Submitted and Denied:
Understanding Variation in Case Status across Supplemental Nutrition Assistance Program (SNAP) Applications

Shellye Suttles, The O'Neill School of Public & Environmental Affairs, Indiana University, shelsutt@iu.edu

Angela Babb, The Ostrom Workshop, Indiana University, ababb@indiana.edu

Daniel C. Knudsen, Department of Geography, Indiana University, knudsen@indiana.edu

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Abstract

Our study investigates the application process for the Supplemental Nutrition Assistance Program (SNAP) and barriers to successful SNAP participation among food-insecure households. We know that only 84 percent of eligible individuals in the United States participated in the SNAP program prior to the COVID-19 pandemic. To understand continued barriers to food security and, ultimately, SNAP participation among eligible applicants, we study Indiana households that have applied to the SNAP program, including those that have been subsequently denied benefits. We analyze census-tract level data from Indiana's administrator of SNAP benefits, Family Social Services Administration (FSSA), in combination with census-tract level socioeconomic data. We extend previous methodologies in micro- and macro-level socioeconomic analysis of SNAP participation to examine not only the participation rate (approved applications), but also the larger pool of applicants (submitted applications) and the instances in which applicants are not chosen to be participants (denied applications). Our empirical model seeks to understand micro- and macro-level predictors of the variation in SNAP case status across Indiana, particularly submitted applications and denied applications. We believe our analysis of Indiana SNAP applications has statistically confirmed anecdotal findings that the most difficult hurdle in the SNAP application process is not solely the means test of

household income and assets. Our results show evidence of increased time in the application process for communities with high SNAP denial rates. We also find that broader socioeconomic trends in a community are associated with SNAP application submissions while applicants' personal circumstances better predict denial rates.

1 INTRODUCTION

Our study investigates the application process for the Supplemental Nutrition Assistance Program (SNAP) and barriers to both application and participation among food-insecure households. Prior to the COVID-19 pandemic, only 84 percent of eligible individuals in the United States participated in the SNAP program (Cunnyngham, 2020). Given the correlation between food security and public health, closing the gap in SNAP participation among food-insecure households would increase health equity for hundreds of thousands of U.S. families. Therefore, we seek to understand the characteristics and challenges of a distinct portion of the 16 percent of households that are eligible for SNAP but do not participate in the program – denied applicants.

SNAP is a means-tested federal benefit, where eligibility is largely dependent on a household's gross monthly income, net monthly income (gross income less deductions), and total assets. Depending on state-level administration of SNAP benefits, eligibility may also be based on elderly or disabled household members, U.S. residency status, and participation in an employment or job training program among other requirements. As a result, researchers have found that state-level SNAP policies are largely responsible for the micro-level household decisions to apply and participate in the program, with macro-level economic conditions and community influences also playing a role (Dickert-Conlin & Fitzpatrick, 2020; Ganong & Liebman, 2013; Ziliak, 2013).[1]

[1] State-level SNAP policies refer to discretionary exemptions granted when state agencies petition for specific federal SNAP program requirements to be waived by the USDA Food and Nutrition Service (FNS), the federal-level

Nonetheless, research has shown SNAP participation is under-reported in U.S. Census self-reported survey response data by 46 percent and in microsimulations of U.S. Census data by 36 percent (Stevens, Fox, & Heggeness, 2018). As a result, there are studies that seek to overcome survey reporting bias by analyzing SNAP administrative data from states' SNAP caseload records (Bitler, Cook, & Rothbaum, 2021; Edwards, Heflin, Mueser, Porter, & Weber, 2016; Kang & Moffitt, 2019; Newman & Scherpf, 2013). Although our analysis utilizes state SNAP administrative data, it differs from these previous studies in that we explore not just the participation rate (i.e. approved applications), but also the various options for case status throughout the application process (i.e. submitted, approved, and denied applications).

We also follow similar applied studies that analyze SNAP participation across two statistical relationships: (1) household predictors at the micro-level (Newman & Scherpf, 2013; Swann, 2017; Ziliak, 2013) and (2) the economic and community predictors at the macro-level (Currie, Grogger, Burtless, & Schoeni, 2001; Ganong & Liebman, 2013; Klerman & Danielson, 2015). We believe that distinguishing these micro- and macro-level predictors of SNAP application and participation will highlight opportunities for SNAP policy to be more effective in expanding accessibility and eligibility to close the gap in participation and food insecurity.

We utilize data from Indiana's administrator of SNAP benefits, Family Social Services Administration (FSSA), to examine food-insecure SNAP applicants, particularly those households that have been denied SNAP benefits. Given that the Indiana SNAP participation rate was considerably lower than the national average at 74 percent (Cunnyngham, 2020), we

administrator of SNAP. These exemptions, often referred to as waivers or flexibilities, ease program restrictions and may extend SNAP eligibility to households ineligible for benefits under federal guidelines.

examine micro-level household characteristics and macro-level socioeconomic influences for a portion of Indiana residents who likely qualify for SNAP but do not participate in the program. Among households that have submitted a SNAP application in Indiana, we utilize aggregated SNAP administrative data from FSSA in conjunction with U.S. Census socioeconomic and demographic data, both at the census-tract level, to quantitatively answer the following questions:

1. What are characteristics of Indiana households and their communities that have applied for SNAP benefits?
2. What share of those who apply for SNAP is denied benefits?
3. What are characteristics of Indiana households and their communities that have been denied SNAP benefits?

Our empirical application uses both linear and quantile regression analysis to understand the micro-level household characteristics and macro-level community influences that are correlated with the variation in SNAP case status, particularly submitted applications and denied applications. Our study is unique in that it examines how a state's SNAP participation rate and denial rate are correlated at the micro-level given the household's decision to complete the full application process, in addition to the macro-level given the local socioeconomic conditions that may lead to poverty and food insecurity.

Our results ultimately show that broader socioeconomic trends in a community are better predictors for SNAP application submissions while applicants' own set of personal circumstances are better predictors for SNAP denial rates. Thus, the final outcome of SNAP participation rests largely on the household's own characteristics during the SNAP application process, particularly net monthly income, time in application process, employment status,

disability status, citizenship status, and whether they are considered an able-bodied adult without dependents (ABAWD).

2 BACKGROUND

Food insecurity is highly correlated with poverty (Coleman-Jensen, Rabbitt, Gregory, & Singh, 2018). As of 2018, households with incomes below 185 percent of poverty guidelines comprised 54.5 percent of food insecure households in the United States (Coleman Jensen, Rabbitt, Gregory, & Singh, 2019). Fortunately, participation in SNAP has been shown to reduce the likelihood of being food insecure by nearly one-third (Ratcliffe, McKernan, & Zhang, 2011; Swann, 2017).

SNAP is a federal benefits program, administered by the U.S. Department of Agriculture (USDA), designed to increase the purchasing power of low-income households that are threatened by food insecurity. SNAP provides eligible households with monthly benefits to purchase unprepared food, edible plants, and seeds at authorized retailers, including supermarkets, farmer's markets, and farm stands. Studies have shown that SNAP-participating households increase their food expenditures beyond their benefits, which has implications for improved health and nutrition (Beatty & Tuttle, 2015; Keith-Jennings, Llobrera, & Dean, 2019; Kim, 2016).

Policymakers, practitioners, and researchers are interested in the ever-changing dynamics of SNAP participation and non-participation. Pinard et al. (2017) conducted a review of both peer-reviewed literature and research reports on the influences of SNAP participation across micro- and macro-level approaches of socioecological framework models. Micro-level approaches focused on household characteristics of SNAP participation while macro-level approaches

explored local, state, and federal influences of participation. The authors find that micro-level approaches generally indicated that SNAP participation is positively associated with single parent households, children in the household, individuals with disabilities, and lower levels of education. Macro-level approaches typically indicated that SNAP participation is positively associated with higher unemployment and poverty rates, broad-based categorical eligibility standards (to allow for less restrictive income and asset tests), and increased SNAP outreach.

There is limited research, however, that examines submitted and denied SNAP applications at any level of analysis despite the presence of a plethora of research on approved applications for participating households. Dickert-Conlin et al. (2012) studied county-level submitted, approved, and denied SNAP applications as the result of a large-scale radio outreach campaign to encourage SNAP participation among eligible, non-participating households. The study's application data came from nine states (not including Indiana). The results showed that although both submitted applications and approved applications were positively correlated with radio outreach, so were denied applications. Additionally, Kogan (2017) examined the relationship between county-level SNAP participation and denial rates in ten states (including Indiana) and local public opinion of income redistribution programs like SNAP and found that the program participation rate was positively associated with support for income redistribution in local public opinion while the denial rate was negatively associated with support for income redistribution.

