THREE ESSAYS ON FOOD STAMP PROGRAM PARTICIPATION AND POVERTY DYNAMICS

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ABSTRACT

This dissertation is composed of three essays that analyze the significance of the Food Stamp Program (FSP) for low-income households. The first essay entitled "Intensity of Food Stamp Use and Transient and Chronic Poverty: Evidence from the Panel Study of Income Dynamics" examines the impact of intensity of use of FSP benefits on household exposure to transient and chronic poverty with respect to food and housing expenditures. The study finds that FSP is used for both long-term expenditure support and as a smoothing mechanism before the welfare reform, and only for smoothing expenditures after the welfare reform. Factors that influence both components of poverty are number of children, human capital, minority status and local economic conditions. Another finding is that shorter recertification periods reduce the length of FSP use, and indirectly result in higher poverty.

The second essay entitled "The End of the Paper Era in the Food Stamp Program: The Impact of Electronic Benefits on Program Participation" documents the impact of the implementation of the statewide Electronic Benefits Transfer (EBT) system on household participation behavior in the entire period of nationwide implementation. The major finding is that the switch from paper coupons to EBT cards induces participation among eligible households, most likely by reducing the stigma associated with FSP participation. The effect of the EBT system on participation

probabilities is the largest among households residing in the rural South, those not headed by a single mother or those with a White household head.

The third essay entitled "The Dynamics of Food Stamp Program Participation: A Lagged Dependent Variable Approach" investigates the existence of state dependence and its sources by analyzing the dynamics of participation in the FSP using a lagged dependent variable approach. Results show that FSP receipt in the previous period is an important determinant of current FSP receipt. Estimated persistence rates declined significantly after 1996, suggesting that long-term welfare dependency was reduced after the welfare reform, at least with respect to the FSP. The source of state dependence in FSP participation among low-income households is mostly structural implying that a welfare trap does exist for these households.

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INTRODUCTION

The United States Department of Agriculture's (USDA) Food Stamp Program (FSP), a joint effort of federal and state governments, was launched in 1965 to provide in-kind food benefits to low-income households. Over the course of four decades, the program has expanded significantly to become the cornerstone of the U.S. social safety net, reaching 26 million households, with approximately $31 billion in benefits annually (USDA Food and Nutrition Service). Benefits are fully funded by the federal government while states are responsible for administering the program.

The policy debate surrounding the FSP focuses on three important aspects of the program: the role of the FSP in improving the well-being of low-income households, increasing participation among eligible families, and its potential for encouraging long-term welfare dependency. The program does not limit benefits to a specific group of people, and therefore reaches a wide range of low-income persons. Still, a large number of families potentially eligible for benefits do not participate in the program. As the program's effectiveness depends on the extent to which the program reaches its target population, efforts to encourage participation are very important to the success of the program. However, the objective of reducing poverty without encouraging long-term welfare dependency remains a major policy concern.

For those who participate, food stamps have been found to provide positive benefits in terms of increased consumption or household expenditures in general (Bishop et al., 1996; Wilde et al., 1999; Hoynes et al., 2006), improvements in food intake and quality (Wilde et al., 1999), and increased food security (Gundersen and Oliviera, 2001; Kabbani and Kmeid, 2005). Perhaps the most important aspect of the FSP is the expenditure smoothing benefits of the program (Breunig

et al., 2001; Gundersen and Ziliak, 2003) and its role as an automatic stabilizer for low-income households in the face of adverse shocks (Mykerezi and Mills, 2007). As such, an important measure of success for the program is its impact on reducing temporary and long-term expenditure poverty.

Another important measure of the program's performance is its ability to reach its target population, as indicated by the proportion of people eligible for benefits who actually participate. Recent estimates by several USDA studies suggest that about 55 percent of those eligible for the program actually participate (USDA, 2003). There are many reasons why families eligible for benefits do not apply for food stamps including lack of information about eligibility and potential benefits, the complexity of the application process, and the stigma attached to participation (USDA Food and Nutrition Service, 2005). Improving access to the FSP has been a major policy concern throughout the history of the program due to the low rates of participation in the FSP among families eligible for benefits. The effectiveness of new policies will however depend greatly on whether they can address the underlying causes of nonparticipation.

As with any government welfare program, balancing program access with program accountability is central to the policy debate regarding the FSP. Welfare programs continue to be the focus of controversy due to concerns with long-term welfare dependency among recipients. Prolonged periods on welfare may be caused by the adverse effects of the welfare system on recipients' choices and behavior, especially with respect to work and family structure disincentives (Moffitt, 1992). In order to minimize these adverse incentives it is important to understand whether welfare generates long-term dependence among recipients.

This dissertation is composed of three essays that use innovative approaches to analyze the significance of the FSP for low-income households, with each essay focusing on a different aspect of the program. First, the role of the FSP in reducing temporary and long-term expenditure poverty is explored. Second, the effect of the largest policy change in the history of the program, namely the switch from paper coupons to electronic cards, on participation rates is analyzed. Third, the existence of state dependence in FSP participation and its sources are investigated.

The first essay entitled "Intensity of Food Stamp Use and Transient and Chronic Poverty: Evidence from the Panel Study of Income Dynamics" examines the impact of intensity of use of FSP benefits on household exposure to transient and chronic poverty with respect to food and housing expenditures. Some households experience poverty for long periods of time, while others are exposed to poverty for only short periods due to negative short-run shocks. Evidence from research on poverty dynamics indicates that the determinants of chronic poverty may differ from the determinants of transient poverty. FSP may also have a differential impact on these dimensions of poverty. For instance, food stamp benefits can be used as a smoothing mechanism to reduce expenditure variability, in which case they will have an important impact on transient poverty. The use of FSP can also support base expenditure levels over time and reduce chronic poverty.

Mykerezi and Mills (2007) is, to our knowledge, the first study to examine the relationship between FSP participation and poverty dynamics explicitly. The study generated intra-annual transient and chronic poverty measures and examined the relationship between FSP participation and intra-annual family poverty in a simultaneous equation framework. My first paper follows Mykerezi and Mills (2007) in generating inter-annual expenditure-based poverty measures to

examine the determinants of transient and chronic poverty, with particular focus on the differential role of food assistance on these dimensions of poverty.

The study augments several aspects of the existing literature on the dynamics of poverty and the effectiveness of food assistance. First, pre- and post-welfare reform panels of expenditure data are used to examine inter-annual family poverty dynamics, allowing us to comment on possible structural changes in how households move in and out of poverty in the medium- and long-run. Second, the study accounts for local economic conditions that play important roles in shaping both family poverty dynamics and FSP participation. Third, transient and chronic poverty trends are documented for both the nation and the rural South. The rural South is given special consideration as the region's disproportionate share of persistently poor counties foster a high rate of chronic poverty in the region (Miller and Weber, 2004).

The second essay entitled "The End of the Paper Era in the Food Stamp Program: The Impact of Electronic Benefits on Program Participation" documents the impact of the implementation of the statewide Electronic Benefits Transfer (EBT) system on household participation behavior in the entire period of nationwide implementation. The most important reason for switching to electronic cards was to replace the paper coupon based system, which had become highly inefficient due to the high cost of administering and delivering benefits and its vulnerability to fraud, waste, and abuse. Another major reason for the transition from paper coupons to EBT cards was the greater convenience EBT offers for recipients by reducing the social stigma and embarrassment felt by recipients when using paper coupons.

Previous evidence of EBT program impacts on FSP participation is mixed. A qualitative study by Ponza et al. (1999) found that when surveyed, nonparticipating eligible individuals were more

likely to indicate that they would participate in the FSP if benefits were provided through EBT cards than via paper coupons. A study by Banks (2003) suggests that when food stamp recipients no longer have to present paper coupons in public, stigma is reduced, leading to higher participation rates among eligible households. A more comprehensive study by Hofferth (2003) found that the EBT was associated with lower rates of exit from the FSP. On the other hand, an overwhelming number of studies find that there is no link between the implementation of statewide EBT systems and FSP participation rates or that the impact is restricted to specific sub-groups of the eligible population (USDA, 1994; Kornfeld, 2002; Kabbani and Wilde, 2003; McKernan and Ratcliffe, 2003; Currie and Grogger, 2001; Ziliak et al., 2000).

While the existing literature provides some insights into whether the new EBT system changed FSP participation rates, some limitations are apparent. First, research on the impact of EBT on program participation generally focused on food stamp caseloads, and either examined the food stamp caseload as a whole or considered broad subpopulations. Studies that use household-level data to examine FSP participation exist in the literature; however these studies typically employ reduced form approaches that model FSP participation probabilities (Gundersen and Oliveira, 2001; Haider et al., 2003; Hanratty, 2006; and McKernan and Ratcliffe, 2003). Since participation decisions are ultimately the result of comparing utilities from participation and non-participation, household-level data can be used to analyze the factors that influence utility directly. Another major limitation with the existing studies is the variable used to measure the existence of the EBT system. The common approach is to use an indicator variable for the presence of a statewide EBT system. While using the presence of an EBT system statewide enables some control for the potential effects of the system, there is a great deal of variation in

the timing of the adoption of EBT technology, an underexploited source of variation that may be highly relevant to program outcomes in terms of participation rates.

My second paper addresses these modeling and data limitations in the existing literature on the impact of EBT on FSP participation. First, since electronic cards replaced paper coupons in all states in 2004, no updates have been made to existing studies examining state FSP participation dynamics or individual participation behavior. This paper is the first to examine the role of the EBT system on individual FSP participation behavior across the entire period of nationwide adoption. Second, FSP participation decisions are modeled at the household-level using a structural model to disentangle household, FSP policy and economic effects on FSP participation. Third, a different measure for EBT system adoption is used. Until statewide implementation was achieved in each state, food stamps were delivered both as coupons and debit cards. A measure of state-level EBT penetration, represented by the percentage of food stamps issued via EBT cards in a given year, is developed.

The third essay entitled "The Dynamics of Food Stamp Program Participation: A Lagged Dependent Variable Approach" investigates the existence of state dependence and its sources by analyzing the dynamics of participation in the FSP using a lagged dependent variable approach. It is a well-documented empirical fact that present welfare participation increases the likelihood of future participation (Blank, 1989; Bane and Ellwood, 1994; Moffitt, 1992; Chay and Hyslop, 1998; Blank and Ruggles, 1996). There are two distinctive explanations often put forward for the observed serial persistence in welfare receipt (Heckman, 1981). On one hand, persistence may be the result of "true" state dependence in which current participation directly influence an individual's propensity to participate in the future by altering the cost or stigma related to welfare participation and shifting the structure of the individual's preferences. True state dependence refers to the concept

known as a "welfare trap" in the literature. On the other hand, persistence may also result from unobserved individual heterogeneity, in that individuals have different underlying propensities to experience an outcome in all periods. In this case, current participation does not structurally affect the future propensity to participate, but rather this source of serial correlation can be viewed as "spurious".

Distinguishing state dependence from other sources of welfare persistence is important from a policy perspective. If the relationship between past and current participation in a welfare program is mostly due to state dependence, changing welfare program parameters to prevent people from entering welfare can have long-term benefits in terms of reducing welfare dependency. Policies that discourage participation in welfare may also indirectly encourage work and improve economic well-being among recipients. If most participation is due to persistent individual unobserved heterogeneity, then changing the welfare policy will be less effective in the long-run and can have only temporary effects, and the unobserved causes of welfare participation need to be addressed.

Recently, dynamic binary response panel data models, also known as lagged dependent variable models have been adopted to distinguish between true and spurious state dependence in social assistance dynamics (Andren, 2007; Hansen and Lofstrom, 2009; Hansen, Lofstrom and Zhang, 2006; Cappellari and Jenkins, 2008). These models have only recently received attention in the U.S. to study welfare dynamics (Chay and Hyslop,1998; Chay, Hoynes and Hyslop, 2004). The dynamics of participation in the FSP have not been studied using this approach. My third paper fills this gap in the literature and employs dynamic binary response panel data models to study FSP participation dynamics and decompose the observed state dependence into structural and spurious components.

All three papers in this dissertation use innovative quantitative methods to examine the different aspects of the FSP in improving the well-being of low-income households. Results are expected to help policy makers formulate better informed policies in making the program more effective. Specifically, information on the differential impact of FSP on the temporary and long-term dimensions of poverty can be used by policy makers to improve the role of the FSP in meeting the needs of the transiently and chronically poor families. Further, understanding the underlying causes of non-participation can help a great deal in devising policy changes aimed at increasing participation and therefore reducing transient or chronic poverty. However the potential issue of long-term welfare dependence remains a concern for policy makers, in which case factors underlying persistence in program participation should be better understood.

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ESSAY 1

Intensity of Food Stamp Use and Transient and Chronic Poverty: Evidence from the Panel Study of Income Dynamics

Introduction

Poverty has an important dynamic dimension. Some households experience poverty for long periods of time, while others are exposed to poverty for only short periods due to negative short run shocks. Using static poverty measures based on cross-sectional data, the poor can be differentiated on the basis of how far their consumption, expenditure or income lies below the poverty line. However, the short run approach fails to distinguish the chronically poor and the temporarily poor. Analysis of changes in households' welfare over time is therefore required for identifying the transiently and chronically poor. Poverty dynamics also provide useful insights into the determinants of movements into and out of poverty and duration of poverty.

Evidence from research on poverty dynamics indicates that the determinants of chronic poverty may differ from the determinants of transient poverty. Information on these unique determinants is needed in the design of poverty reduction strategies. In the U.S., one of the largest transfer programs targeting the poor is the Food Stamp Program (FSP). Many dimensions of FSP impacts have been analyzed including impacts on self-reported measures of food insecurity (Gundersen and Oliviera, 2001; Kabbani and Kmeid, 2005), impacts on the income-based official poverty measure for the general population (Bishop et al., 1996; Hoynes et al., 2006), impacts on specific target groups like children (Jolliffe et al., 2005), the impact of the FSP on family expenditures, food consumption, intake and diet quality (Wilde et al., 1999), Studies have also highlighted the expenditure smoothing benefits of the program (Breunig et al., 2001; Gundersen and Ziliak,

2003). Yet, despite evidence that FSP participation has a significant impact on family well-being, the literature exploring the quantitative impacts of FSP participation on family poverty dynamics is limited. Mykerezi and Mills (2007) is, to our knowledge, the first study to examine the relationship between FSP participation and poverty dynamics explicitly. The study used quarterly expenditure data from the Consumer Expenditure Survey (CEX) to generate intra-annual transient and chronic poverty measures and examined the relationship between FSP participation and intra-annual family poverty in a simultaneous equation framework. Transient and chronic poverty measures are generated based on family expenditures as opposed to income, as income has several limitations as a measure of economic well-being, especially in dynamic poverty indexes. Family incomes vary more in response to shocks than do expenditures, as families use accumulated assets and credit markets to smooth consumption when faced with transitory income changes, so they are likely to inflate transient poverty measures (Jorgenson, 1998). Expenditures also appear to be less subject to systematic under-reporting than income, especially among low-income families (Meyer and Sullivan, 2003).

