journal of Applied Econometrics* 31: 652–77.
- Moulton, S., J.M. Collins, C. Loibl, and A. Samek. 2015. Effects of Monitoring on Mortgage Delinquency: Evidence from a Randomized Field Study. *Journal of Policy Analysis and Management* 34: 184–207.
- Perozek, M. 2008. Using Subjective Expectations to Forecast Longevity: Do Survey Respondents Know Something We Don't Know? *Demography* 45: 95–113.
- Postmus, J.L., A. Hetling, and G.L. Hoge. 2015. Evaluating a Financial Education Curriculum as an Intervention to Improve Financial Behaviors and Financial Well-being of Survivors of Domestic Violence: Results from a Longitudinal Randomized Controlled Study. *Journal of Consumer Affairs* 49: 250–66.
- Ribar, D.C., and K.S. Hamrick. 2003. Dynamics of Poverty and Food Sufficiency. Washington DC: U.S. Department of Agriculture, Economic Research Service, Food Assistance and Nutrition Research Report No. 33.
- Seligman, H.K., B.A. Laraia, and M.B. Kushel. 2009. Food Insecurity is Associated with Chronic Disease among Low-income NHANES Participants. *Journal of Nutrition* 140: 304–10.
- Smith, M.M., and C.C. Hevener. 2014. Subprime Lending over Time: The Role of Race. *Journal of Economics and Finance* 38: 321–44.
- Turney, K. 2015. Paternal Incarceration and Children's Food Insecurity: A Consideration of Variation and Mechanisms. *Social Service Review* 89: 335–67.
- Van Rooij, M., A. Lusardi, and R. Alessie. 2011. Financial Literacy and Stock Market Participation. *Journal of Financial Economics* 101: 449–72.
- Vyas, S., and L. Kumaranayake. 2006. Constructing Socio-economic Status Indices: How to Use Principal Components Analysis. *Health Policy and Planning* 21: 459–68.
- Xiao, J.J., C. Chen, and L. Sun. 2015. Age Differences in Consumer Financial Capability. *International Journal of Consumer Studies* 39: 387–95.
- Xiao, J.J., and B. O'Neill. 2016. Consumer Financial Education and Financial Capability. *International Journal of Consumer Studies* 40: 712–21.
- Xiao, J.J., and N. Porto. 2017. Financial Education and Financial Satisfaction: Financial Literacy, Behavior, and Capability as Mediators. *International Journal of Bank Marketing* 35: 805–17.
- Ziliak, J., C. Gundersen, and M. Haist. 2008. The Causes, Consequences, and Future of Senior Hunger in America. Special Report by the University of Kentucky Center for Poverty Research for the Meals on Wheels Association of America Foundation.