2.1 Micro-level Conditions: Household Characteristics

Although states have flexibilities in certain aspects of administering the SNAP program, the means test for SNAP eligibility and benefit levels is largely decided at the federal level and uniform across the United States (CBPP, 2019). Nationally, SNAP has two income limits: gross

and net income. In Indiana, most households must meet both the gross and net income limits to qualify for SNAP (FSSA, 2021). Gross income is a household's total income before taxes or deductions. Net income is gross income less certain allowable deductions, including housing costs, child support payments, child-care payments, self-employment expenses, etc. If anyone in a household receives Temporary Assistance for Needy Families (TANF) or Supplemental Security Income (SSI), income limits do not apply. Additionally, in the state of Indiana, households are limited to $5,000 in assets in order to qualify for SNAP benefits, but this does not include the household's primary residence, personal belongings, and life insurance policies (FSSA, 2021).

Research has shown SNAP-participating households have lower income and asset levels than non-participating households, which allows them to meet the means test of income and asset limits to participate in the program (Bartlett, Burstein, & Hamilton, 2004). Additionally, studies have found a relationship between the use of SNAP and the use of other federal assistance, including TANF, SSI, Earned-Income Tax Credit (EITC), Medicaid, etc. It has been found that a decrease in the use of TANF benefits is associated with an increase in the use of SNAP and SSI nationally (Parolin & Luigjes, 2019). In a study of Wisconsin households, the use of TANF was associated with higher use of other federal assistance programs compared to the use of SNAP (Cancian, Han, & Noyes, 2014).

As it pertains to other micro-level characteristics beyond income, assets, and deductions, studies have shown similar trends in demographic characteristics of SNAP participants. Researchers have found that households with children experience food insecurity at rates higher than the national average, particularly households with children under six years old (Coleman-Jensen, Rabbitt, Gregory, & Singh, 2018). Households with higher numbers of children and lower

numbers of adults are associated with increased SNAP participation (Ratcliffe, McKernan, & Zhang, 2011). Vigil (2019) found a 15 percent increase in the rate of SNAP participation among households with young children between 2010 and 2017 given that SNAP participation among children had been historically high. Conversely, the change in participation rate of citizen children living with non-citizen adults did not experience a statistically significant increase during the same time period, and non-citizens are associated with lower SNAP participation in general (Ratcliffe, McKernan, & Zhang, 2011).

Studies have also found that Black and Hispanic households are more likely to participate in SNAP, as are households with a member with a disability (Ratcliffe, McKernan, & Zhang, 2011). One can argue that this is likely a function of racism and ableism that is pervasive in U.S. society disadvantaging these households (Massey & Denton, 1993; Wilson, 2012). People with disabilities are more likely to participate in SNAP after exiting employment (Brucker, 2018), and individuals with poor overall physical health and multiple chronic conditions are less likely to enroll in SNAP without also being enrolled in Medicaid (Meyerhoefer & Pylypchuk, 2014).

2.2 Macro-level Conditions: Economic, Policy, and Community Influence

SNAP participation among low-income households has been found to be highly influenced by broader economic conditions (Andrews & Smallwood, 2012; Hanson & Oliveira, 2012). Macro-level economic conditions between 2007-2011 played a significant role in an increase in state SNAP participation rates, but less so between 2000-2007 (Klerman & Danielson, 2015). Average monthly participation in SNAP peaked in 2013 with the 2009 American Recovery and Reinvestment Act that provided a temporary increase in SNAP benefits from 2009 to 2013, and

the SNAP program then saw declines in the participation rate and benefits spending between 2013-2018 (Rosenbaum & Keith-Jennings, 2019).

In addition to state-level economic conditions, SNAP participation is largely associated with differing food and cash assistance policies in each state (Dickert-Conlin & Fitzpatrick, 2020; Edmiston, 2018; Klerman & Danielson, 2011). Studies have found that SNAP participation, in addition to being sensitive to income-based household eligibility due to macro-economic conditions, can also be attributed to changing eligibility policies of federal and state government (Edmiston, 2018; Ganong & Liebman, 2013).

In recent years, the federal and state governments have made policy changes that expand SNAP accessibility, eligibility, and benefit levels. These policy changes include relaxing asset limits, allowing categorical eligibility based on the use of other federal benefits programs (e.g. TANF, SSI, etc.), and offering increased shelter and earnings deductions (Alison Aussenberg, 2014). Nonetheless, the SNAP application is still considered arduous to complete, particularly in states without a streamlined process (Cohen, 2019; Hammond, Li, McKinnon, & Munoz, 2020). Certain states use broad-based categorial eligibility to streamline the SNAP application process, which allows households to become categorically eligible for SNAP because they qualify for a non-cash TANF or various state-funded benefits (USDA FNS, 2020). The motivation of the policy is to promote saving among low-income households and reduce the state's administrative burden (Dean, Pawling, & Rosenbaum, 2008; Sprague & Black, 2012).

Beyond broad-based categorical eligibility, there are a variety discretionary exemptions through flexibilities and waivers available that allow states to tailor other SNAP program requirements to their residents. Waivers offer the opportunity for state and county SNAP administrators to expand eligibility and accessibility to the program, which assists food insecure households in

overcoming the barriers to successful application. State-level SNAP policies generally encompass waivers of federal SNAP regulation that allow states to adapt the federal program to their own needs, populations, and economies. Waivers allow for more effective and efficient administration of the program across geographies (USDA FNS, 2021). As a result, studies have found that differences in state-level policies on accessibility, eligibility, and SNAP benefits levels through discretionary exemptions and outreach marketing result in varying participation rates across states (Cuffey, Beatty, & Mykerezi, 2021; Klerman & Danielson, 2011; Todd, Jo, & Boohaker, 2019).

One example of an often-waived federal SNAP regulation is USDA's two sets of work requirements for participation: (1) If you are between 16-59 years old you must meet general work requirements[2], and (2) If you are between 18-49 years old, able to work, and do not have dependents you are considered an Able Bodied Adult Without Dependents (ABAWD) and subject to additional work requirements (USDA FNS, 2019). The waiver of work requirements for SNAP participation has been shown to increase SNAP participation in Virginia (Gray, Leive, Prager, Pukelis, & Zaki, 2021). A study by Harris (2021) showed that work requirements can increase employment among ABAWDs but reduce their SNAP participation.

Policy analysis shows that the social climate and community influences also affect SNAP participation and non-participation, including for "eligible-but-not-enrolled" households that may be challenged by stigma or fear of government agencies (Cohen, 2019). Generally, these

[2] General work requirements include not voluntarily quitting a job or reducing work hours if employed, registering for work if unemployed, taking a job if offered, or participating in an employment and training program if assigned by the state SNAP agency (USDA FNS, 2019).

non-participating households have food insecurity rates (23.4 percent) lower than participating households (50.1 percent) as of 2017 (Coleman-Jensen, Rabbitt, Gregory, & Singh, 2018).

Nevertheless, researchers argue that in considering the declining use of other federal benefit programs like TANF, SNAP has become an automatic fiscal stabilizer to provide expeditious benefits to an increasingly number of eligible households during economic downturns, particularly following recessions (Edmiston, 2018; Hanson, 2010; Vogel, Miller, & Ralston, 2021; Ziliak, 2013). In certain instances, overall SNAP participation has also been shown to increase economic activity and employment nationwide (Hanson, 2010), and particularly increase employment in rural areas as a result of the increase in demand for agricultural and food products (Vogel, Miller, & Ralston, 2021; Weerasooriya & Reimer, 2020).

2.3 SNAP Administration in Indiana

Indiana is considered one of the more conservative states in the administration of SNAP benefits (Dickert-Conlin & Fitzpatrick, 2020). It limits SNAP eligibility to households with gross income at or below 130 percent of federal poverty guidelines, if no member of the household is elderly or disabled (Alison Aussenberg & Falk, 2019). As of 2019, Indiana was one of eight states to use this most restrictive gross income limit for SNAP eligibility. This income limit contrasts with states like Illinois that allow households to be at or below 165 percent of the poverty or states like Michigan that allow households to be at or below 200 percent of poverty.

Indiana also uses a restricted form of broad-based categorical eligibility that otherwise allows for SNAP applicants who receive TANF, SSI, or general assistance to be automatically eligible for SNAP benefits without passing income and assets tests (Alison Aussenberg & Falk, 2019).