The current study follows Mykerezi and Mills (2007) in generating expenditure-based poverty measures to examine the determinants of transient and chronic poverty, with particular focus on the differential role of food assistance on these dimensions of poverty. However, in this study we use Panel Study of Income Dynamics (PSID) data from 1990-1995 and 1996-2003 to generate transient and chronic poverty measures based on annual household expenditures. Transient poverty measures the component of poverty that stems from inter-annual variability in family expenditures across years in each period, while chronic poverty refers to the component of poverty associated with average expenditures below the poverty line over the same number of years.

The study augments several aspects of the existing literature on the dynamics of poverty and the effectiveness of food assistance. First, pre- and post-welfare reform panels of expenditure data are used to examine inter-annual family poverty dynamics, allowing us to comment on possible structural changes in how households move in and out of poverty in the medium- and long-run. Second, the study employs proprietary geo-coded panel data to account for local economic conditions that play important roles in shaping both family poverty dynamics and FSP participation. Third, transient and chronic poverty trends are documented for both the nation and the rural South. The rural South is given special consideration as the region's disproportionate share of persistently poor counties foster a high rate of chronic poverty in the region (Miller and Weber, 2004).

The rest of the paper is organized a follows. The next section describes the data and the measures of the incidence and severity of transient and chronic poverty used in the study. Section 1.3 presents the empirical strategy, and section 1.4 presents the descriptive statistics on poverty measures and model covariates. Section 1.5 presents the results, while section 1.6 discusses policy implications and concludes.

Data and Measures

The primary source of data for the analysis is the Panel Study of Income Dynamics (PSID), a long-term panel that started in 1968 with a sample of roughly 5,000 households (3,000 nationally representative households and an over sampling of 2,000 low-income households). The original families and the families of their offspring were followed. Thus, by 2001 over 7,000 families are included in the sample. However, the panel continued to be nationally representative through the application of household weights.

One problem with the PSID is that it contains information on a limited number of consumption items, primarily food at home, food away from home, and housing expenditures. Several previous studies have used data from the Consumer Expenditure Survey (CEX) to impute total consumption from the limited expenditure categories in the PSID (e.g. Meyer and Sullivan, 2002; Blundell, Pistaferri, and Preston, 2008). The current study takes an alternative approach and uses the existing expenditure categories in the PSID to construct food and housing expenditure based poverty measures. In order to establish a "food and housing needs standard", we first use CEX data to determine the share of total consumption that is comprised by expenditures on food and housing for households with overall consumption levels near the official poverty line. Figure 1.1 presents locally weighted regression estimates of the sum of food share and the housing share as a function of total expenditures normalized by the official poverty line, and indicate that food and housing expenditures comprise about 45% of total expenditures for households near poverty (those with expenditures equal to 125 percent of the poverty line). Then food and housing poverty measures are generated by comparing total food and housing expenditures reported in the PSID to 45% of the official poverty line. Constructing poverty measures using actual food and housing expenditures was preferred over using imputed total consumption because the transient poverty measure indexes in the current application is highly sensitive to measurement error (Mykerezi and Mills, 2007). Measurement error associated with imputed non-food and housing expenditures is likely to be very high.

A unique strength of the PSID data is that information on county of residence is available, enabling the estimation of the impacts of local economic conditions on economic well-being and social assistance. County-level poverty rates obtained from the U.S. Census Bureau of Small Area Income and Poverty Estimates (SAIPE) are employed to account for the general level of

economic well-being in the county in which the household resides. Information on state-level certification periods used to generate instruments to identify the parameter estimates in the poverty equations was obtained from the FSP Quality Control (FSPQC) database. The database contains information generated from monthly quality control reviews of FSP cases that are conducted by state FSP agencies.

Transient and Chronic Poverty Measures

As mentioned, transient expenditure poverty refers to the component of the severity of poverty that stems from inter-annual variability in expenditures across years, while chronic poverty refers to the component of poverty associated with average expenditures below the expenditure poverty line over the same period.

A severity of poverty measure is employed and defined as:

$$P(y_{it}) = (1 - y_{it})^2 \; if \; y_{it} < 1 \tag{1.1}$$

$$= 0 \; if \; y_{it} \geq 1$$

where y_{it} represents family expenditures normalized to the family-type-specific poverty line. This severity measure has the advantageous property of penalizing inequality among the poor (Sen, 1976). For empirical work, the measure also has the advantageous properties of being convex and approaching zero at the poverty line smoothly from below.

The severity of poverty measure is also additively decomposable into transient and chronic components. Let P_i be a measure of the average severity of poverty for the *i*th household over *T* years:

$$P_i = \frac{1}{T}\sum_{t=1}^{T} P(y_{it}) \tag{1.2}$$

Severity of poverty at mean expenditures is the measure of chronic poverty:

$$C_i = P(\bar{y}_i), \qquad \bar{y}_i = \frac{1}{T}\sum_{t=1}^{T} y_{it} \tag{1.3}$$

The transient component of poverty is then defined as the portion of the severity of poverty measure attributable to variability in expenditures:

$$T_i = P_i - C_i = \overline{P(y_i)} - P(\bar{y}_i) \tag{1.4}$$

Empirical Model

The transient poverty component depends on family exposure to income related shocks and access to expenditure smoothing mechanisms. These shocks may, in some cases not be easily observable, but in the empirical specification they are assumed to be related to both family demographic characteristics and local economic conditions. A primary expenditure smoothing mechanism observed in the analysis is FSP participation. Well developed service sectors in the local economy can also improve family's abilities to smooth income shocks through labor markets with lower transaction costs to job search (Mills, 2000).

The relationship between transient poverty and the observed covariates is:

$$T^* = X\beta_T + \gamma_T FS + \varepsilon_T \tag{1.5}$$

where T^* is a latent continuous measure of household transient poverty, X is a vector of observed covariates assumed to influence T^*, FS measures the length of FSP use defined as the number of months the household receives food stamps over the period considered, β_T and γ_T are conformable parameter vectors and ε_T is a random error.

Two empirical issues associated with the estimation of β_T and γ_T need to be addressed: First, we can only observe $T = \max\{T^*, 0\}$, with most families having transient severity of poverty

measures of zero. Second, FSP participation is a choice, and there may be unobserved effects that influence both, FS and T^*. If that were the case the ordinary least squares estimate of γ_T would be biased. To address these concerns the relationship between T and FS is estimated using an instrumental variable (IV) Tobit model, with FS expressed as:

$$FS = X\beta_F + \delta Z + \varepsilon_F \tag{1.6}$$

where X is as previously defined, Z is a vector of covariates assumed to only affect FS, β_F and δ are parameter vectors and ε_F is a random error.[1] The reduced form of the system is given by:

$$T^* = X(\beta_T + \gamma_T\beta_F) + Z(\gamma_T\delta) + \varepsilon_T^* \tag{1.7}$$

where $\varepsilon_T^* = \gamma_T\varepsilon_F + \varepsilon_T$. Assuming that ε_T and ε_F are joint normally distributed with correlation ρ and variances σ_T^2 and σ_F^2, respectively, then ε_F and ε_T^* have a joint normal distribution with covariance matrix

$$\Omega = \begin{bmatrix} \sigma_F^2 & \gamma_T\sigma_F^2 + \rho\sigma_F\sigma_T \\ \gamma_T\sigma_F^2 + \rho\sigma_F\sigma_T & \gamma_T^2\sigma_F^2 + 2\gamma_T\rho\sigma_F\sigma_T + \sigma_T^2 \end{bmatrix}. \tag{1.8}$$

The chronic poverty model is specified in a similar manner. The chronic component of severity of poverty depends on average family income, which is a function of family assets and local economic assets, and FSP participation. The role of the FSP in ameliorating chronic poverty is in this case that of long-term expenditure support, rather than expenditure smoothing. The relationship between chronic poverty and observed covariates is given by:

$$C^* = X\beta_C + \gamma_C FS + \varepsilon_C \tag{1.9}$$

where C^* is a latent continuous measure of household chronic poverty, X is as previously defined. With FS expressed as in equation (1.6), the reduced form of the chronic poverty model is given by:

[1] The likelihood function for the instrumental variable Tobit is well-known and it is not replicated here. The models are estimated using STATA's CMP routine programmed by David Roodman for STATA.

(1.10) $$C^* = X(\beta_C + \gamma_C \beta_F) + Z(\gamma_C \delta) + \varepsilon_C^*$$

where $\varepsilon_C^* = \gamma_C \varepsilon_F + \varepsilon_C$.

Three common groups of covariates are included in the specifications of the determinants of transient and chronic poverty and the specification of the determinants of the intensity of FSP use. Family demographic and structure characteristics include family size, additions and reductions in family size, number of children and number of children squared, as well as the age, age squared, gender, marital status and race of the household head. Family educational assets are measured by discrete indicators of education level of the household head (no high-school degree, high-school degree, some post-secondary education but no college degree, and a college degree). Location attributes are measured by county level poverty rates.

In addition, the state-level share of active caseloads that had recertification periods of less than 3 months, 4 to 6 months, 7 to 9 months, and 10 to 12 months (as opposed to higher then 12) are included in the FSP equation, but not the poverty equations, to identify the parameter estimates in the poverty equations. The state level recertification periods are justified as valid instruments in that they are likely to affect transactions costs associated with FSP participation but do not influence household poverty, except through their impact on FSP participation.

Descriptive Statistics

In this section, estimates of food and housing expenditure-based measures of total poverty and their transient and chronic components across the 1990-1995 and 1996-2003 periods along with descriptive statistics on covariates employed in the statistical model are presented. Note that household weights are applied in calculating means and standard deviations as PSID over samples low-income families.

The incidence and severity of total poverty and its chronic and transient components are presented in table 1.1 for the nation and the rural South. For the incidence measures, a family is identified as chronically poor if food and housing expenditures averaged across the time period considered are below the adjusted poverty line. A family is identified as transiently poor if food and housing expenditures are below the poverty line for at least one year, but the family is not chronically poor.

The results indicate that the nation has a significantly higher percentage of its population experiencing transient poverty than chronic poverty in the 1990-1995 and 1996-2003 periods. This is also the case for the rural South. It is also important to note that the incidence of both transient and chronic poverty is substantially higher in the rural south than in the nation as a whole. About 16.4 percent of the population experiences transient poverty and 5.2 percent experiences chronic poverty in the nation prior to welfare reform, whereas 19.2 percent of the rural South's population is transiently poor and 16 percent is chronically poor in the pre welfare reform period. Post welfare reform, about 14.4 percent of the nation's population experiences transient poverty and 4.3 percent experiences chronic poverty, whereas 22.4 percent of the population is transiently poor and 11.3 percent is chronically poor in the rural South.

The severity of poverty measures also indicate that transient poverty is the larger component of the total severity of poverty for both the nation and the rural south in the two time periods. As with the incidence measure, the severity of both transient and chronic poverty is substantially higher for the rural south in both the pre-welfare reform and post-welfare reform period.

Descriptive statistics for the other endogenous variable, the total number of months of FSP participation over the entire period, are provided in table 1.2. Nationally, 20.1 percent of all

households participated in the FSP at least once in the six-year period preceding the welfare reform, with an average of 31 months of FSP use among participants. After the welfare reform, both FSP participation rates and average number of months of FSP use decline, with 15.4 percent of the population receiving food stamps at some point in the six-year period for an average of 26 months. Participation rates and the average number of months of FSP participation are higher in the rural South than the nation in both time periods. Similar to the nation as a whole, both participation rates and the length of FSP use decline in the rural South after the welfare reform from 23.3 percent with an average of 34 months in the FSP to 19.7 percent with an average of 28 months of FSP use in the second.

In both periods, the participation rate in the FSP is always significantly higher among chronically poor households than transiently poor households in both in the nation and the rural South. Average number of months of FSP participation is also almost always higher for the chronically poor than the transiently poor both in the nation and the rural South, the exception being the pre-welfare reform period, when transiently poor households stay longer on the FSP than the chronically poor in the rural South. Comparing the nation and the rural South, we observe a surprising outcome: the percentage of poor households (both chronic and transient) participating in the FSP is significantly smaller in the rural South than the nation as a whole in both time periods. Given higher transient and chronic poverty rates in the rural South, this implies that poor households in the rural South have a lower propensity to participate in the FSP.

It is also important to note that FSP participation rates decline after the implementation of welfare reform measures. Transiently poor households in the nation experience the largest decrease in FSP participation rates after the welfare reform, declining from 45 percent to 35 percent. The time spent on FSP also declines nationally post-welfare reform among both all

households and poor households. In the rural South the trend across time periods is different: length of FSP use is lower in the post-welfare reform period for transiently poor households, but higher for chronically poor households.

Descriptive statistics for the other covariates employed in the model are provided in table 3. The pre- and post-welfare reform samples display similar characteristics with respect to most of the covariates. The average family in the pre-welfare reform PSID sample has 2.6 members and 1.3 children below the age of 18, whereas post-welfare reform, the average family in the sample has 2.5 members with 1.2 children. Taking the more educated spouse to be the head of the household for married families and the reported head for families with other marital status, the head is 49 years old on average pre welfare reform, and 51.4 years old on average post welfare reform. The head and spouse of the average family spend a little more than 1 week unemployed during both periods. The average household faces a county-level poverty rate of 13 percent in the pre welfare reform period, and 11.9 percent in the post welfare reform period.

Before turning to the discrete indicators, note that for the discrete variables used in the analysis, the initial values observed at the beginning of each period are used. 20 percent experienced a decrease in family size and 15 percent of the sample experienced an increase in the pre-welfare reform period, whereas 28 percent a decrease and 16 percent had an increase in family size in the post welfare reform period. In both periods, the majority of the households are headed by married couples. Similarly, households with a male head constitute the majority of the sample in both periods. A large percentage of the households have white (88 percent in both periods) or African American (11 percent pre welfare reform and 10 percent post welfare reform) heads, leaving only a very small percentage to Hispanic and other non-white heads. Families with a head with some college but no degree represent 35 percent of the sample, while those with a

college degree and at least a high school degree represent 30 and 21 percent of the sample, respectively in the pre-welfare reform period. In the post-welfare reform period, 37 percent of the households in the sample have a head with a college degree, 29 percent with at least a high school degree, and 25 percent with some college but no degree.