Indiana is one of few states that restrict broad-based categorical eligibility by instituting an asset limit. Indiana has, however, allowed for an increase in the asset limit, which has been found to remedy the disincentive to save among SNAP-participating households (Todd, Jo, & Boohaker, 2019). In January 2018, Indiana's Family & Social Services Administration (FSSA) increased asset limits to $5,000 for countable assets in bank accounts, cash, real estate, etc. (FSSA, 2021). Prior to this increase, the asset limit was $2,250 for most households and $3,500 for households with a member with a disability or over 60 years old.

Eligibility limitations further shape SNAP participation in Indiana. Until January 2020, Indiana had a lifetime ban on individuals with drug felonies receiving SNAP benefits, which is currently waived for individuals who are complaint with parole or not subject to parole (FSSA, 2022). As of 2021, Indiana requires that applicants between 16-59 years old, who are not physically or mentally impaired or taking care of a child under 6 years old, meet work requirements or participate in an approved job training program, such as the Indiana Manpower Placement and Comprehensive Training (IMPACT) job training program (FSSA, 2018). There is a specific category of applicant that is considered an able-bodied adult without dependents (ABAWD) if they are between 16-49 years old and do not have dependents (of any age). In Indiana and other states that do not have discretionary exemptions for ABAWDs, applicants classified as ABAWDs are required to work an average of 20 hours per week or at least 80 hours per month and/or take part in an approved job training program. Regarding applicants with ABAWD status, Indiana is considered a conservative state that can be perceived as restricting SNAP accessibility, eligibility, and outreach by not applying waivers or simplifying SNAP enrollment in the ways other states have. Indiana waived the work requirements for SNAP participation during the Great Recession of 2009, but reimposed work requirements for ABAWDs in July 2015 and limited

these individuals to three months of SNAP benefits every 36 months unless they complied with work requirements (as is the case in many states). During the COVID-19 pandemic, Indiana was generous in applying to SNAP waivers and issued emergency allotments, extended certification periods, allowed phone interviews to screen applicants, provided pandemic EBT to school-aged children, and piloted an online SNAP purchasing program.

3 METHODOLOGY

It is important to note that denied applicants are not always ineligible non-participants. A portion of our broader research study also includes qualitative analysis of variations in SNAP case status in Indiana. Our qualitative research finds that applicants can be denied for reasons beyond the means tests of income, assets, and deductions.

In a series of focus groups with SNAP caseworkers representing 25 of Indiana's 92 counties, caseworkers shared that although the initial application process can be completed online, paperwork (required via in-person delivery, U.S. mail, or fax) not provided is as common a reason for benefit denials. According to caseworkers, applicants are commonly denied benefits because they do not provide the paperwork required to support their application, including pay stubs, other proof of income, child support, and bank statements by the federally mandated 30-day deadline to complete the application process. Otherwise, applicants are denied because they are over income or asset limits, making them ineligible, or because they miss the mandatory phone interview and do not reschedule.

During additional qualitative research, Indiana households that have applied for SNAP benefits confirmed these three main reasons for denials. We conducted a series of interviews and focus

groups with 120 households across the state of Indiana in 2021, and paperwork was the most common theme. In Indiana, SNAP applicants must submit their paperwork by fax, U.S. mail, or in-person delivery to a Division of Family Resources (DFR) office. Households describe a myriad of barriers to obtaining and submitting documents, including transportation, postage costs, lack of printers and fax machines, and working during DFR office hours. Some households recounted stories of submitting paperwork, only to hear from caseworkers that the documents were never received.

Aside from paperwork and failing the means test, applicants also shared their struggles to complete the mandatory phone interview. Interview times are scheduled by the DFR office, and applicants are notified of the appointment with a mailed letter. Often, applicants are working or otherwise unavailable during the scheduled interview time, and sometimes they do not receive the letter before the interview appointment. Households and caseworkers both described a common issue of the caseworkers' phone call being blocked by the household's cellular phone's spam filter. Households also recounted the frustrating experience of waiting by their phone during the appointment time, only to never receive a call.

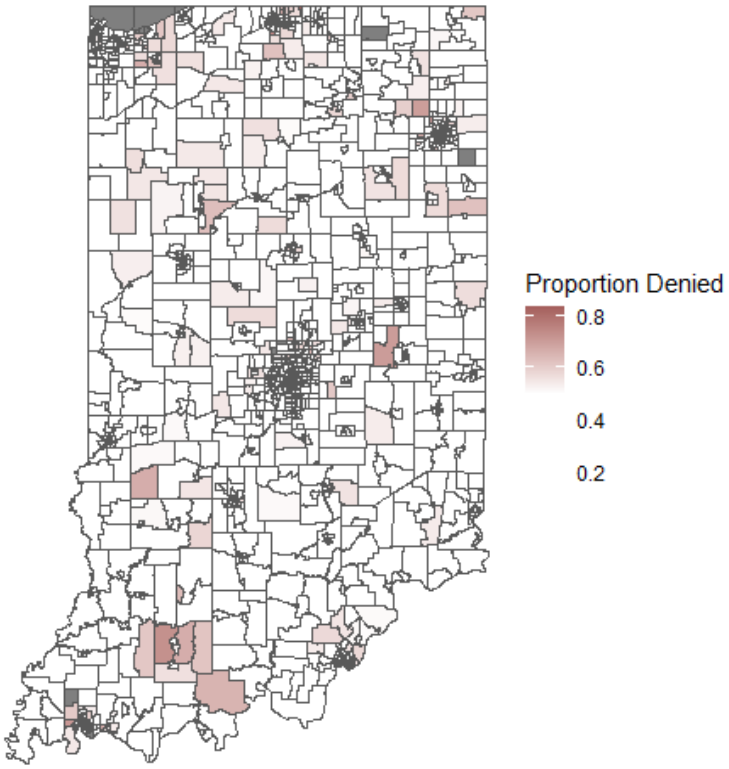
These findings from our focus group discussions across Indiana, in combination with reviewed literature on SNAP case load variation across the United States, have led to our empirical analysis that seeks to understand potentially uneven variation in a household's decision to apply to SNAP benefits and the state SNAP administrator's decision to deny SNAP benefits.

3.1 Data

We have two primary sources of census-tract level data which define our micro-level analysis with administrative data from FSSA case load records and define our macro-level analysis with primarily U.S. Census data. Micro-level analysis includes data on household characteristics of SNAP applicants that is available in FSSA administrative records. It is important to note that the data used in micro-level analysis was provided by FSSA pre-aggregated by census tract but is exclusively for households that have applied for SNAP benefits. Macro-level analysis includes data on economic, policy, and community influences provided by the U.S. Census, USDA Economic Research Service, and Gleaners Food Bank. The data used in the macro-level analysis reflects the broader economy and community within each census tract.

Analysis of state administrative data for all case statuses provides the true number of households applying to SNAP in Indiana (submitted), as well as the number of Indiana households accepted to participate in the SNAP program (approved) and the number of Indiana households that are not accepted to participate (denied). Figure 1 illustrates the geographical distribution of the proportion of denied SNAP applications across Indiana, focusing on census tracts with denial rates above 50 percent.

Figure 1. Indiana Census Tracts with Majority of SNAP Applications Denied (2017-2019)



Source: FSSA (2021)

An important initial consideration is how we define our dependent variables, because FSSA shared administrative data at the census-tract level and not the individual-household level. Based on analysis by Dickert-Conlin (2012), we examine two dependent variables regarding SNAP case status: (1) all submitted applications per capita (based on 2018 U.S. Census population estimates) and (2) the proportion of denied applications. Our focus on these two dependent variables adds to the relevant literature that has already thoroughly examined approved SNAP applications, which existing literature has often analyzed as the SNAP "caseload" or "participation" rate, but without considering submitted and denied applications.

3.1.1 Micro-level Analysis of Administrative Data

We develop four econometric models in which we use both the per capita submitted applications and the share of applications denied as the dependent variables. We explore the relationship between each of these variables and a variety of micro-level explanatory variables that describe the socioeconomic, demographic, and program participation of the households within each census tract. We base this on studies of micro-level analysis of SNAP participation that includes income, assets, unemployment, other federal assistance benefits, number of children in the household, disability, and citizenship status in addition to conventional demographic characteristics such as age, race, gender, educational attainment, and employment status.

Our analysis includes as many micro-level explanatory variables used in previous studies as were made available in FSSA's administrative data. The data include monthly census-tract level aggregation of SNAP applicants between January 2017 and December 2019. The data are categorized by the applications' final case status: approved or denied. The data also include household characteristics about the tract's SNAP applicants.

Table 1 shows descriptive statistics for select household characteristics, comparing submitted application, approved applications, and denied applications, aggregated for the months between 2017- 2019. Indiana's SNAP applications are renewed every 12 months. As a result, we see that even denied applications can be from households that previously received benefits, as seen by denied applications receiving $73 of SNAP benefits monthly on average. The descriptive table includes a comparison of median with interquartile range (IQR) and mean with standard deviation to better summarize the data available.

Table 1. Micro-level Descriptive Statistics of Census Tracts (2017-2019), by Application Status

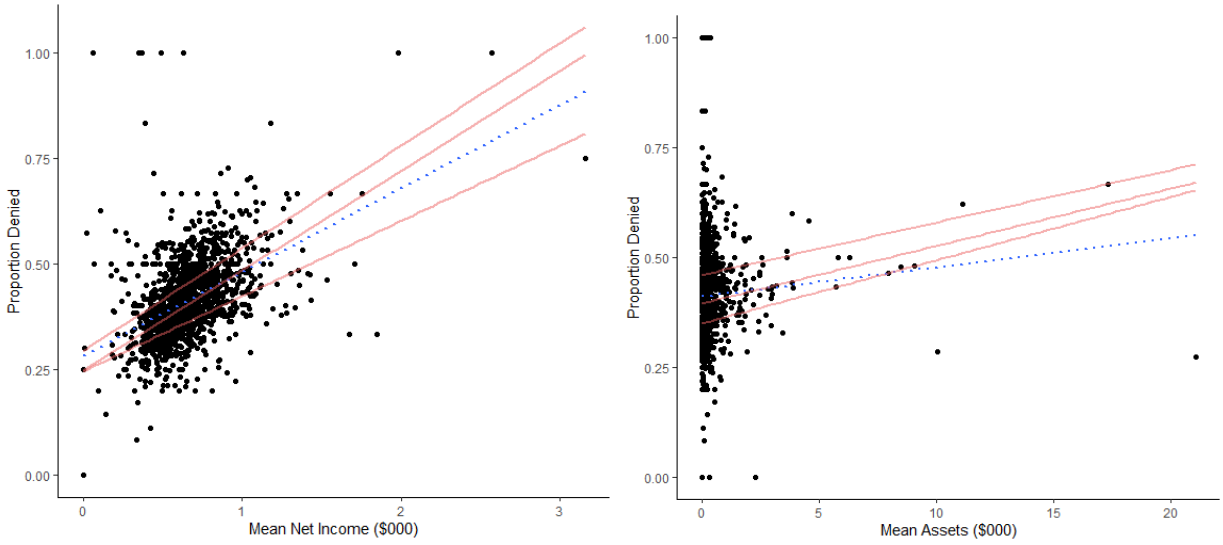
Micro-level Characteristic	Submitted	Denied	Approved	p-value*
Per capita applications (000)				<0.001
Median (IQR)	8 (4, 19)	7 (4, 15)	10 (5, 23)	
Mean (SD)	15 (20)	12 (15)	19 (24)	
Mean monthly SNAP benefit ($)				<0.001
Median (IQR)	182 (71, 339)	71 (47, 94)	339 (305, 371)	
Mean (SD)	205 (142)	73 (42)	338 (59)	
Mean net monthly income ($000)				<0.001
Median (IQR)	0.62 (0.35, 1.04)	1.04 (0.84, 1.23)	0.36 (0.28, 0.45)	
Mean (SD)	0.72 (0.44)	1.06 (0.35)	0.37 (0.16)	
Mean assets ($000)				<0.001
Median (IQR)	0.12 (0.05, 0.25)	0.16 (0.07, 0.35)	0.09 (0.05, 0.17)	
Mean (SD)	0.37 (1.47)	0.52 (1.90)	0.23 (0.81)	
Mean months in certification				<0.001
Median (IQR)	0.67 (0.43, 0.85)	0.84 (0.78, 0.90)	0.43 (0.37, 0.51)	
Mean (SD)	0.64 (0.24)	0.84 (0.12)	0.45 (0.14)	
Mean adults in household				<0.001
Median (IQR)	1.20 (1.10, 1.35)	1.27 (1.13, 1.43)	1.16 (1.08, 1.27)	
Mean (SD)	1.24 (0.23)	1.29 (0.26)	1.19 (0.17)	
Mean children in household				<0.001
Median (IQR)	1.79 (1.53, 2.06)	1.76 (1.50, 2.03)	1.83 (1.55, 2.10)	
Mean (SD)	1.81 (0.48)	1.79 (0.48)	1.84 (0.48)	
Share unemployed				<0.001
Median (IQR)	0.53 (0.41, 0.63)	0.43 (0.35, 0.53)	0.60 (0.53, 0.68)	
Mean (SD)	0.52 (0.16)	0.44 (0.16)	0.60 (0.13)	
Share disability without SSI				<0.001
Median (IQR)	0.60 (0.22, 0.92)	0.22 (0.16, 0.28)	0.92 (0.88, 0.96)	
Mean (SD)	0.56 (0.36)	0.22 (0.11)	0.91 (0.08)	
Share ABAWD on IMPACT				<0.001
Median (IQR)	0.000 (0.000, 0.025)	0.000 (0.000, 0.000)	0.022 (0.000, 0.042)	
Mean (SD)	0.016 (0.034)	0.004 (0.012)	0.028 (0.044)	
Share White				0.054
Median (IQR)	0.78 (0.44, 0.96)	0.79 (0.46, 0.97)	0.76 (0.42, 0.96)	
Mean (SD)	0.68 (0.32)	0.69 (0.32)	0.67 (0.32)	
Share citizen				<0.001
Median (IQR)	1.00 (0.96, 1.00)	1.00 (0.97, 1.00)	1.00 (0.96, 1.00)	
Mean (SD)	0.97 (0.07)	0.97 (0.07)	0.96 (0.08)	

* Wilcoxon rank sum test, which ranks all the observations from both groups, sums the ranks, and compares both rank sums to an expected rank sum. It is possible for groups to have different rank sums and equal medians (UCLA Advanced Research Computing, 2022), as in the case of "share citizen."

Source: FSSA (2021)

In this time period, 160,043 SNAP applications were associated with 1,499 of 1,511 census tracts in Indiana. Descriptive analysis shows that 38.8 percent of these submitted applications were denied (62,128 applications). Regarding the means test for SNAP eligibility, net monthly income and assets were found to be significantly higher for households that were denied benefits. Figure 2 shows both the relationship between the proportion of SNAP application denials and household net monthly income as well as the relationship between the proportion of SNAP denials and household assets, given that net income and asset limits are central to SNAP eligibility. We demonstrate the positive relationship between the proportion of denials and net income and assets between 2017-2019. We also note the differences between the 25th, 50th, and 75th percentiles illustrated by the red solid trend lines compared to the mean illustrated by the dotted blue trend line.

Figure 2. Proportion of Denied Applications in Relation to Means-tested Net Monthly Income and Total Assets (2017-2019)



Source: FSSA (2021)

For reference, an Indiana household with three members can have a net monthly income up to $1,830 and assets up to $5,000 and qualify for SNAP benefits in most cases. Using an average household size of three, we see that denied applications would largely have net monthly income and assets below this eligibility threshold which would qualify them for SNAP benefits. Therefore, we seek to explore other micro-level household characteristics and macro-level economic and community influences beyond the conventional means test that may predict SNAP application and participation.

3.1.2 Macro-level Analysis of U.S. Census and Other Data

Coleman-Jensen et al. (2018) found that households with children or headed by a Black or Hispanic individual experience food insecurity at rates higher than the national average. Additionally, households headed by single women or with income below 185 percent of the poverty line were associated with very low food security compared to the national average (Coleman Jensen, Rabbitt, Gregory, & Singh, 2019). Therefore, we include these variables in our macro-level models to better understand the dynamics of social demographics that may lead to community influence among potential applicants in a neighborhood.

At the macro-level, we replace FSSA administrative data with census-tract level U.S. Census data to account for broader economic and community trends, including single parent households, education level, population of elderly, and ethnicity. We include census tract-level poverty rates for children five years old and younger. We also include macro-level socioeconomic variables that would impact a household's ability to apply to SNAP, including private vehicle, computer,

and phone ownership. Edmiston (2018) found that SNAP participation does not peak until months after unemployment peaks, given that households must exhaust their financial resources to be eligible for the program. Therefore, we examine 2018 unemployment as well.