Finally, for the instruments used in the analysis, the average share of state-level caseloads with a recertification period of 10-12 months was 54 percent in the pre-welfare reform period and 51 percent in the post-welfare reform period. On average 26 percent had a recertification period of 4-6 months pre-welfare reform and 25 percent in the post-welfare reform period. The average shares of active caseloads recertified in 7-9 months were 7 percent pre-welfare reform and 4 percent post-welfare reform whereas the share of caseloads that were recertified in less than 3 months of recertification period was 5 percent in the pre-welfare reform period and 11 percent post-welfare reform.

Results

Results for the estimation of the IV Tobit model for transient poverty are presented in table 1.4 and 1.5 for the pre-welfare reform and post-welfare reform periods, respectively. We observe that length of FSP participation reduces transient poverty *(p=0.1)* in both time periods. Marginal effects computed at the sample means of covariates used in the analysis indicate that a one month increase in FSP participation reduces the severity of transient poverty by 9 percent among the transiently poor in the pre welfare reform period, and 15 percent among the transiently poor in the post welfare reform period.[2]

[2] Marginal effects are computed as $\frac{\partial[T^*|T>0,X]}{\partial FS}\Big|_{X=\bar{X}}$.

Estimates of the IV Tobit model for chronic poverty are given in table 1.6 and 1.7 for the pre-welfare reform and post-welfare reform periods, respectively. The parameter estimate associated with months of FSP participation is negative and statistically significant *(p=0.1)* only in the pre-welfare reform period implying that longer periods of FSP participation decrease the severity of chronic poverty during this period. The associated marginal effect suggest an 11 percent reduction in chronic poverty associated with an additional month of FSP participation for the average chronically poor household in the pre welfare reform period.

These results imply that before the implementation of welfare reform measures, poor households use food stamps for both long-term expenditure support and as a smoothing mechanism, whereas post welfare reform, the FSP is only used to smooth expenditures against shocks. This may be explained partly by the increasing exit rates from the FSP following the passage of the 1996 PRWORA legislation. The Temporary Assistance to Needy Families (TANF) program introduced with PRWORA focused on moving families off cash welfare into the workforce by setting five-year cumulative limits on cash welfare, but existing literature has shown that TANF and FSP participation are strongly linked (Mills et al., 2001; Ziliak et al., 2000; Quint and Widom, 2000; Currie and Grogger, 2001). These studies find that still eligible families leave the FSP after leaving TANF after the welfare reform, which can explain why FSP participation addresses only temporary poverty and not long-term poverty in the post welfare reform period.

Turning to the other model covariates, the determinants of transient poverty are the same before and after the implementation of the welfare reform measures. More children, reductions in family size, and time spent unemployed lead to higher levels of transient poverty. Transient poverty is also higher for households headed by African Americans, and for residents of higher poverty counties. Note that residence in counties with poor economic conditions affect poverty

even after controlling for household characteristics and actual unemployment. On the other hand, households headed by a married, male or more educated individuals experience lower levels of transient poverty. Transient poverty decreases with the age of the household head until it reaches a minimum at the age of forty-five, and starts to increase after that. Post-welfare reform, the age of the household head decreases transient poverty until forty-nine, and increases transient poverty after the age of forty-nine.

The chronic poverty component of severity of poverty is determined by a different set of covariates. In the pre-welfare reform period, chronic poverty increases with number of children, time spent unemployed by the household head and the spouse, and with higher county poverty rates. Households headed by African Americans experience higher levels of chronic poverty, while having a married, or a more educated household head decreases chronic poverty. In the post-welfare reform period, chronic poverty is higher for households with an African American and Hispanic or other non-White head. Chronic poverty is also higher for residents of higher poverty counties, while households headed by a more educated head (only those with a college degree) experience lower levels of chronic poverty.

Within each period, the parameter estimates associated with the FSP use equation are almost identical in the transient and chronic poverty models. This finding is not surprising as the covariates used in the months of FSP participation equation are the same across the models. Estimates indicate that months of FSP use increases with number of children and time spent unemployed by the household head and spouse. Months of FSP use are also higher for households who experienced a decrease in family size, or have an African American, Hispanic or other non-White head. Households that reside in counties with higher poverty rates also show more months of FSP use, ceteris paribus. Months of FSP use are lower for households with

married, male, and more educated heads. Family size affects length of FSP use only in the pre-welfare reform period, with a negative effect. Length of FSP use is reduced as the average share of state level caseloads with shorter recertification periods increases, perhaps reflecting the higher transactions costs of participation to the program imposed by frequent recertification requirements.

As a final note, results reveal the existence of a joint relationship between months of FSP participation and both dimensions of poverty. In fact, the estimated error correlation is positive and statistically significant at least at the *(p=0.1)* level in all models. This suggests that the unobserved factors in the poverty equations and the months of FSP use equation are correlated and affect the chronic and transient poverty dimensions and length of FSP use in the same direction, so single equation model coefficients would suffer from upward bias. Indeed, single equation Tobit estimates of transient poverty and chronic poverty (presented in table A1 and table A2 in Appendix A) show positive FSP participation coefficients in both equations *(p=0.05)*. The positive coefficients clearly reflect self-selection of poor households into the FSP rather than a detrimental effect of FSP use on household well-being.

Discussion and Conclusions

This study finds that transient poverty, measured as the portion of severity of poverty due to variability in expenditures, accounts for a larger share of economic hardship than chronic poverty. In fact, results indicate that the transient component of food and housing expenditure-poverty accounts for seventy-four percent of the total severity of poverty for the nation as a whole and sixty percent for the rural South measured prior to welfare reform. Post-welfare reform the transient component accounts for sixty-five percent of the total severity of poverty in

the nation as a whole and fifty-eight percent of the total severity of poverty in the rural South. Given its high prevalence, mechanisms that specifically address transient poverty are likely to greatly improve household well-being.

Results from the estimation of transient and chronic poverty models indicate that transient poverty and chronic poverty are both reduced at approximately the same rate by additional months of FSP participation before welfare reform; nine percent per month for transient poverty and eleven percent per month for chronic poverty. In the post-welfare reform period, FSP participation affects only transient poverty; an additional month of FSP participation decreases transient poverty by fifteen percent. This implies that poor households use food stamps for both long-term expenditure support and as a smoothing mechanism before the welfare reform, and only for smoothing food and housing expenditures after the welfare reform. This likely reflects a spillover effect from the TANF program which has been shown to contribute to declines in FSP participation the post-welfare reform era (Mills et al., 2001; Ziliak et al., 2000; Quint and Widom, 2000; Currie and Grogger, 2001). In any case, given that FSP participation has a differential impact on transient and chronic poverty after the welfare reform it is perhaps advisable to adjust the program to cater to both, those who are transiently poor and to households with more persistent poverty. Perhaps a two-track eligibility program that offers easy access to smaller emergency benefits (to cater to the transiently poor) one the one hand, and more rigorous but larger and more sustained benefits (to serve the chronically poor) on the other hand may improve targeting.

The other determinants of the severity of poverty differ slightly across the transient and chronic poverty models. Factors that influence both transient and chronic poverty are number of children, human capital, minority status and local economic conditions. These factors represent lack of

opportunity, and therefore both components of poverty can be reduced with policies targeted at improving economic opportunities for these households. Transient poverty is also correlated with time spent unemployed by the household head and the spouse, reductions in family size, age of head, and marital status. For these households, availability of short-term transfers would be an effective tool in leveling out fluctuations in well-being. It is also important to note that the determinants of transient poverty have not changed over time whereas this is not the case for chronic poverty. For instance, while among the determinants of chronic poverty in the pre-welfare reform period, marital status has no impact on chronic poverty after the welfare reform. This implies that after 1996, married households are as likely to experience chronic poverty as single-headed households.

The state-level FSP policy variables, namely shorter recertification periods reduce length of FSP use, likely because of increased transaction costs, and indirectly result in higher poverty. While FSP participation no longer addresses long-term poverty, the program continues to play a major role in ameliorating transient poverty. This implies that policies aimed at increasing FSP participation via lowered transactions costs or otherwise stand to reduce transient poverty. Program changes such as delivering food stamp benefits via debit cards or FSP outreach programs are already in place with the primary goal of increasing participation. Expansion of these programs may be crucial in efforts to reduce temporary exposure to poverty.

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Figure 1.1: Locally Weighted Regression Estimates, Food and Housing Share and Normalized Expenditures

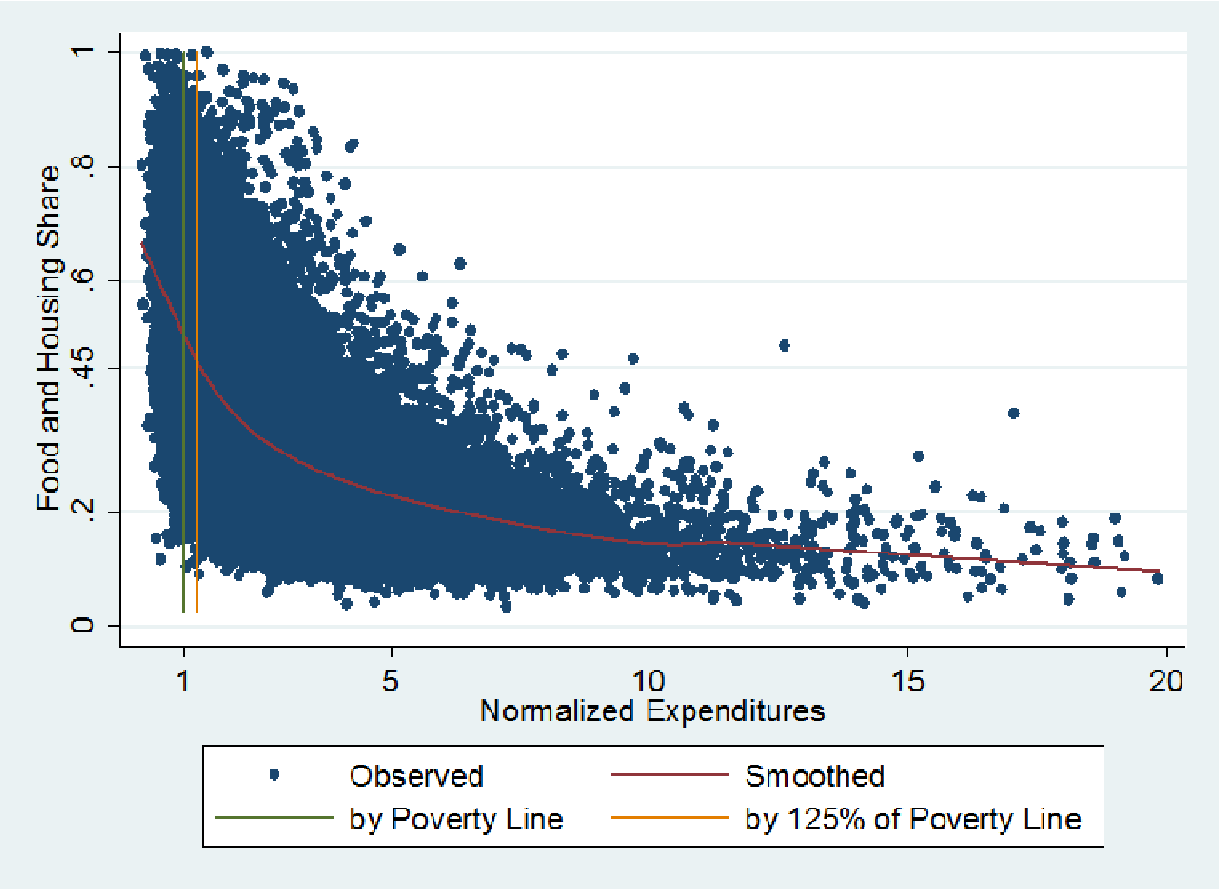

Table 1.1: Decomposition of Severity of Poverty and Incidence of Transient and Chronic Poverty, Nation and Rural South

	% Population Transiently Poor	% Population Chronically Poor	Total Poverty	Transient Poverty	Chronic Poverty	Sample Size
1990-1995						
Nation	16.42	5.23	0.0050	0.0037	0.0013	5316
Rural South	19.17	15.98	0.0139	0.0083	0.0056	532
1996-2005						
Nation	14.41	4.29	0.0034	0.0022	0.0011	3192
Rural South	22.37	11.32	0.0066	0.0038	0.0028	380

Table 1.2: FSP Participation Rates and Length of FSP Use, Nation and Rural South

	Nation		Rural South	
	Rate (%)	Months of Participation [a]	Rate (%)	Months of Participation [a]
1990-1995				
All	20.06	30.99	23.26	33.54
Chronic	54.34	39.97	40.24	30.63
Transient, not Chronic	44.69	33.58	28.35	38.16
1996-2005				
All	15.42	25.49	19.73	28.24
Chronic	51.09	33.91	37.21	33.33
Transient, not Chronic	34.64	23.30	25.00	21.99

[a] Expressed as the sum of all months in which a household participating in the FSP received food stamps in the period.

Table 1.3: Descriptive Statistics

Variable [a]	1990-1995		1996-2005	
	Mean	Std Dev	Mean	Std Dev
Family Size	2.56	1.27	2.51	1.20
Additions to Family	0.15	0.36	0.16	0.37
Reductions in Family	0.20	0.40	0.28	0.45
Number of Children	0.68	1.00	0.63	0.91
Age of Head (10 years)	4.90	1.54	5.14	1.42
Age of Head (10 years) Squared	26.35	16.40	28.41	15.40
Head is Married	0.63	0.48	0.65	0.48
Head is Male	0.59	0.49	0.61	0.49
Head is White	0.88	0.32	0.88	0.32
Head is African American	0.11	0.31	0.10	0.29
Head is Other Race	0.01	0.10	0.02	0.14
Head has no High School Degree	0.13	0.34	0.09	0.28
Head is High School Graduate	0.21	0.41	0.29	0.45
Head has College No Degree	0.35	0.48	0.25	0.43
Head has College Degree	0.30	0.46	0.37	0.48
Time Spent Unemployed (Head & Spouse)	1.20	2.88	1.14	2.71
County Poverty Rate	13.04	5.60	11.89	4.48
Average Certification Period <3 Months	0.05	0.06	0.11	0.10
Average Certification Period 4-6 Months	0.26	0.20	0.25	0.16
Average Certification Period 7-9 Months	0.07	0.06	0.04	0.03
Average Certification Period 10-12 Months	0.54	0.22	0.51	0.24

[a] Head is defined to be the more educated spouse.