In an effort to explore increased outreach, we include the efforts of Gleaners Food Bank of Central Indiana that conducts SNAP outreach across 21 counties in Central Indiana, which encompassed the 2017-19 years of our analysis. Gleaners' SNAP outreach is largely funded by FSSA and includes Gleaners staff connecting to potential SNAP applicants through its food bank, food pantry, and mobile food pantry operations. Gleaners provides education about SNAP policies and benefits, pre-screening to determine if households may be eligible for SNAP benefits, and over-the-phone or in-person SNAP application assistance. We include an indicator variable to identify whether Gleaners conducted outreach in a census tract.

The U.S. Census American Community Survey data (2021) used to explore macro-level characteristics of the SNAP applicants and non-participants in Indiana is seen in Table 2. The macro-level descriptive statistics include a comparison of median with interquartile range (IQR) and mean with standard deviation to better summarize the data available for macro-level variables. We also note that 30 percent of Indiana census tracts are served with SNAP outreach by Gleaners Food Bank of Central Indiana (2020) and 3.7 percent of census tracts are classified as completely rural, non-metro adjacent, by the 2013 USDA Economic Research Service's Rural-Urban Continuum Codes (2020), both of which are controlled for in the models.

Table 2. Macro-level Descriptive Statistics of Indiana Census Tracts (2017-2019)

Macro-Level Characteristic	Summary
Median household income ($000)	
Median (IQR)	52 (39, 64)
Mean (SD)	54 (21)
Share population White	
Median (IQR)	0.91 (0.78, 0.96)
Mean (SD)	0.82 (0.22)
Share population Hispanic	
Median (IQR)	0.04 (0.02, 0.08)
Mean (SD)	0.07 (0.09)
Share foreign born	
Median (IQR)	0.03 (0.01, 0.06)
Mean (SD)	0.05 (0.06)
Share children under 5yo in poverty	
Median (IQR)	0.18 (0.05, 0.36)
Mean (SD)	0.23 (0.22)
Share population over 60yo	
Median (IQR)	0.22 (0.17, 0.26)
Mean (SD)	0.22 (0.07)
Share female household head	
Median (IQR)	0.16 (0.09, 0.31)
Mean (SD)	0.24 (0.23)
Share less than HS	
Median (IQR)	0.06 (0.04, 0.08)
Mean (SD)	0.06 (0.04)
Share unemployment	
Median (IQR)	0.032 (0.021, 0.048)
Mean (SD)	0.038 (0.025)
Share no vehicle	
Median (IQR)	0.05 (0.02, 0.10)
Mean (SD)	0.08 (0.08)
Share no computer	
Median (IQR)	0.13 (0.09, 0.18)
Mean (SD)	0.14 (0.08)
Share phone service	
Median (IQR)	0.981 (0.968, 0.990)
Mean (SD)	0.975 (0.028)
Share SNAP participation	
Median (IQR)	0.10 (0.05, 0.17)
Mean (SD)	0.13 (0.11)
Population (000)	
Median (IQR)	3.98 (2.96, 5.40)
Mean (SD)	4.40 (2.24)

Source: U.S. Census (2021)

4 EMPIRICAL APPLICATION

In an effort to understand how micro- and macro-level characteristics are associated with success in Indiana's SNAP application process, we develop a set of models for two dependent variables: (1) the log of all SNAP applications per 1,000 census-tract residents in 2018 (U.S. Census , 2021), and (2) the share of denied applications. The share of denied SNAP applications is calculated as the number of denied SNAP applications in a census tract of all SNAP applications in the same tract between 2017-2019.

We explore two different sets of analysis based on previous literatures' examination of submitted, approved, and denied SNAP applications. The first set of analyses is based on micro-level indicators derived from FSSA administrative data of households in most Indiana census tracts. The second set of analyses is based on macro-level socioeconomic indicators, primarily derived from U.S. Census data (Klerman & Danielson, 2011; Klerman & Danielson, 2015).

Studies of SNAP participation often examine binary program participation or they relate participants' characteristics to those of eligible non-participants, often using various publicly available data sources, including the Current Population Survey, Survey of Income and Program Participation, National Health Interview Survey, National Health and Nutrition Examination Survey, etc. (Gregory, Rabbitt, & Ribar, 2013; Kang & Moffitt, 2019). These researchers and others have examined the instances where simultaneity bias exists between SNAP participation and the host of financial hardships that lead to food insecurity, caused by the fact that financial hardship and SNAP participation and may be jointly determined or influencing each other (Han, 2016; Joyce, et al., 2012; Shaefer & Guiterrez, 2011). We will explore the potential for correlation between submitted and denied applications with micro-level and macro-level

characteristics using two statistical approaches, where a linear regression approach provides validation to conduct a quantile regression approach. The linear models each provide some degree of explanatory power to warrant additional analysis of the distributional variation in SNAP application and denial rates using quantile regression analysis.

4.1 Linear Model

In our linear regression analysis, we explore simple relationships between our outcome variables and the micro-level and macro-level predictor variables.

$$Y_c = x_c'\beta + \varepsilon_c$$

Y_c is the outcome variables, such as the log of SNAP applications per capita and the SNAP application denial rate for census tract c, and x_c is a vector of explanatory variables aggregated at the census-tract level. β are estimated coefficients. ε is the random disturbance associated with each census tract.

4.2. Quantile Model

Quantile regression analysis is a useful analysis technique when least squares can be severely distorted by outliers (Greene, 2008). This is indeed the case for the variable that represents per capita SNAP applications, where certain sparsely populated census tracts have relatively high SNAP applications per capita. In order to overcome these distortions, robust estimators that are unaffected by outliers have been developed to minimize the sum of absolute deviances. The quantile regression uses linear programming to solve for the following equation:

$$Y_c = x_c'\beta_q + \varepsilon_{q_c}$$

Y_c is the outcome variable at each quantile of interest, q. x_c is a vector of explanatory variables, including census-tract level aggregates of certain variables in our micro-level analysis. β_q are estimated coefficients for each quantile of interest, q. ε is the random disturbance at each quantile associated with each census tract.

Quantile regression allows us to stabilize variance of heteroskedastic data with a technique more than a monotone transformation, such as log transformation (Rodriguez & Yao, 2017); as seen with our previous use of Y_c in the dependent variable *log of per capita applications* in the linear model. Although the log transformation corrects for non-normality in the residuals of our dependent variable, given the model we have chosen it does not correct for the "outliers." That is, we still find outlying census tracts with observed values considerably different than would be predicted by the model. It is important to note that we have chosen quantile regression model because it uses general linear models to fit quantiles without making assumptions about the distribution of the dependent variable or its residuals.

Our analysis of conditional quantile regression is most similar to previous literature on wages (Angrist, Chernozhukov, & Fernandex-Val, 2006; Buchinsky, 1994), education (Costanzo & Desimoni, 2017; Eide & Showalter, 1998), and food economics (Cheah, Abdul Adzis, Abu Bakar, & Applanaidu, 2021; Iddrisu & Alagidede, 2020). We do not pursue unconditional quantile regression as developed by Firpo, Fortin, and Lemieux (2009) with the understanding we are interested in the conditionality of the SNAP means test which includes net income and asset limits that influence application submissions and the success of those submissions. Therefore, we express our original research questions as what are the typical characteristics of

Indiana households and their communities that submit SNAP applications and are denied SNAP benefits as a function of the means test variables: net income and assets.

5 RESULTS

5.1 Micro-level Analysis Results

In Table 3, the quantile analysis of micro-level independent variables shows differences in the results of the linear model (also known as ordinary least squares or OLS) and the quantile model's analysis of low (25 percentile), medium (50 percentile), and high (75 percentile) values of the outcome variables, which are shown to be statistically different in a joint test of equality. In the quantile model of the log of SNAP application submissions, we find that communities with low and medium submission rates largely have a similar profile of predictors, while communities with high submission rates differ in that they are also influenced by unemployment, but not assets or adults in the household. We find that both net income and assets are negatively correlated with low and medium submission rates. In communities with high submission rates, we find net income to be more influential compared to low submission rates, but that assets are not statistically significant. The number of adults in the household has a statistically significant influence on low and medium submission rates. In communities with high submission rates, unemployed applicants are positively associated with submission rates. The influence of applicants with a disability and not receiving SSI is more influential for low submission rates. The influence of ABAWD applicants in the IMPACT program is less influential for medium submission rates than low or high submission rates. In our micro-level models, we do not include household income or federal benefits (i.e. TANF, SSI) to avoid endogeneity (Ziliak, 2013).

Table 3. Micro-level Model Results: Log of Per Capita SNAP Applications

	OLS	Quantile		
		Low (q=0.25)	Medium (q=0.50)	High (q=0.75)
Net income ($000)	-0.661 ***	-0.561 ***	-0.882 ***	-1.003 ***
	(0.158)	(0.143)	(0.096)	(0.102)
Assets ($000)	-0.090 ***	-0.096 *	-0.079 ***	-0.070
	(0.024)	(0.038)	(0.022)	(0.039)
Months in certification	-0.751 **	-0.796 ***	-0.723 ***	-0.756 ***
	(0.230)	(0.237)	(0.190)	(0.172)
Adults in household	0.254	0.526 **	0.296 *	-0.139
	(0.176)	(0.183)	(0.138)	(0.140)
Children in household	0.135	0.033	0.081	0.065
	(0.069)	(0.074)	(0.055)	(0.034)
Unemployed	-0.017	0.070	0.307	0.534 **
	(0.229)	(0.192)	(0.187)	(0.165)
Disability without SSI	1.140 ***	1.831 ***	0.993 ***	0.710 ***
	(0.284)	(0.282)	(0.286)	(0.190)
ABAWD on IMPACT	3.583 ***	5.472 ***	3.335 ***	5.982 ***
	(1.018)	(1.576)	(0.865)	(1.155)
White	-1.597 ***	-1.578 ***	-1.817 ***	-1.649 ***
	(0.093)	(0.161)	(0.084)	(0.062)
Citizen	1.011 **	1.061	0.753	-0.065
	(0.383)	(0.754)	(0.543)	(0.169)
N	1499	1499	1499	1499
R^2	0.304			
Pseudo R^2		0.114	0.223	0.305
logLik	-2001.939	-2240.975	-1951.456	-1893.092
AIC	4027.879	4503.949	3924.912	3808.184

*** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$.

We note that the micro-level independent variables are better predictors of the variation in denial rates than they are predictors for variation in SNAP application submissions, as seen by adjusted R^2 and pseudo R^2 values in Table 4. The quantile model is shown to be statistically different across the three quantiles in a joint test of equality. In this quantile model of the SNAP application denial rate, we find that communities with medium and high denial rates largely have a similar profile of predictors, while communities with low denial rates differ in that they are

also influenced by ABAWD applicants in job training and citizenship status. Among all levels of denial rates, net income is positively correlated with denial rates in the quantile analysis while assets are not a statistically significant factor in denial rates. We find the influence of time in the certification process is stronger for high denial rates. The proportion of White applicants in a community is more influential to tracts with medium and high denial rates. In communities with low denial rates, the share of applicants with ABAWD status and in the IMPACT program is associated with an increased denial rate. Additionally, citizenship is also influential to communities with low denial rates, where the increase in the proportion of citizens reduces denial rates in the low quantile.

Table 4. Micro-level Model Results: Proportion of Denied SNAP Applications

	OLS	Quantile		
		Low (q=0.25)	Medium (q=0.50)	High (q=0.75)
Net income ($000)	0.076 ***	0.040 ***	0.038 **	0.057 ***
	(0.011)	(0.010)	(0.012)	(0.015)
Assets ($000)	-0.002	-0.002	0.003	0.000
	(0.002)	(0.004)	(0.003)	(0.002)
Months in certification	0.125 ***	0.107 ***	0.141 ***	0.164 ***
	(0.016)	(0.015)	(0.015)	(0.020)
Adults in household	-0.041 ***	0.002	0.000	-0.010
	(0.012)	(0.011)	(0.011)	(0.015)
Children in household	0.003	0.000	0.002	-0.001
	(0.005)	(0.004)	(0.004)	(0.005)
Unemployed	-0.119 ***	-0.164 ***	-0.136 ***	-0.085 ***
	(0.016)	(0.013)	(0.013)	(0.018)
Disability without SSI	-0.590 ***	-0.603 ***	-0.655 ***	-0.710 ***
	(0.020)	(0.018)	(0.020)	(0.026)
ABAWD on IMPACT	0.074	0.118 *	-0.017	-0.054
	(0.070)	(0.057)	(0.056)	(0.117)
White	0.023 ***	0.009 *	0.015 **	0.022 **
	(0.006)	(0.004)	(0.005)	(0.007)
Citizen	-0.056 *	-0.057 ***	-0.015	-0.009
	(0.026)	(0.012)	(0.018)	(0.019)
N	1499	1499	1499	1499
R^2	0.590			
Pseudo R^2		0.381	0.413	0.433
logLik	2012.762	2137.497	2224.226	2048.464
AIC	-4001.524	-4252.994	-4426.452	-4074.929

*** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$.

5.2 Macro-level Analysis Results

The quantile analysis of macro-level independent variables in Table 5 does show differences from the linear model results and the quantile model's analysis of low (25 percentile), medium (50 percentile), and high (75 percentile) values of the outcome variables, which are shown to be statistically different in a joint test of equality. Unlike the micro-level analysis of applicant

characteristics, the macro-level independent variables are better predictors of the variation in SNAP application submission rates than they are predictors for variation in application denial rates, as seen by the adjusted R^2 of 0.755 and pseudo R^2 above 0.50.

Fortunately, we do find a positive association between high submission rates and the share of children 5 years old and younger living in poverty. The share of residents over 60 years old, however, is negatively associated with submission rates in medium and high quantiles. The lack of access to a private vehicle is associated with reduced submissions while access to a personal phone is associated with increased submissions. Gleaners Food Bank's SNAP outreach is positively associated with SNAP application submissions, with greater influence for high submission rates. Population and rurality are not influential at low submission rates, while associated with decreased submission rates for communities with medium and higher submission rates.

Table 5. Macro-level Model Results: Log Per Capita SNAP Applications

	OLS	Quantile		
		Low (q=0.25)	Medium (q=0.50)	High (q=0.75)
Median household income ($000)	-0.023 ***	-0.028 ***	-0.028 ***	-0.025 ***
	(0.001)	(0.001)	(0.001)	(0.001)
Share White	-1.114 ***	-1.091 ***	-1.080 ***	-1.189 ***
	(0.105)	(0.134)	(0.105)	(0.088)
Share Hispanic	0.927 ***	0.376	0.418	0.308
	(0.230)	(0.253)	(0.233)	(0.204)
Share foreign born	-1.854 ***	-0.712 *	-1.350 ***	-1.179 **
	(0.378)	(0.357)	(0.323)	(0.403)
Share under 5 yo in poverty	0.039	0.097	-0.070	0.189 *
	(0.095)	(0.099)	(0.090)	(0.079)
Share over 60 yo	0.277	-0.335	-0.957 ***	-1.315 ***
	(0.281)	(0.317)	(0.275)	(0.237)
Share female household head	0.008	0.125	-0.031	-0.142
	(0.110)	(0.127)	(0.094)	(0.085)
Less than HS education	1.479 *	1.332	2.019 ***	0.694
	(0.631)	(0.739)	(0.560)	(0.507)
Share 2018 unemployment	0.024 **	0.024 **	0.016 *	0.020 **
	(0.007)	(0.008)	(0.007)	(0.006)
Share no vehicle	-1.992 ***	-2.385 ***	-1.489 ***	-0.633 *
	(0.317)	(0.385)	(0.321)	(0.256)
Share no computer	0.325	0.463	-0.284	-0.367
	(0.310)	(0.305)	(0.291)	(0.246)
Share phone service	1.438 *	1.284 *	1.792 *	1.906 ***
	(0.674)	(0.654)	(0.704)	(0.385)
Share SNAP participation	0.032 ***	0.023 ***	0.024 ***	0.022 ***
	(0.003)	(0.003)	(0.003)	(0.002)
Gleaners outreach	0.329 ***	0.202 ***	0.260 ***	0.279 ***
	(0.034)	(0.037)	(0.034)	(0.035)
Population	-0.022 **	-0.009	-0.020 **	-0.029 ***
	(0.008)	(0.008)	(0.008)	(0.007)
Rural	-0.162 *	-0.102	-0.129 **	-0.208 ***
	(0.079)	(0.072)	(0.042)	(0.041)
N	1495	1495	1495	1495
R^2	0.755			
Pseudo R^2		0.519	0.553	0.583
logLik	-1203.396	-1324.644	-1123.260	-1123.872
AIC	2442.793	2683.288	2280.521	2281.745

*** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$.

Macro-level independent variables are not particularly strong predictors of the variation in application denial rates, as seen by the low adjusted R^2 and pseudo R^2 values in Table 6. The quantile model is shown to be statistically different across the three quantiles in a joint test of equality. Nonetheless, the quantile model shows the variation in statistical significance of certain independent variables in explaining the variation of SNAP application denial rates. Median household income is statistically significant in communities with medium and high denial rates. In communities with low denial rates, the share of foreign-born residents and access to a personal phone reduced denial rates while population size increased denial rates. The share of unemployment, less than high school education, and lack of access to a computer are associated with reduced denial rates in communities with high denial rates. Although counterintuitive, our focus group discussions revealed that, in severely resource-constrained communities, FSSA staff work diligently to support households through the application process. Gleaners outreach is associated with a reduction in denial rates in medium and high quantiles.