Table 1.4: Transient Poverty Model Parameter Estimates, 1990-1995

Variable	Months of FSP Participation			Transient Poverty*100		
	Parameter		SE	Parameter		SE
Months of FSP Participation				-0.382	*	0.21
Intercept	12.084	***	2.69	2.030		2.32
Family Size	-0.839	**	0.41	-0.317		0.32
Additions to Family	-0.097		0.56	0.019		0.38
Reductions in Family	0.862	*	0.52	1.071	***	0.39
Number of Children	4.036	***	0.46	2.516	***	0.90
Age of Head (10 years)	0.285		0.94	-1.606	***	0.63
Age of Head (10 years) Squared	-0.001		0.09	0.178	***	0.06
Head is Married	-4.926	***	0.56	-2.779	***	1.11
Head is Male	-2.948	***	0.42	-1.439	**	0.69
Head is African American	3.532	***	0.50	3.192	***	0.82
Head is Other Race	2.787		1.77	1.452		1.34
Head is High School Graduate	-5.428	***	0.66	-3.802	***	1.20
Head has College No Degree	-8.312	***	0.62	-6.673	***	1.77
Head has College Degree	-8.320	***	0.68	-9.032	***	1.82
Time Spent Unemployed (Head & Spouse)	0.452	***	0.06	0.294	***	0.10
County Poverty Rate	0.197	***	0.04	0.218	***	0.05
Average Certification Period <3 Months	-8.828	**	3.95			
Average Certification Period 4-6 Months	-4.113	***	1.33			
Average Certification Period 7-9 Months	-0.085		3.09			
Average Certification Period 10-12 Months	-4.709	***	1.35			
Error Variance	12.485	***	0.14	6.921	***	2.04
Error Covariance	0.780	***	0.15			
N	4,197					
Log-Likelihood	-19,853.37					

Note: ***, **, and * indicate significance at 1%, 5%, and 10%, respectively.

Table 1.5: Transient Poverty Model Parameter Estimates, 1996-2005

Variable	Months of FSP Participation			Transient Poverty*100		
	Parameter		SE	Parameter		SE
Months of FSP Participation				-0.937	*	0.54
Intercept	9.786	***	2.737	7.022		5.04
Family Size	-0.172		0.40	0.288		0.45
Additions to Family	0.037		0.51	0.139		0.57
Reductions in Family	0.895	**	0.41	1.229	*	0.66
Number of Children	2.569	***	0.47	2.568	*	1.49
Age of Head (10 years)	-0.607		0.93	-2.078	*	1.10
Age of Head (10 years) Squared	0.094		0.09	0.213	**	0.11
Head is Married	-3.907	***	0.51	-4.571	**	2.23
Head is Male	-2.123	***	0.37	-2.513	**	1.23
Head is African American	2.449	***	0.46	3.598	***	1.41
Head is Other Race	2.896	**	1.27	3.092		2.13
Head is High School Graduate	-6.386	***	0.63	-7.303	**	3.55
Head has College No Degree	-8.256	***	0.65	-9.875	**	4.53
Head has College Degree	-7.872	***	0.65	-11.272	***	4.33
Time Spent Unemployed (Head & Spouse)	0.545	***	0.05	0.604	**	0.30
County Poverty Rate	0.216	***	0.04	0.336	***	0.12
Average Certification Period <3 Months	-4.682	*	2.84			
Average Certification Period 4-6 Months	-1.114		1.10			
Average Certification Period 7-9 Months	3.203		4.46			
Average Certification Period 10-12 Months	-2.644	*	1.48			
Error Variance	9.093	***	0.12	9.573	***	4.63
Error Covariance	0.941	***	0.06			
N	2,981					
Log-Likelihood	-12,822.03					

Note: ***, **, and * indicate significance at 1%, 5%, and 10%, respectively.

Table 1.6: Chronic Poverty Model Parameter Estimates, 1990-1995

Variable	Months of FSP Participation			Chronic Poverty*100		
	Parameter		SE	Parameter		SE
Months of FSP Participation				-4.564	*	2.56
Intercept	9.760	***	2.67	16.522		23.93
Family Size	-0.812	**	0.41	-2.926		2.92
Additions to Family	-0.116		0.56	-2.366		2.86
Reductions in Family	0.882	*	0.52	2.420		3.48
Number of Children	4.006	***	0.47	20.298	*	10.56
Age of Head (10 years)	0.222		0.94	-1.805		4.81
Age of Head (10 years) Squared	0.005		0.09	0.346		0.45
Head is Married	-4.961	***	0.56	-19.994		13.07
Head is Male	-2.942	***	0.42	-15.588	**	7.93
Head is African American	3.609	***	0.50	19.360	**	9.57
Head is Other Race	2.840		1.77	7.429		11.92
Head is High School Graduate	-5.425	***	0.66	-27.871	**	14.29
Head has College No Degree	-8.337	***	-0.62	-44.253	**	21.45
Head has College Degree	-8.353	***	-0.68	-51.999	**	21.67
Time Spent Unemployed (Head & Spouse)	0.457	***	0.06	2.348	**	1.21
County Poverty Rate	0.200	***	0.03	1.288	**	0.54
Average Certification Period <3 Months	-4.977		3.18			
Average Certification Period 4-6 Months	-1.357		0.99			
Average Certification Period 7-9 Months	4.389	**	2.04			
Average Certification Period 10-12 Months	-2.502	*	1.40			
Error Variance	12.494	***	0.14	59.139	***	31.51
Error Covariance	0.984	***	0.02			
N	4,197					
Log-Likelihood	-17,747.88					

Note: ***, **, and * indicate significance at 1%, 5%, and 10%, respectively.

Table 1.7: Chronic Poverty Model Parameter Estimates, 1996-2005

Variable	Months of FSP Participation			Chronic Poverty*100		
	Parameter		SE	Parameter		SE
Months of FSP Participation				-1.523		1.38
Intercept	10.607	***	2.90	-21.643		14.15
Family Size	-0.182		0.40	1.476		1.26
Additions to Family	0.013		0.51	-0.897		1.77
Reductions in Family	0.887	**	0.41	1.219		1.88
Number of Children	2.573	***	0.47	4.737		3.86
Age of Head (10 years)	-0.599		0.93	-0.142		3.48
Age of Head (10 years) Squared	0.092		0.09	0.150		0.34
Head is Married	-3.892	***	0.51	-8.133		5.87
Head is Male	-2.118	***	0.37	-4.880		3.26
Head is African American	2.433	***	0.46	7.687	**	3.66
Head is Other Race	2.874	**	1.27	9.072	*	5.57
Head is High School Graduate	-6.399	***	0.63	-10.378		9.15
Head has College No Degree	-8.248	***	0.65	-18.074		11.66
Head has College Degree	-7.881	***	0.65	-21.122	*	11.25
Time Spent Unemployed (Head & Spouse)	0.545	***	0.05	0.984		0.76
County Poverty Rate	0.215	***	0.04	0.857	***	0.32
Average Certification Period <3 Months	-7.553	**	3.31			
Average Certification Period 4-6 Months	-0.302		1.89			
Average Certification Period 7-9 Months	-5.366		8.29			
Average Certification Period 10-12 Months	-3.372	**	1.70			
Error Variance	9.090	***	0.12	18.639	***	10.25
Error Covariance	0.809	**	0.23			
N	2,981					
Log-Likelihood	-11,547.75					

Note: ***, **, and * indicate significance at 1%, 5%, and 10%, respectively.

Appendix A

Table A1: Single Equation Tobit Estimates, 1990-1995

Variable	Transient Poverty*100			Chronic Poverty*100		
	Parameter		SE	Parameter		SE
Months of FSP Participation	0.050	***	0.006	0.091	***	0.024
Intercept	-1.446		1.215	-20.979	***	4.657
Family Size	0.050		0.201	0.940		0.734
Additions to Family	0.052		0.283	-1.983	*	1.144
Reductions in Family	0.686	***	0.266	-1.955	*	1.057
Number of Children	0.768	***	0.238	1.502		0.856
Age of Head (10 years)	-1.720	***	0.473	-2.787		1.788
Age of Head (10 years) Squared	0.177	***	0.044	0.312	*	0.167
Head is Married	-0.632	**	0.283	3.281	***	1.164
Head is Male	-0.141		0.226	-1.712	**	0.874
Head is African American	1.640	***	0.240	2.555	***	1.001
Head is Other Race	0.246		0.863	-5.039		5.031
Head is High School Graduate	-1.474	***	0.306	-2.704	***	1.066
Head has College No Degree	-3.113	***	0.331	-5.857	***	1.177
Head has College Degree	-5.454	***	0.494	-13.515	***	2.245
Time Spent Unemployed (Head & Spouse)	0.095	***	0.027	0.217	***	0.083
County Poverty Rate	0.1332	***	0.0174	0.359	***	0.072
Error Variance	4.342	***	0.223	10.676	***	0.845
N	4,197			4,197		
Log-Likelihood	-3,341.96			-1,240.32		

Note: ***, **, and * indicate significance at 1%, 5%, and 10%, respectively.

Table A2: Single Equation Tobit Estimates, 1996-2005

Variable	Transient Poverty*100			Chronic Poverty*100		
	Parameter		SE	Parameter		SE
Months of FSP Participation	0.052	***	0.009	0.132	***	0.034
Intercept	-0.729		1.322	-35.209	***	8.897
Family Size	0.439	**	0.198	1.697	*	0.952
Additions to Family	0.126		0.282	-0.914		1.545
Reductions in Family	0.369	*	0.224	-0.280		1.198
Number of Children	0.016		0.234	0.485		1.199
Age of Head (10 years)	-1.463	***	0.540	1.109		3.020
Age of Head (10 years) Squared	0.117	**	0.051	-0.031		0.272
Head is Married	-0.619	**	0.266	-1.458		1.554
Head is Male	-0.408	**	0.198	-1.339		1.184
Head is African American	1.201	***	0.246	3.740	***	1.331
Head is Other Race	0.236		0.731	4.357		3.979
Head is High School Graduate	-0.934	***	0.301	0.363		1.353
Head has College No Degree	-1.724	***	0.331	-4.383	**	1.834
Head has College Degree	-3.480	***	0.406	-8.068	***	2.289
Time Spent Unemployed (Head & Spouse)	0.067	***	0.026	0.097		0.099
County Poverty Rate	0.130	***	0.021	0.510	***	0.124
Error Variance	3.262	***	0.187	10.980	***	1.373
N	2981			2981		
Log-Likelihood	-2019.89			-739.66		

Note: ***, **, and * indicate significance at 1%, 5%, and 10%, respectively.

ESSAY 2

The End of the Paper Era in the Food Stamp Program: The Impact of Electronic Benefits on Program Participation

Introduction

The United States Department of Agriculture's (USDA) Food Stamp Program (FSP), a joint effort of federal and state governments, was launched in 1965 to provide food benefits to low-income households. By 2005, the program had become the cornerstone of the US social safety net, reaching 25 million households, with approximately $29 billion in benefits annually (USDA, Food and Nutrition Service). For those who participate, food stamps have been found to provide positive benefits in terms of increased food consumption or household expenditures in general, improvements in food intake and diet quality, and more stable consumption in the face of adverse shocks.

However, there are also a substantial number of eligible families that do not participate in the program. Recent estimates by several USDA studies suggest that about 55 percent of those eligible for the program actually participate (USDA, 2003). As the effectiveness of the program depends on the extent to which eligible persons take up the benefits to which they are entitled, many federal and state level changes were introduced to the FSP to improve accessibility. The state level changes focused mostly on the application and recertification process, and outreach spending, while the federal government increased state flexibility. For instance, new regulations in the 1990s specified that states could require families with earnings to file reports either every three months or only when a change occurred, and face-to-face interviews had to be conducted only once a year. Many states also began implementing outreach programs to reach out to

eligible people who do not participate in the program. In addition to providing outreach materials, the USDA Food and Nutrition Service also provides grants to non-profit organizations that work to improve access to the FSP by low-income families.

An important innovation in program administration was the federal government initiative to introduce electronic benefits to replace the paper coupon based system, which had become highly inefficient due to the high cost of administering and delivering benefits and its vulnerability to fraud, waste, and abuse. The first Electronic Benefit Transfer (EBT) pilot in Reading, Pennsylvania (1984) confirmed EBT's potential advantages in delivering FSP benefits and led to the launch of a standard nationwide system to deliver benefits electronically in 1993 (Federal Electronic Transfer Task Force, 1994). In 1996, the Personal Responsibility and Work Opportunity Reconciliation Act (PRWORA) required all states to issue food stamps electronically by 2002. In June 2004, the USDA announced that distribution of all federal food stamp payments had been successfully converted from paper coupons to plastic EBT cards in all states, putting an end to the "paper era" of the food stamp program.

Another major reason for the transition from paper coupons to EBT cards was the greater convenience EBT offers for recipients by reducing the social stigma and embarrassment felt by recipients when using paper coupons. Welfare stigma contributes to high costs of participation, therefore deterring families from seeking benefits. Since Moffitt's (1983) first explicit treatment of welfare stigma in household decisions, a vast literature has emerged identifying stigma as an important factor contributing to nonparticipation in welfare programs (Blank and Ruggles, 1996; Daponte et al., 1999; Ponza et al., 1999). Since welfare stigma is difficult to measure and address directly, the common approach in these studies is to use household characteristics to proxy for the psychological costs associated with welfare program participation.

Evidence of EBT program impacts on FSP participation is mixed. A qualitative study by Ponza et al. (1999) found that when surveyed, nonparticipating eligible individuals were more likely to indicate that they would participate in the FSP if benefits were provided through EBT cards than via paper coupons. A study by Banks (2003) suggests that when food stamp recipients no longer have to present paper coupons in public, stigma is reduced, leading to higher participation rates among eligible households. A more comprehensive study by Hofferth (2003) found that the EBT was associated with lower rates of exit from the FSP.