Table 6. Macro-level Model Results: Proportion of Denied SNAP Applications

	OLS	Quantile		
		Low (q=0.25)	Medium (q=0.50)	High (q=0.75)
Median household income ($000)	0.000	0.000	0.000 **	0.001 ***
	(0.000)	(0.000)	(0.000)	(0.000)
Share White	0.014	0.001	0.025 **	0.038 ***
	(0.018)	(0.009)	(0.009)	(0.011)
Share Hispanic	0.020	0.086 ***	0.074 **	0.011
	(0.039)	(0.022)	(0.029)	(0.025)
Share foreign born	0.022	-0.091 *	-0.028	0.063
	(0.064)	(0.047)	(0.056)	(0.048)
Share under 5 yo in poverty	0.016	0.004	0.003	-0.005
	(0.016)	(0.011)	(0.011)	(0.013)
Share over 60 yo	-0.063	0.010	0.018	-0.043
	(0.048)	(0.037)	(0.038)	(0.049)
Share female household head	0.003	-0.006	0.007	0.000
	(0.019)	(0.012)	(0.011)	(0.010)
Less than HS education	-0.015	0.015	-0.125	-0.190 *
	(0.107)	(0.076)	(0.068)	(0.074)
Share 2018 unemployment	-0.002	-0.001	0.000	-0.002 *
	(0.001)	(0.001)	(0.001)	(0.001)
Share no vehicle	0.043	-0.065	-0.028	0.024
	(0.054)	(0.035)	(0.038)	(0.039)
Share no computer	-0.105 *	-0.066	-0.033	-0.063 *
	(0.053)	(0.036)	(0.031)	(0.026)
Share phone service	-0.149	-0.240 **	-0.116	-0.115
	(0.114)	(0.078)	(0.107)	(0.083)
Share SNAP participation	-0.002 ***	-0.002 ***	-0.002 ***	-0.001 ***
	(0.001)	(0.000)	(0.000)	(0.000)
Gleaners outreach	-0.018 **	-0.001	-0.009 *	-0.025 ***
	(0.006)	(0.004)	(0.004)	(0.005)
Population	0.001	0.003 **	0.000	-0.002
	(0.001)	(0.001)	(0.001)	(0.001)
Rural	-0.011	-0.005	-0.020	0.013
	(0.013)	(0.012)	(0.021)	(0.015)
N	1495	1495	1495	1495
R^2	0.132			
Pseudo R^2		0.068	0.099	0.143
logLik	1450.912	1517.034	1574.452	1422.920
AIC	-2865.825	-3000.068	-3114.904	-2811.840

*** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$.

6 POLICY IMPLICATIONS

Gundersen often writes about ensuring dignity and autonomy of SNAP-participating households (Gundersen, 2019; Gundersen, 2020). Gundersen argues that high participation among eligible households is critical to the program's success. In the past, researchers and advocates have argued that SNAP participation increases when eligibility is expanded (Keith-Jennings, Llobrera, & Dean, 2019). There are, however, mechanisms to increase participation with current eligibility policies that promote initial application to the program and assist with successful application processing.

We believe our study of Indiana SNAP applications has statistically confirmed anecdotal findings that the most difficult hurdle in the SNAP application process is not solely the means test of household net monthly income and total assets. Net income appears to be a significant predictor in submissions and denials, but we also find that assets do not predict denial rates. Therefore, we conclude that assets may simply be an administrative burden that is not a distinguishing factor in the final decision. We also find evidence of increased time in the application's certification process for communities with higher SNAP denial rates. Households may still struggle with the "paperwork test" due to the administrative burden of completing an application for full consideration.

In communities with low denial rates, we find that U.S. citizenship among applicants reduced the denial rate. This fact may highlight an important topic of discussion in our forthcoming qualitative analysis that indicates applicants with an undocumented immigration status find it difficult to navigate the SNAP application process for a household where individuals may have differing immigration and residency statuses. We also recognize that Indiana is home to various refugee populations that, in fact, receive support and guidance from local social service agencies

in how to navigate federal food, housing, and income assistance programs (including SNAP) that provide concessions for those who have been victims of overseas conflict or various forms of human trafficking. Perhaps, outside of policy, additional outreach to all residents in need would be helpful in navigating state-administered social services with complicated application processes.

Advocates for broader use of SNAP benefits to alleviate food insecurity would argue for increased application submissions and reduced denial rates. In communities with high application rates, we find that unemployment is an influential factor associated with increased submissions that is not present in communities with low and medium application rates. At the same time, we find reduced application submission rates in communities with a higher share of residents over 60 years old and living in less populated, rural areas of Indiana. If policymakers are interested in reducing food insecurity through SNAP participation, one might again argue for increased outreach to all residents, particularly unemployed, senior, and rural residents.

7 CONCLUSIONS

Unlike previous studies that have found macro-level indicators are associated with SNAP participation rates, we find that macro-level indicators may not be influential to understanding SNAP denial rates but rather application submission rates. We find that broader socioeconomic trends in a community are associated with SNAP application submissions, but applicants' own set of personal circumstances best predict denial rates. In the context of the preliminary results of our focus group analysis, we attribute this statistical finding to community influences, which dictate whether or not households apply for SNAP benefits given information, misinformation,

and disinformation about the program, its application process, and the likely outcome. Nonetheless, the final outcome of SNAP participation rests largely on the household's individual characteristics when they have completed the application process.

There are several limitations to our study. The aggregated nature of census-tract level data masked the granular distributional outcomes we hoped to understand about SNAP-participating and non-participating households with quantile regression analysis. For example, the administrative data do not allow us to know the exact age of children, only that a certain number of children in the tract's SNAP applications are under 18 years old. Although applicants' race information is included in the shared administrative data for our analysis, the data do not include ethnicity information. As a result, we are unable to control for Hispanic applicants utilizing the current administrative data.

We believe further research on the topic of SNAP application submissions and denials should be expanded to all states with analysis of individual household observations. This would allow a detailed examination of various state-level policies that influence SNAP participation and causal connections between state SNAP policy and the true potential SNAP participation based on application submissions. Understanding the challenges of denied applications and supporting denied applicants that meet current eligibility guidelines might prove a more fruitful advocacy tactic than simply expanding eligibility.