On the other hand, an overwhelming number of studies find that there is no link between the implementation of statewide EBT systems and FSP participation rates or that the impact is restricted to specific sub-groups of the eligible population. An evaluation of the EBT program in Maryland, the first state to implement the system statewide in 1993, found that there was no discernable EBT program impact on participation rates (USDA, 1994). Kornfeld (2002) finds that the statewide EBT system increased FSP caseloads for households with adults and children, but lowered FSP participation among elderly persons living alone. Similarly, a study by Kabbani and Wilde (2003) suggests that the adoption of the EBT system increases participation rates only among nonworking households. McKernan and Ratcliffe (2003) find that the presence of EBT only has an impact on FSP participation among the most economically disadvantaged households. Comparing participation among different populations, Currie and Grogger (2001) identify only marginally significant positive effects of EBT on the participation of married households without children and in rural areas. Finally, Ziliak et al. (2000) find no significant relationship between the existence of an EBT system and FSP caseloads.

While the existing literature provides some insights into whether the new EBT system changed FSP participation rates, some limitations are apparent. Research on the impact of EBT on

program participation generally focused on food stamp caseloads, and either examined the food stamp caseload as a whole or considered broad subpopulations such as working and nonworking families, rural and urban families. The only exception is Hofferth (2003), who looked at individual participation behavior. Since participation decisions are made at the household level, using household-level data can lead to better estimates of the role of EBT adoption in the FSP participation decision. Studies that use household-level data to examine FSP participation exist in the literature; however these studies typically employ reduced form approaches that model FSP participation probabilities (Gundersen and Oliveira, 2001; Haider et al., 2003; Hanratty, 2006; and McKernan and Ratcliffe, 2003). Since participation decisions are ultimately the result of comparing utilities from participation and non-participation, household-level data can be used to analyze the factors that influence utility directly.

Another major limitation with the existing studies is the variable used to measure the existence of the EBT system. The common approach is to use an indicator variable for the presence of a statewide EBT system. In an effort to capture the timing of the implementation of the EBT system in a state, several studies included the proportion of the fiscal year in which a statewide EBT system was in effect. While using the presence of an EBT system statewide enables some control for the potential effects of the system, there is a great deal of variation in the timing of the adoption of EBT technology, an underexploited source of variation that may be highly relevant to program outcomes in terms of participation rates.

This paper addresses these modeling and data limitations in the existing literature on the impact of EBT on FSP participation. First, since electronic cards replaced paper coupons in all states in 2004, no updates have been made to existing studies examining state FSP participation dynamics or individual participation behavior. This paper is the first to examine the role of the EBT system

on individual FSP participation behavior across the entire period of nationwide adoption. The study uses Panel Study of Income Dynamics (PSID) data, which limits the analysis to the period of 1994-2003, however this does not pose a major problem since by 2004 almost all states had completed statewide implementation of EBT systems. Second, FSP participation decisions are modeled at the household-level using a structural model to disentangle household, FSP policy and economic effects on FSP participation. Third, a different measure for EBT system adoption is used. Until statewide implementation was achieved in each state, food stamps were delivered both as coupons and debit cards. A measure of state-level EBT penetration, represented by the percentage of food stamps issued via EBT cards in a given year, is developed.

The rest of the paper is organized as follows. The next section describes the empirical framework. Section 3 presents the data sources used in this study, and section 4 provides the descriptive statistics for the covariates used in the models. Section 5 presents the results, while section 6 discusses policy implications and concludes.

Empirical Model

The analytical framework specifies the household's FSP participation decision using a structural approach (Moffitt, 1983). Assume that the household is aware of their eligibility and makes the decision to participate in the FSP only if the utility from participation exceeds that of nonparticipation. If the household derived utility only from disposable income Y (i.e. participation in FSP were costless), then utility from participating would always exceed the utility from not participating for eligible families. However, in reality, welfare program participation is associated with costs that lead to disutility from participation. Such costs can be direct and include gathering information about application and eligibility conditions, traveling to

the welfare office, or indirect such as filing an application, and welfare stigma. This implies that the household chooses to participate or not in the FSP by comparing the relative benefits and costs of participation.

More formally, define the utility difference $P^* = U\big(Y + P_F F, P_F C(M,S)\big) - U(Y)$, where P_F is a FSP participation variable equal to one if the household participates and zero if not, F is FSP benefits available to the household, and $C(M,S)$ is the cost of FSP participation. The cost function has two components: M represents direct costs in terms of the money and time required to apply for food stamp benefits, whereas S refers to the stigma costs and indicates the distaste a household might feel about receiving public assistance. A way of portraying the household's participation decision is to solve for the minimum or required food stamps F^* the household must receive in order to participate in the FSP by setting the net utility of participation $P^* = U\big(Y + P_F F^*, P_F C(M,S)\big) - U(Y) = 0$ (Levedahl, 1995). According to this specification, the household's decision can then be portrayed as:

(2.1) $$P_F = 1 \quad if \quad F - F^*(z) \geq 0$$
$$P_F = 0 \quad if \quad F - F^*(z) < 0$$

where z includes household characteristics and program characteristics that directly affect participation. A household will be uncertain about both the amount of FSP benefits required for its participation and the FSP benefits it can actually receive. Thus the participation decision has a random element and can therefore be expressed as:

(2.2) $$P_F = 1 \quad if \quad F - F^*(z) - \varepsilon \geq 0$$
$$P_F = 0 \quad if \quad F - F^*(z) - \varepsilon < 0$$

where ε is an error term.

The decision underlying the structural equation (2.2) is based on a comparison of utilities from participation and non-participation in the FSP. Higher level of benefits available to the household will increase the disposable income of the household, increasing their utility. However, costs of participation in the program reduce their utility either directly through stigma or by reducing the disposable income through monetary costs, and thus affect minimum amount of food stamps required for the household to participate in the program. It is well established in the literature that both direct and indirect costs are a function of household characteristics, economic conditions and policy variables. For instance, geographic isolation and availability of public/private transportation the welfare office affects the monetary cost of participating in the FSP (Blank and Ruggles, 1996). Therefore it may not be worthwhile for households with high transportation costs to apply for program benefits. On the other hand, some individuals such as those with low education levels may have lower stigma, and therefore would require a lower level of minimum benefits to participate in the program.

Estimation

The structural FSP participation equation (2.2) can be extended to a panel data binary choice model with individual specific effects:

$$S_{it} = Z_{it}\beta_Z + K_i\beta_K + a_i + \varepsilon_{it}, \quad P_{F,it} = 1[S_{it} \geq 0] \tag{2.3}$$

where $S_{it} = F_{it} - F_{it}^*$, Z_{it} includes time-varying household characteristics, K_i includes variables that do not vary over time, a_i captures unobserved household characteristics, and ε_{it} is an error term, normally distributed and uncorrelated with $Z_i = (Z_{i1}, \dots, Z_{iT})$, K_i and a_i. The econometric difficulty with estimating equation (2.3) is that we only observe whether a household participated in the FSP and the level of FSP benefits obtained conditional on participation. Also, the

minimum amount of FSP benefits required for the household to participate is not observed. Many previous applications have largely ignored this problem and estimated the reduced form of equation (2.3) using standard panel data techniques (Gundersen and Oliveira, 2001; Haider et al., 2003; Hanratty, 2006; and McKernan and Ratcliffe, 2003). The disadvantage of the reduced form approach is that the direct effect of household, economic and policy variables on the FSP participation choice cannot be distinguished from the indirect effect of these characteristics on the choice to participate in the program through expected level of FSP benefits.

This problem can be addressed by generating selectivity corrected FSP benefits to include in equation (2.3) using the FSP benefits equation:

$$F_{it} = X_{it}\beta_X + Y_i\beta_Y + b_i + u_{it} \tag{2.4}$$

where F_{it} is observed only if $S_{it} \geq 0$, X_{it} includes time-varying household characteristics, Y_i includes variables that do not vary over time, b_i captures unobserved household characteristics, and u_{it} is an error term. If the sample selection process is constant over time, standard panel data estimators could be applied to eliminate selection bias (Dustmann and Rochina-Barrachina, 2007). Recently, various panel data estimators that correct for selection bias associated with time varying characteristics were suggested in the literature. The most widely used estimators, developed by Wooldridge (1995) and Kyriazidou (1997), both assume strict exogeneity of regressors, while later applications mainly focused on extending these estimators to handle endogenous regressors (Kyriazidou, 2001; Lewbel, 2002; Semykina and Wooldridge, 2006; Dustmann and Rochina-Barrachina, 2007).

In the current application, the endogeneity problem may arise if income is included in the FSP participation equation since labor force participation decisions (a direct determinant of income) are likely to be made jointly with welfare participation decisions by the household (Keane and

Moffitt, 1998). In order to circumvent this problem, a number of covariates that influence income indirectly (family composition, gender, education, involuntary unemployment, etc.) are included in the analysis. With the exclusion of income as a potentially endogenous variable, the appropriate estimators to consider are those by Wooldridge (1995) and Kyriazidou (1997).

This paper utilizes the Wooldridge (1995) approach to obtain selectivity corrected predicted FSP benefits, which are then used as an additional explanatory variable in the third stage estimation of the structural FSP participation equation (2.3). There are several reasons the Wooldridge estimator is preferred over Kyriazidou's estimator. First, Wooldridge's estimator is a simple and practical application of Heckman type sample selection methods to panel data (Vella, 1998; Baltagi, 2005). Second, the Kyriazidou (1997) method draws on individual differences over time and thus requires substantial variation over time in the explanatory variables, which are unfortunately rare. By contrast, the Wooldridge (1995) approach can accommodate slight variation over time. (Beblo et al., 2003; Ooms and Hall, 2005). Third, and most importantly Kyriazidou (1997) employs a conditional fixed effects logit model in the first stage, which controls for unobserved heterogeneity by focusing on changes in individual's participation status over time, and drops those individuals whose participation status did not change (Chamberlain, 1980; Maddala, 1987), resulting in a significant loss of information. In other words, Chamberlain's approach relies on conditioning the likelihood function on the sum of each individual's outcomes $\sum_t P_{F,it}$ and maximizes the function

$$L = \prod_i Prob\left(P_{F,i1}, \ldots, P_{F,iT} \middle| \sum_t P_{F,it}\right) \tag{2.5}$$

where individuals whose participation status did not change over time, i.e. $\sum_t P_{F,it} = 0$ or $\sum_t P_{F,it} = T$ do not contribute to the likelihood function.[3]

Wooldridge's (1995) approach deals with this information loss by employing a correlated random effects (also called quasi-fixed effects) probit model developed by Mundlak (1978) and Chamberlain (1984). The key insight of this approach is that instead of assuming strict exogeneity at one extreme (random effects) or making no assumptions at the other (fixed effects), one can specify parametrically the relationship between the unobservable heterogeneity and the observable heterogeneity. Specifically, this approach allows for correlation between the individual effects and the explanatory variables by adding the means (over time) of the time-varying explanatory variables as control variables.

Following Wooldridge (1995) write a_i as a linear projection onto the time averages of Z_{it}, denoted $\bar{Z}_i$, and an error c_i. Then, the participation equation (2.3) can be rewritten as:

$$S_{it} = Z_{it}\theta_Z + K_i\theta_K + \bar{Z}_i\theta_{\bar{Z}} + v_{it} \tag{2.6}$$

where the composite error term $v_{it} = c_i + \varepsilon_{it}$ is independent of Z_{it}, and normally distributed. Wooldridge (1995) imposes what he calls conditional mean independence assumptions and specifies the relationship between u_{it}, b_i, and v_{it}. First, u_{it} is a linear function of v_{it} and mean independent of Z_i conditional on v_{it}. Second, similar to the selection equation, the unobserved effect is modeled as a projection of b_i onto $(\bar{X}_i, v_{it})$ and an error term d_i. This method

[3] The basic idea can be illustrated for $T = 2$. The sum $P_{F,i1} + P_{F,i2}$ can be 0, 1, or 2. If it is 0, both $P_{F,i1}$ and $P_{F,i2}$ are 0, and $Prob\left(P_{F,i1} = 0, P_{F,i2} = 0 | P_{F,i1} + P_{F,i2} = 0\right) = 1$. Similarly, if the sum is 2, both $P_{F,i1}$ and $P_{F,i2}$ are 0, and $Prob\left(P_{F,i1} = 1, P_{F,i2} = 1 | P_{F,i1} + P_{F,i2} = 2\right) = 1$. These terms do not contribute to the log-likelihood function since $\log(1) = 0$. Therefore, only observations for which the sum $P_{F,i1} + P_{F,i2}$ equals 1 matter in the likelihood function (Baltagi, 2005).

specifically models the unobserved effect such that b_i and (X_{it}, v_{it}) are correlated. Under these assumptions, the FSP benefits equation (2.5) can be rewritten as:

$$F_{it} = X_{it}\theta_X + \bar{X}_i\theta_{\bar{X}} + Y_i\theta_Y + \psi_t\lambda_{it} + \epsilon_{it} \tag{2.7}$$

where $\epsilon_{it} = d_i + \omega_{it}$, and ω_{it} is the remaining part of u_{it} after including the inverse Mills ratios, λ_{it}. To complete the estimation procedure, Wooldridge (1995) proposes estimating the selection equation (2.6) with standard probit methods for each t and obtaining the inverse Mills ratios from each one. The parameters of the FSP benefits equation can then be consistently estimated by using a pooled linear regression with the observed data, and replacing λ_{it} by $\hat{\lambda}_{it}$. Once the FSP benefits equation is estimated consistently, the level of FSP benefits can be predicted for households who receive and do not receive food stamps. Predicted FSP benefits can then be used in the estimation of the structural FSP participation equation (2.6) as an explanatory variable. The steps in the estimation procedure can be summarized as:

1) Estimate T cross-sectional probits and obtain inverse Mills ratios $\hat{\lambda}_{it}$ for each t.
2) Obtain consistent estimates of the FSP benefits equation including the inverse Mills ratios $\hat{\lambda}_{it}$ using a pooled linear regression, and generate predicted FSP benefits for households who receive and do not receive food stamps.
3) Estimate the structural selection equation using a correlated random effects specification with the predicted FSP benefits as an explanatory variable.

Variables and Data

For identification, the reduced form participation equation should include all variables that affect both the FSP participation decision directly and the level of FSP benefits. Variables that directly influence benefit levels are likely to affect participation propensity, however the costs associated

with program participation, especially stigma, are likely to play a role in the participation decision, and not influence benefit levels. In order to achieve identification, state-level average recertification periods, distance to the closest welfare office, state-level EBT penetration rates, and the percentage of the population receiving food stamps in the county of residence are included in the reduced form participation equation as they directly influence the propensity to participate in the FSP, and are excluded from the FSP benefits equations. State-level average recertification periods and the EBT system were used in similar contexts to identify the FSP participation equation (Mykerezi, 2008; Yen et al, 2008; Gundersen and Oliveira, 2001). Distance to the welfare office is a proxy for transportation costs and therefore a key determinant of FSP participation (Gundersen and Oliveira, 2001; Blank and Ruggles, 1996). The percentage of the population receiving food stamps in the county of residence is included to control for the attitude of the community towards public assistance, which affects the psychological costs of participation. These variables only influence costs of program participation and have no direct influence on benefit levels, and therefore make valid instruments.

In order to achieve identification of the structural participation equation, the FSP benefits equation should include at least one variable that does not influence the participation propensity. If this condition is not satisfied, the inclusion of predicted FSP benefits in the structural participation equation may generate collinearity issues since predicted FSP benefits are obtained from the reduced form equation that includes all explanatory variables. In order to deal with this problem, home ownership and time spent unemployed by the household head[4] are excluded from the structural participation equation. Time spent unemployed is an indicator of income and

[4] This variable refers to involuntary unemployment since it represents the actual number of weeks the household head missed due to unemployment or temporary layoff. The time the head did not have a job and was not looking for one is recorded as a separate variable in PSID.

therefore affects FSP benefit levels directly. There is evidence that welfare program participation generates work disincentives; however since this variable refers to involuntary unemployment, it influences the decision to participate in the program only through its impact on FSP benefits. The validity of home ownership as an instrument is less clear as it is expected that a large percentage of FSP participants do not own their homes. However, in the low-income sample considered in the study, about one quarter of the households that participate in the program own their homes. Further, home ownership has been used in a number of studies as a proxy for assets (Gundersen and Oliviera, 2001; McKernan and Ratcliffe, 2003; Haider et al., 2003). Therefore, home ownership is also likely to play a key role in determining FSP benefits levels.

The reduced form participation equation includes three groups of covariates that influence the FSP participation propensity and/or the level of FSP benefits. Family demographic and structure characteristics include number of adults, number of children, home ownership, number of weeks spent unemployed by the household head, as well as the age, gender, marital status and race of household head. Family educational assets are measured by discrete indicators of education level of the household head (no high-school degree, high-school degree, some post-secondary education but no college degree, and a college degree). Location attributes are measured by county unemployment rates and an indicator of residence in the rural South.

The primary source of data for the analysis comes from the PSID waves of 1994-2003. PSID is a long-term panel that started in 1968 with a sample of roughly 5,000 households (3,000 nationally representative households and an over sampling of 2,000 low-income households). The original families and the families of their offspring were followed. Thus, by 2001 over 7,000 families are included in the sample. The analysis is conducted on a sample of low-income households with annual income less than twice the official poverty line to capture the population that is the most

likely to be eligible to participate in the FSP.[5] Specifically, the sample was constructed as follows. First, in each period households that have an annual income less than twice the official poverty line are selected. Second, information on these households in other periods (even if they are not low-income households in other periods) is added to these period specific low-income household samples, which are then stacked together to construct the panel. This results in a panel of households that have an annual income less than twice the official poverty line in at least one survey period.

A unique strength of the PSID data is that information on residence is available at both the zip code and the county level, enabling the estimation of the impacts of local conditions and neighborhood characteristics on social assistance. First, a measure of distance to the nearest FSP office is employed for each household as the distance from the zip code of the household to the zip code of the closest FSP office.[6] Second, the number of FSP recipients at the county-level obtained from the U.S. Census Bureau of Small Area Income and Poverty Estimates (SAIPE), and is divided by county population estimates obtained from the U.S. Census Bureau to obtain the percentage of the population receiving food stamps in the county of residence. County unemployment rates obtained from the Bureau of Labor Statistics (BLS), and an indicator of residence in the rural South generated using the Beale codes obtained from the USDA are employed to account for the neighborhood conditions in the county in which the household resides.

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[5] The gross income test for eligibility requires that a household's before tax income the previous month must be at or below 130% of the poverty line. However, monthly incomes are not reported in the PSID, making it difficult to assess eligibility. Following a number of previous studies, a low-income sample based on annual incomes is constructed to capture the households that are the most likely to be eligible to participate in the FSP. This assumption is further supported by the data: about 90 percent of FSP participants are also low-income households.

[6] If the household resides in a zip code where there is a FSP office, distance is zero miles, otherwise, it is measured as distance to nearest FSP office within the same state.

Data on FSP participation by issuance system (paper coupon, EBT cards, and cash-out demonstrations) from the USDA FNS FSP State Activity Reports for the years 1994-2003 is used to construct state level EBT penetration rates. Information on state-level certification periods is obtained from the FSP Quality Control (FSPQC) database which is generated from monthly quality control reviews of FSP cases by state FSP agencies.

Descriptive Statistics

Figure 2.1 presents FSP participation rates for the low-income sample. Overall, the participation rates among the low-income population are low and tend to decline over time, especially following the 1996 Personal Responsibility and Work Opportunity Reconciliation Act (PRWORA). These households represent the most likely population to be eligible to participate in the program, and therefore observed low participation rates constitute a major concern to policy makers. In contrast to declining participation rates, average FSP benefits received by households that participate in the program increase over time (table 2.1).

Table 2.2 summarizes the evolution of the EBT program in all states since it was first initiated in 1994. On average, statewide EBT implementation was slow in the beginning, with only a few states adopting the new technology. In 1998, average EBT penetration rates started climbing steadily, and reached an average of 92 percent by 2003. There is however a great deal of variation in the EBT penetration rates across states across the entire period of nationwide implementation. Also, the pace at which the system was operational statewide varies significantly across states. For instance, while Iowa is one of the early adopters, statewide implementation took place at a very slow rate and was not achieved until 2004. In comparison,

some states, including District of Columbia, Hawaii, Rhode Island, Tennessee, and West Virginia completed the switch to the EBT system from paper coupons in only one year.

Descriptive statistics for other covariates for households participating in the FSP in all periods, in at least one period and for those that never participated in the FSP are provided in table 2.3.[7] Household characteristics display expected differences when comparing FSP participants and non-participants. The typical food stamp receiving household has a smaller number of adults and more children than a non-participant household. For instance, families that participated in the FSP in all periods have an average of 1.4 adults and 2.2 children, those who participate in at least one period have 1.6 adults and 1.6 children whereas the average non-participant family has 1.6 adults and 0.8 children. Taking the more educated spouse to be the head of the household for married families and the reported head for families with other marital status, the food stamp receiving households have younger household heads: the average age of the household head is 45 years for FSP participants in all periods, 41 years for those who receive food stamps in at least one period, and 48 years old for non-participants. The head of the average FSP participant families was unemployed longer (4.3 weeks for those in receipt in all periods and 4.7 weeks for those who participated in at least one period) than the head of the average non-participating family (2.5 weeks).

A larger percentage of food stamp receiving households do not own their homes, are headed by an African-American or by a single mother compared to non-participants. For instance, the proportion of households with an African-American head is 84 percent of those families that participate in the program in all periods and 67 percent of those that received food stamps in at

[7] Descriptive statistics are not presented for each year separately since means and standard deviations of covariates do not show significant variation over time.

least one period whereas only 41 percent of non-participants are headed by an African-American. Single mother headed households constitute 64 percent of participants in all periods, 45 percent of participants in at least one periods 51 percent of participants, and 14 percent of non-participants. Food stamp receiving households also have heads with lower levels of educational attainment than heads of non-participating households.

With respect to economic and policy variables, differences between FSP participants and non-participants appear to be smaller. The percentage of households residing in the rural South is comparable across FSP participants (18 percent for those in receipt in all periods and 15 percent for those in receipt in at least one period) and non-participants (15 percent). On the other hand, food stamp receiving households tend to reside in counties with higher unemployment rates and with a higher percentage of FSP recipients compared to non-participants. Also, FSP recipients live slightly closer to the nearest FSP office than non-participants. Finally, state-level policy variables, namely average certification periods and EBT penetration rates, vary only slightly across samples and FSP participants and non-participants.

Results

In this section, estimation results are presented. The discussion focuses on the parameter estimates of the third stage structural FSP participation equation since the role of the first two stages of estimation is to obtain selectivity corrected FSP benefits. As such, the coefficient estimates for the reduced form cross-sectional FSP participation equations and the FSP benefits equation are provided in Appendix B. One finding to note from these results is that the inverse Mills ratio used for sample selection correction is significant at the 5% level, supporting the assumption of selection bias. The positive coefficient on the inverse Mills ratio in the second

stage regression implies that the correlation between the FSP benefits equation and the reduced form participation equation errors is positive, meaning that unobserved effects tend to influence the probability of receiving food stamps and the level of food stamp benefits in the same direction. Failure to account for this selection bias will yield biased and inconsistent estimates in the FSP benefits equation, which is used to obtain predicted FSP benefits.

In addition to presenting the parameter estimates of the structural participation equation, this section also reports the average partial effects (APEs) for the covariates employed in the model, as the coefficients from the nonlinear model do not have a straightforward interpretation. The APEs are computed by calculating individual marginal effects using individual characteristics and averaging these over the sample. APEs are arguably more appropriate than taking the marginal effects at the mean of the independent variables, as sample mean characteristics might not realistically represent the actual households (Bartus, 2005). For a continuous variable, the APE can be estimated by taking the derivative of the predicted probability with respect to the variable in question. For dummy variables, the APE is calculated by first predicting the probability when the dummy variable is one and predicting the probability when the dummy variable takes the value of zero, and then averaging the difference between the two probabilities over households in the sample.[8]

Parameter estimates of the structural FSP participation equation are presented in table 2.4. Results suggest that the percentage of FSP benefits delivered via EBT cards in the state has a positive effect on the probability of applying for and receiving food stamps. Although the magnitude of the impact of state EBT penetration rates on participation propensities is small (a 1

[8] APEs were generated using the STATA routine margeff, developed by Tamas Bartus of Boston College.

percent increase in the percentage of food stamps delivered with EBT cards increases the average household propensity to participate in the FSP by less than 1 percent), this clearly indicates that the switch from paper coupons to EBT cards induces participation among eligible households, most likely by reducing the stigma associated with FSP participation.

An alternative way to look at the impact of EBT on participation probabilities is to examine the distribution of household level partial effects associated with statewide EBT penetration rates. Figure 2.2 presents the kernel density estimates of these effects.[9] The estimated density of the household-level partial effects shows that there is a concentration of households around a low value of 0.01 percent and a high value of 0.08 percent. Further, the density is steeper close to the lower value, which means that for a larger percentage of households, statewide EBT penetration rates has a smaller than average impact on participation probabilities. Still, there is a considerable proportion of households for which the partial effect of statewide EBT penetration rates is high.

It is also important to consider regional differences that may exist with respect EBT's impact on household participation probabilities. In order to analyze the differential impact the system had on different regions, the structural participation equation was estimated using an extended specification with interaction effects between statewide EBT penetration rates and region dummies that include the Northeast, North Central, South Central, South Atlantic, Pacific and Mountain, with South Atlantic taken as the reference category[10]. Parameter estimates are then used to evaluate household level partial effects associated with statewide EBT penetration rates

[9] Kernel density estimates were obtained using a Gaussian kernel with the default optimal bandwidth, i.e. the width that would minimize the mean integrated squared error (between the true and estimated densities).

[10] A list of the states that constitute each region is provided in table B4 in Appendix B.

by region. Kernel density estimates of these effects are presented in figure 2.3 for all regions for comparison even though parameter estimates of the structural participation equation (provided in table B5 in Appendix B) indicate that statewide EBT penetration rates have a differential impact on participation only in the Pacific region (relative to the reference category South Atlantic). Overall, the distribution of the partial effect associated with the EBT system is very similar across regions, with one notable difference. Statewide EBT penetration rates appear to have a larger effect on the probability of participating in the FSP for households residing in the Pacific and North Central regions relative to the other regions. In fact, the partial effect is larger than one percent for most households in these regions while one percent is not even reached in all other regions. One explanation for this may be that most of the states in these regions, especially those in the Pacific region, requested and received waivers of certain FSP regulations governing the EBT systems in order to promote the operational efficiency of the EBT system during implementation.[11] These waivers allow recipients to select their personal identification number (PIN) and to receive EBT training by mail rather than in-person, and extend the time for card replacement (Kirlin and Logan, 2002). These EBT customer service waivers are likely to make it more convenient for both FSP recipients and states, therefore increasing the effect of the EBT system on the propensity to participate in the program.

The effect of the switch to the EBT system on the probability of program participation is consistent across different specifications. Parameter estimates associated with the EBT system from alternative models are presented in table 2.5. These specifications are estimated using different measures for the EBT system: state EBT penetration rates, proportion of fiscal year

[11] By 2002, FNS granted EBT customer service waivers to 37 states. In the Pacific region, Alaska, Hawaii and Washington received 3 waivers, and California and Oregon 2 waivers. In the North Central region, Michigan, Wisconsin, Minnesota and Missouri received 3 waivers, Indiana, Iowa, North Dakota and South Dakota 1 waiver, and Illinois, Kansas and Nebraska received none (Kirlin and Logan, 2002).

with a statewide EBT system, and a discrete indicator for the presence of a statewide EBT system. Some specifications also include the number of months it took for a state to complete the implementation of statewide EBT systems after the initial pilot is used to control for possible unobserved state level effects that affect the states' effectiveness in implementing EBT systems. An additional concern is that the sample of households that have low income in at least one period may include families who are poor only short-term since there is a great deal of movement in incomes over time. In order to capture behavior among the long-term poor, alternative models are estimated for households with low income levels in most of the periods.[12] Finally, in an effort to examine the impact of FSP policies on participation behavior among households with very low-income levels, alternative models using state EBT penetration rates and the proportion of fiscal year with a statewide EBT system are estimated for households with incomes below 150 and 130 percent of the poverty line (in at least one period) separately.

State EBT penetration rates and the proportion of fiscal year with an EBT system are closely linked to each other, and therefore produce identical results with respect to the parameter estimate associated with the EBT system. In addition, controlling for the state's effectiveness in implementing EBT systems does not affect the parameter estimate associated with the EBT system. On the other hand, the discrete indicator does not appear to have an effect on the probability of FSP receipt, which may be one reason previous studies found little impact of the EBT system on FSP participation rates. The effect of a statewide EBT system, whether it is measured by state EBT penetration rates or the proportion of fiscal year with an EBT system, is larger for lower-income households (compared to the original low-income sample). Results are

[12] Specifically, households with incomes below 200 percent of the poverty line in at least four of the seven periods are included in this sample. Alternatively, households with low income in all periods may also be considered as a separate sample. However this results in a very restricted sample with a small number of households and almost no variation in household characteristics, making estimation difficult.

virtually identical for households with incomes below 150 and 130 percent of the poverty line; a 1 percent increase in the presence of a statewide EBT system increases the propensity to participate by 0.03 percent in both samples independent of the measure used for the statewide EBT system.