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9 APPENDIX

Figure A. Micro-level Quantile Model Plots: Log Per Capita SNAP Applications

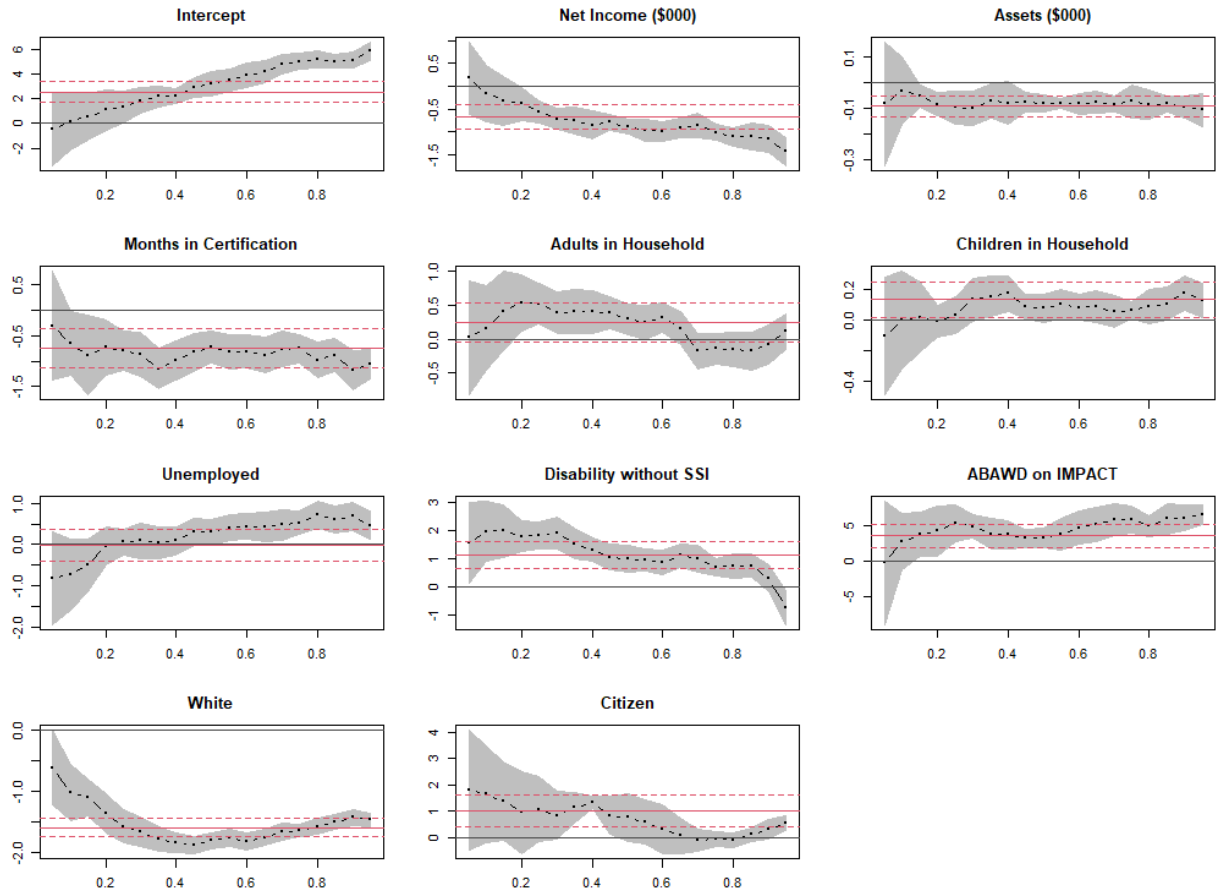

Figure B. Micro-level Quantile Model Plots: Proportion of Denied SNAP Applications

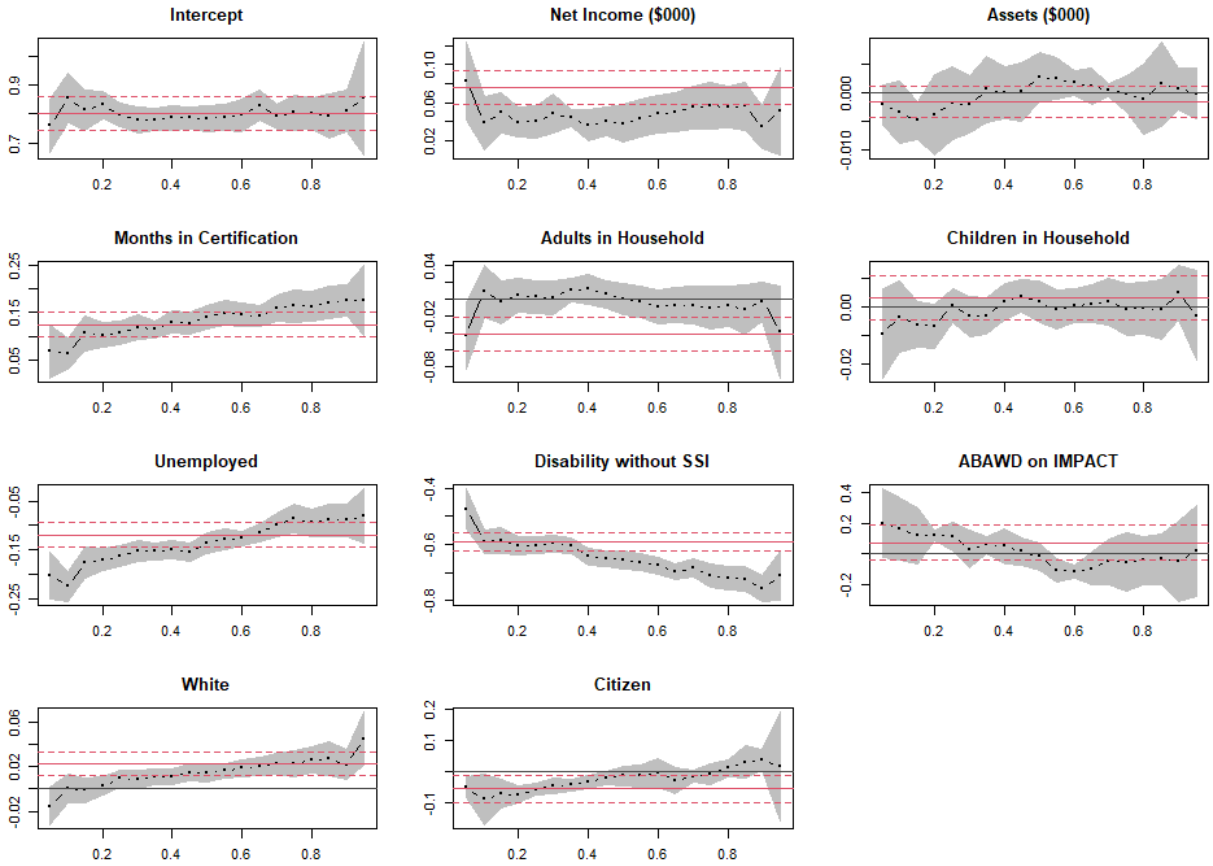

Figure C. Macro-level Quantile Model Plots: Log Per Capita SNAP Applications

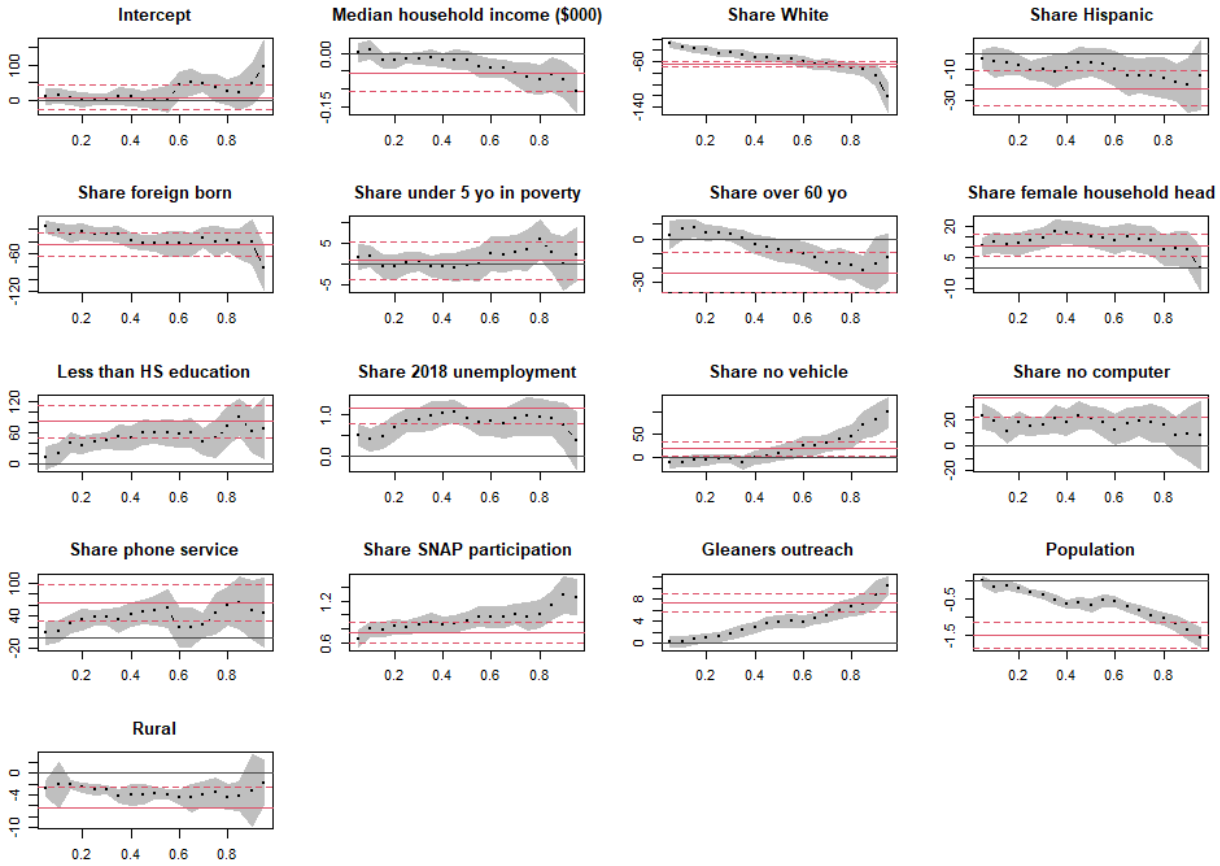

Figure D. Macro-level Quantile Model Plots: Proportion of Denied SNAP Applications