The other state-level policy variable, average recertification periods, is an important aspect of the FSP that makes participation in the program difficult due to costs associated with frequent recertification. It is a federal requirement to recertify families at least once a year; however some states choose to implement shorter intervals in an effort to lower program error rates (Hanratty, 2006). Surprisingly, average recertification periods do not appear to have an influence on the probability of participating in the FSP.

Turning to the other covariates, an important finding is that households expecting higher levels of benefits are more likely to participate in the program, even after controlling for number of children and other factors that influence both benefit levels and participation. Most of the factors hypothesized to have an influence on the cost of participating in the program play a role in the participation decision. For instance, older household heads are less likely to participate in the FSP than younger heads, which may reflect the difficulty associated with the application process or the stigma with public assistance surrounding older individuals. Surprisingly, number of children does not appear to have an effect on the probability of FSP participation. Results also indicate that a number of household characteristics that are often associated with difficulty of workforce entry play a role in the FSP participation decision. In particular, single motherhood, minority status and low educational attainment increase the probability of participating in the FSP among low-income households.

Location attributes also affect the probability of FSP receipt. For instance, households may face differing levels of disutility from participation based on attitudes towards public assistance in their communities. Percentage of population receiving FSP benefits in the county, included in the participation equation to account for such effects, is associated with positive impacts on the likelihood of FSP participation. Residing in the rural South also increases the likelihood to participate in the FSP. The distance to the closest FSP office is a rough proxy for transaction costs associated with applying for food stamps and is expected to decrease the probability of FSP receipt. Estimation results support this hypothesis.

An important question this study seeks to answer is how the EBT system impacted participation propensities among eligible populations and regions. In order to assess whether the switch to the EBT system had a different impact on some groups of households and regions, the structural participation equation is estimated with interaction terms between state EBT penetration rates and variables of interest. Parameter estimates for the structural participation equation are then used to calculate the average partial effect associated with state EBT penetration rates for subgroups defined by certain household characteristics including single motherhood, minority status, level of educational attainment and residence in the rural South.

Table 2.6 presents the average partial effect associated with state EBT penetration rates for these subgroups. Parameter estimates for the structural participation equation, presented in table B6 in Appendix B, indicate that the differential impact of statewide EBT systems on participation is statistically significant for all subgroups except for households with low education levels. Overall, the EBT system increases participation propensities among all subgroups, with the APE varying significantly across some groups. The EBT system has the largest effects on participation probabilities among households residing in the rural South, those not headed by

single mothers or those with a White head. The likelihood of participating in the FSP due to the switch to EBT systems is also larger among these households when compared to their counterparts. For instance, the switch to the EBT system increase the participation propensity among households not headed by a single mother almost 5 times more than the increase among single mother headed households. One explanation for this finding may be that non-participation among these households is more due to the psychological cost associated with using food stamp coupons publicly. If this is the case, these households will likely experience the largest reductions in welfare stigma with the introduction of EBT cards, generating larger rates of increase in participation propensities.

Discussion and Conclusions

In June 2004 the USDA announced that all states successfully converted from paper coupons to plastic EBT cards, putting an end to the "paper era" of the food stamp program. One goal of the switch to the new system was to induce eligible families to participate in the program. However, actual FSP participation rates over the implementation period do not appear to indicate that this was the case. In fact, there is a slight increase in the percentage of households taking advantage of the FSP from 1994 to 1995, and a steady decline in FSP participation rates following the welfare reform.

The trend in aggregate FSP participation rates in the EBT implementation period does not however necessarily indicate that the switch to EBT system had no impact on FSP participation. Using the percentage of food stamps issued via EBT cards in a given year to measure state-level EBT penetration rates, this study explores the impact of the new technology on FSP participation and finds that state-level EBT penetration rates do have a positive impact on program

participation probabilities among low-income households. This finding contradicts previous studies that found no link between the EBT system and participation rates. The result implies that when a better measure is developed to evaluate the presence of the system, the switch from paper coupons to EBT cards was in fact successful in reducing stigma among eligible households or participants and inducing participation in the program. The magnitude of the impact of state level EBT penetration rates on participation probabilities is however very small (a 1 percent increase in state EBT penetration rates increases the average household propensity to participate in the FSP by less than 1 percent). The regional distribution of the impact of EBT is even across regions, with the exception of the Pacific region experiencing large increases in participation propensities due to the EBT system. The switch to EBT cards also has an uneven impact on various subpopulations: the effect of the EBT system on participation probabilities is the largest among households residing in the rural South, those not headed by a single mother or those with a White household head. This may be attributed to possibly higher stigma levels attached to the program among these households, which may be reduced with the switch to electronic cards.

Contrary to a wide body of previous research, average state-level recertification periods, was not found to have an impact on FSP participation probabilities. Still, the fact that the EBT system affects households' participation decisions through its impact on transaction costs of participation implies that eligible households may be induced to take advantage of the FSP if costs of program participation can be reduced.

Apart from state-level policy variables, a number of factors appear to play a role in the decision to participate in the FSP by altering the benefit-cost comparison of participating. For household and economic characteristics employed in the study, the choice to participate is a function of these variables' effect on economic well-being and stigma. In other words, for more

economically disadvantaged households the benefits available to them may be high enough to outweigh costs of participation, inducing these households to participate. Results show that after controlling for predicted FSP benefits, participation is a function of number of children, age of head, racial status, educational attainment, single motherhood, distance to the FSP office, county unemployment rates and number of food stamp recipients in the county. The effect of these variables on the disutility from participation reflects both real costs of participation and stigma, so further research is needed to disentangle these effects. Still, the fact that households are forgoing benefit levels because of the stigma attached to public assistance is a concern to policy makers. Efforts to change the public perception of the program among eligible populations can potentially improve access to the program and increase participation rates in the FSP.

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Figure 2.1: FSP Participation Rates, 1994-2003

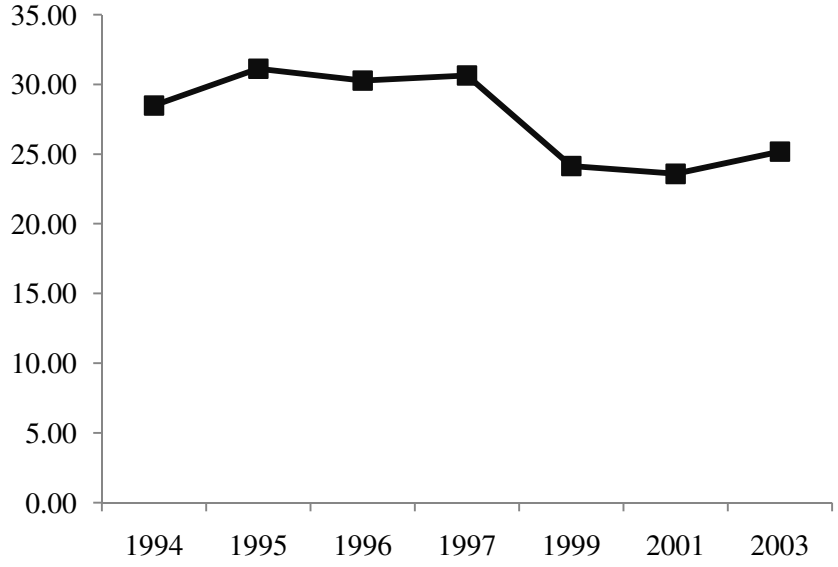

Table 2.1: FSP Benefits, 1994-2003

Year	Low-Income Sample	FSP Participants
1994	$606	$2,090
1995	$641	$2,040
1996	$672	$2,193
1997	$698	$2,263
1999	$569	$2,303
2001	$615	$2,557
2003	$677	$2,624

Table 2.2: State-level EBT Penetration Rates, 1994-2003

State	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Alabama	0	0	0	14.64	99.98	100	100	100	100	100
Alaska	0	0	0	0	46.76	99.58	99.81	99.95	99.98	99.99
Arizona	0	0	0	0	4.63	63.57	99.99	99.99	100	100
Arkansas	0	0	0	0.04	62.85	100	100	100	100	100
California	0	0	0	0	6.48	11.85	11.16	11.33	11.62	31.97
Colorado	0	0	0	12.37	95.60	100	100	100	100	100
Connecticut	0	0	0	21.12	99.98	100	100	100	100	99.82
Delaware	0	0	0	0	0	0	0	0	0	35.72
District of Columbia	0	0	0	0	13.19	100	100	100	100	100
Florida	0	0	0	0	32.08	99.98	100	100	100	100
Georgia	0	0	0	1.07	34.04	99.01	100	100	100	100
Hawaii	0	0	0	0	24.52	100	100	100	100	100
Idaho	0	0	0	1.44	81.47	100	100	100	100	100
Illinois	0	0	0	16.46	97.47	99.97	99.97	99.98	100	100
Indiana	0	0	0	0	0	0	0	10.99	76.15	100
Iowa	0.89	1.28	1.35	1.42	1.50	1.62	1.54	1.77	2.28	12.10
Kansas	0	0	4.28	88.65	99.93	99.93	100	100	100	100
Kentucky	0	0	0	0	0	7.58	97.37	100	100	100
Louisiana	0	0	0	9.27	95.54	100	100	100	100	100
Maine	0	0	0	0	0	0	0	0	0	55.82
Maryland	99.52	99.57	99.49	99.61	100	100	100	100	100	100
Massachusetts	0	0	0	23.06	99.81	99.95	99.97	99.98	99.98	100
Michigan	0	0	0	0	0	0	0.48	49.66	100	100
Minnesota	13.78	29.56	38.02	36.68	65.21	91.53	91.08	90.66	89.77	90.26
Mississippi	0	0	0	0	0	0	0	0	23.24	100
Missouri	0	0	0	3.70	76.02	99.89	99.97	99.99	100	100
Montana	0	0	0	0	0	0	0	0	42.82	100
Nebraska	0	0	0	0	0	0	0	0	32.60	100
Nevada	0	0	0	0	0	0	0	0	31.35	100
New Hampshire	0	0	0	0	0.56	77.87	100	100	100	100
New Jersey	5.99	38.89	48.83	49.76	53.03	88.73	100	100	100	100
New Mexico	34.78	66.01	98.70	99.67	99.72	99.87	99.97	100	100	100
New York	0	0	0	0	0	8.80	63.32	88.86	98.40	99.22
North Carolina	0	0	0	0	3.05	70.24	100	100	100	99.92
North Dakota	0	0	17.73	89.61	99.79	99.83	100	100	100	99.99
Ohio	2.01	1.95	1.93	1.96	10.43	48.08	90.40	93.00	93.81	94.34
Oklahoma	0	0	0	16.06	96.01	100	100	100	100	100
Oregon	0	0	0	0.81	68.93	88.78	88.82	90.30	92.06	92.46

Table 2.2 – continued

Pennsylvania	1.64	1.73	1.80	1.77	40.03	100	100	100	100	100
Rhode Island	0	0	0	0	12.62	100	100	100	100	100
South Carolina	0	23.02	97.36	99.97	99.98	99.98	100	100	100	100
South Dakota	0	0	21.13	91.86	99.85	99.87	100	100	100	100
Tennessee	0	0	0	0	0	41.27	100	100	100	100
Texas	0	23.23	98.99	100	100	100	100	100	100	100
Utah	0	0	51.78	73.08	69.00	69.81	69.81	81.89	89.32	91.44
Vermont	0	0	0	0	6.34	67.37	65.39	64.10	65.08	66.12
Virginia	0	0	0	0	0	0	0	0	39.83	100
Washington	0	0	0	0	0	16.96	98.25	100	100	100
West Virginia	0	0	0	0	0	0	0	0	0	46.55
Wisconsin	0	0	0	0	0	0.02	26.56	95.66	100	100
Wyoming	0	7.94	17.29	17.10	16.61	29.79	95.05	100	100	99.99
Average	3.11	5.75	11.74	19.04	41.43	62.39	72.53	76.04	82.12	92.46

Table 2.3: Descriptive Statistics

Variable	Participating in all Periods		Participating in at least one Period		Never Participating	
	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev
Predicted FSP Benefits ($1000)	2.52	1.19	2.23	0.96	1.62	0.80
Rural South	0.18	0.38	0.15	0.35	0.15	0.36
Number of Adults	1.44	0.65	1.57	0.76	1.64	0.78
Number of Children	2.18	1.87	1.61	1.54	0.78	1.18
Age of Head (10)	4.49	1.53	4.10	1.55	4.79	2.01
Head is White	0.15	0.35	0.26	0.44	0.52	0.50
Head is African American	0.84	0.37	0.67	0.47	0.41	0.49
Head is Other Race	0.01	0.12	0.06	0.24	0.07	0.25
Home Owner	0.26	0.44	0.24	0.42	0.46	0.50
Head has no High School Degree	0.61	0.49	0.46	0.50	0.33	0.47
Head is High School Graduate	0.29	0.46	0.35	0.48	0.36	0.48
Head has College no Degree	0.09	0.29	0.16	0.37	0.20	0.40
Head has College Degree	0.01	0.08	0.03	0.17	0.11	0.31
Head is Single Mother	0.64	0.48	0.45	0.50	0.14	0.35
Head Unemployed Weeks	4.30	10.88	4.65	11.36	2.48	8.36
County Unemployment Rate (%)	6.22	2.11	6.20	2.56	5.81	2.48
State Average Certification Period (months)	10.37	2.11	10.09	2.33	9.93	2.27
County FSP Participation Rate (%)	13.43	6.01	12.06	6.27	10.05	5.76
State EBT Penetration Rate (%)	30.59	43.69	29.59	42.95	26.92	41.40
Proportion of Fiscal Year with Statewide EBT (%)	29.32	44.29	27.59	43.53	24.66	41.90
Distance to Closest FSP office (miles)	4.34	4.92	4.72	5.31	5.22	5.20
Number of Observations	471		6,965		8,910	

[a] Head is defined to be the more educated spouse.

Table 2.4: Structural Participation Equation Estimation Results

Variable	Parameter		SE	APE
Predicted FSP Benefits ($1,000)	0.565	***	0.123	0.090
Rural South	-0.198	**	0.085	-0.030
Number of Adults	-0.059		0.043	-0.009
Number of Children	0.053		0.050	0.008
Age of Head (10 years)	-0.554	***	0.146	-0.088
Head is African American	0.429	***	0.068	0.076
Head is Other Race	0.020		0.115	0.003
Head is High School Graduate	-0.661	***	0.070	-0.100
Head has College No Degree	-0.840	***	0.083	-0.125
Head has College Degree	-1.111	***	0.136	-0.164
Head is Single Mother	0.751	***	0.074	0.144
County Unemployment Rate (%)	-0.004		0.019	-0.001
Average Certification Period (months)	0.020		0.020	0.003
County FSP Participation Rate (%)	0.049	***	0.010	0.008
State EBT Penetration Rate (%)	0.002	***	0.001	0.0004
Distance to Closest FSP Office (miles)	-0.021	**	0.009	-0.003
Mean Number of Adults	-0.328	***	0.068	-0.052
Mean Number of Children	0.051		0.049	0.008
Mean Age of Head	0.532	***	0.150	0.085
Mean County Unemployment Rate	0.028		0.025	0.005
Mean Average Certification Period	-0.015		0.024	-0.002
Mean County FSP Participation Rate	0.014		0.012	0.002
Mean State EBT Penetration Rate	-0.003	***	0.001	-0.001
Mean Distance to Closest FSP Office	0.017		0.011	0.003
Intercept	-2.690	***	0.305	
N	15,875			
Log-Likelihood	-6570.19			

Note: ***, **, and * indicate significance at 1%, 5%, and 10%, respectively.

Figure 2.2: Distribution of Partial Effects Associated with the Statewide EBT System

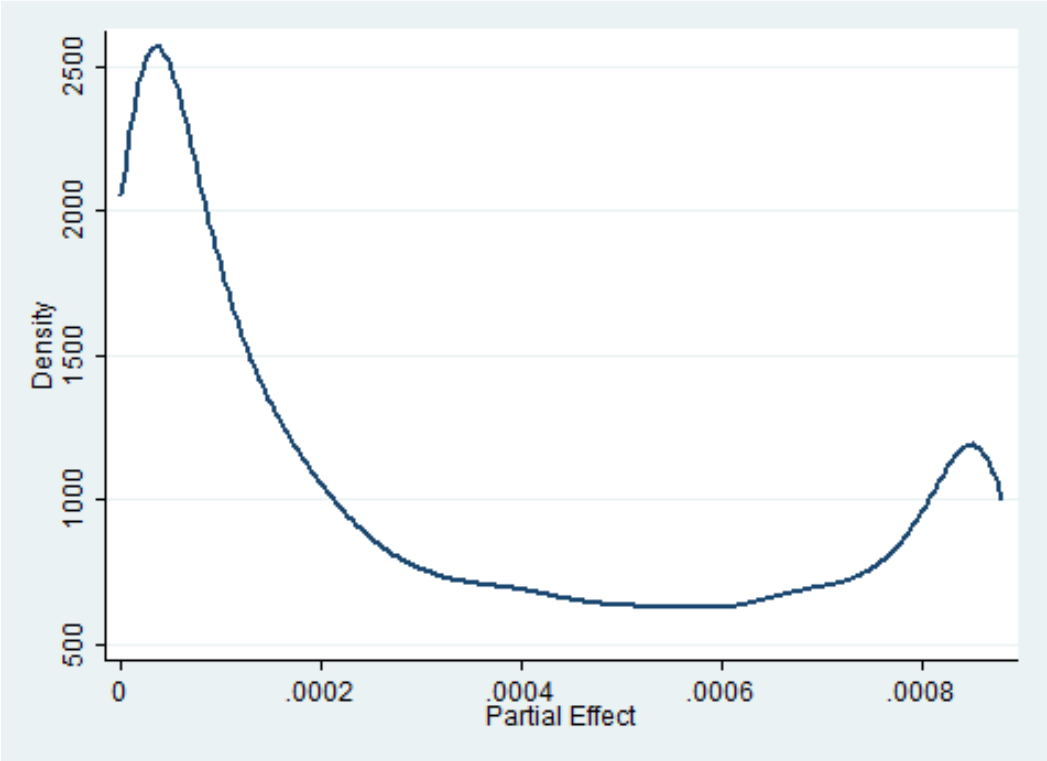

Figure 2.3: Regional Distribution of Partial Effects Associated with Statewide EBT System

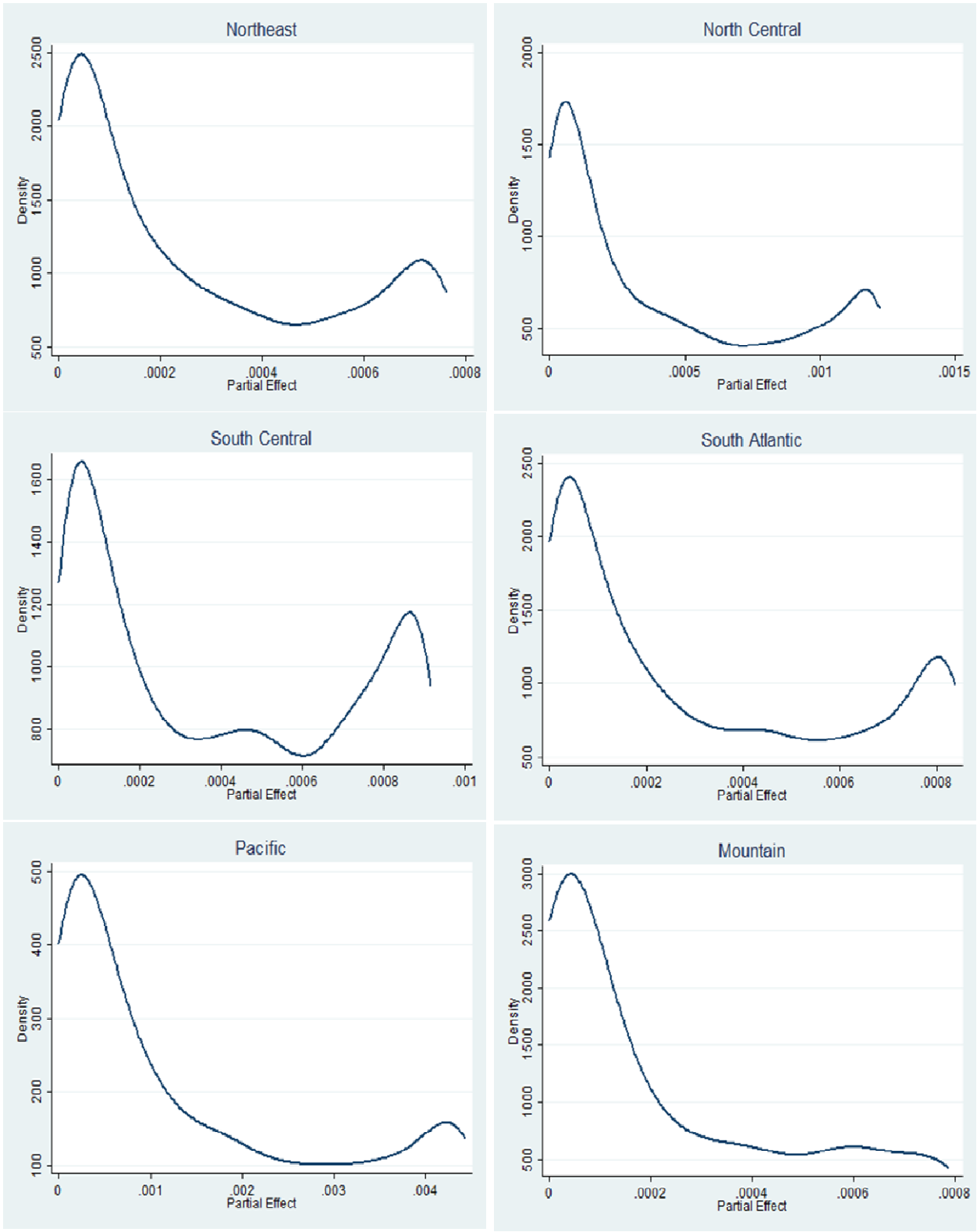

Table 2.5: Parameter Estimates of Statewide EBT System from Alternative Specifications

Sample	Measure of EBT System	Parameter		SE
Income Below 200 percent of Poverty Line in at least One Period	State EBT Penetration Rate (%)	0.002	***	0.001
	Plus State Effectiveness in Implementing EBT System	0.002	***	0.001
	Proportion of Fiscal Year with Statewide EBT (%)	0.002	***	0.001
	Plus State Effectiveness in Implementing EBT System	0.002	***	0.001
	Discrete Indicator for Presence of Statewide EBT	0.062		0.056
Income Below 200 percent of Poverty Line in Most Periods	State EBT Penetration Rate (%)	0.002	**	0.001
	Proportion of Fiscal Year with Statewide EBT (%)	0.002	*	0.001
Income Below 150 percent of Poverty Line in at least One Period	State EBT Penetration Rate (%)	0.003	***	0.001
	Proportion of Fiscal Year with Statewide EBT (%)	0.003	***	0.001
Income Below 130 percent of Poverty Line in at least One Period	State EBT Penetration Rate (%)	0.003	***	0.001
	Proportion of Fiscal Year with Statewide EBT (%)	0.003	***	0.001

Note: ***, **, and * indicate significance at 1%, 5%, and 10%, respectively.

Table 2.6: APE of Statewide EBT System across Household Groups

Subgroup	APE
Single Mother	0.0001
Not Single Mother	0.0005
Non-White	0.0003
White	0.0004
Low Education Level (High School or Less)	0.0004
High Education Level (At Least Some College)	0.0003
Rural South	0.0007
Not Rural South	0.0003

Appendix B

Table B1: FSP Benefits Equation Estimation Results

Variable	Parameter		SE
Rural South	0.083		0.081
Number of Adults	0.056		0.063
Number of Children	0.338	***	0.042
Age of Head (10 years)	-0.067		0.176
Head is African American	0.020		0.074
Head is Other Race	0.143		0.263
Home Owner	-0.355	***	0.115
Head is High School Graduate	-0.027		0.091
Head has College No Degree	-0.130		0.120
Head has College Degree	-0.502	**	0.225
Head is Single Mother	0.333	***	0.104
Head Unemployed Weeks last year	0.006	***	0.002
County Unemployment Rate	0.028		0.026
Mean Number of Adults	0.164	**	0.077
Mean Number of Children	0.236	***	0.067
Mean Age of Head	-0.025		0.178
Mean Head Unemployed Weeks last year	0.007		0.005
Mean County Unemployment Rate	-0.054	*	0.033
Inverse Mills Ratio (IMR)	0.634	**	0.306
Intercept	0.710	*	0.434
Wald Tests on the Joint Significance of			
6 Year Dummies	19.55	***	
6 Year Dummies Interacted with the IMR	7.98	*	
N	4,446		
R-Squared	0.25		

Note: ***, **, and * indicate significance at 1%, 5%, and 10%, respectively.

Table B2: Cross-Sectional FSP Participation Equations, 1994-1996

Variable	1994			1995			1996		
	Parameter		SE	Parameter		SE	Parameter		SE
Rural South	-0.183	**	0.092	-0.149	*	0.083	-0.069		0.088
Number of Adults	0.134	*	0.080	0.231	***	0.090	0.110		0.090
Number of Children	0.134	**	0.058	0.047		0.059	0.054		0.062
Age of Head (10 years)	-0.185		0.245	-0.135		0.214	-0.452		0.289
Head is African American	0.172	***	0.067	0.118	*	0.063	0.218	***	0.067
Head is Other Race	0.467	***	0.169	0.123		0.132	-0.161		0.180
Home Owner	-0.567	***	0.068	-0.493	***	0.065	-0.411	***	0.069
Head is High School Graduate	-0.242	***	0.066	-0.301	***	0.064	-0.304	***	0.067
Head has College No Degree	-0.583	***	0.087	-0.468	***	0.082	-0.434	***	0.084
Head has College Degree	-0.914	***	0.164	-0.493	***	0.107	-0.997	***	0.174
Head is Single Mother	0.553	***	0.074	0.679	***	0.069	0.428	***	0.075
Head Unemployed Weeks last year	0.001		0.004	0.009	***	0.004	0.006		0.004
County Unemployment Rate	0.037		0.038	0.045		0.040	-0.008		0.045
Average Recertification Period	0.013		0.030	0.020		0.044	0.001		0.043
County FSP Participation Rate	0.0407	**	0.017	0.015		0.018	0.023		0.019
State EBT Penetration Rate	0.001		0.002	-0.002		0.002	0.000		0.002
Distance to Closest FSP Office	-0.016		0.016	-0.006		0.016	-0.023		0.018
Mean Number of Adults	-0.230	***	0.089	-0.277	***	0.101	-0.243	**	0.101
Mean Number of Children	0.143	**	0.066	0.172	***	0.066	0.215	***	0.069
Mean Age of Head	0.231		0.247	0.153		0.215	0.476	*	0.291
Mean Head Unemployed Weeks last year	0.020	***	0.006	0.018	***	0.006	0.024	***	0.006
Mean County Unemployment Rate	-0.067		0.044	-0.046		0.046	0.034		0.050
Mean Average Recertification Period	-0.009		0.028	-0.006		0.041	0.006		0.050
Mean County FSP Recipients	-0.011		0.020	0.018		0.020	0.001		0.020
Mean State EBT Penetration Rate	-0.004	**	0.002	-0.002		0.002	-0.005	**	0.002
Mean Distance to Closest FSP Office	0.023		0.017	0.006		0.017	0.024		0.020
Intercept	-1.163	***	0.229	-1.233	***	0.203	-1.177	***	0.216
N	2,762			2,904			2,562		
Log-Likelihood	-1306.34			-1451.36			-1272.02		

Note: ***, **, and * indicate significance at 1%, 5%, and 10%, respectively.

Table B3: Cross-Sectional FSP Participation Equations, 1997-2003

Variable	1997			1999			2001			2003		
	Parameter		SE	Parameter		SE	Parameter		SE	Parameter		SE
Rural South	0.036		0.108	0.071		0.105	-0.150		0.105	0.032		0.098
Number of Adults	0.210	**	0.099	0.042		0.082	-0.131		0.083	-0.132	**	0.069
Number of Children	0.171	**	0.076	0.125	*	0.068	0.263	***	0.061	0.135	***	0.050
Age of Head (10 years)	-0.398		0.341	-0.443		0.304	0.004		0.247	-0.445	**	0.191
Head is African American	0.245	***	0.089	0.117		0.088	0.172	*	0.090	0.067		0.080
Head is Other Race	0.035		0.212	-0.234	*	0.138	-0.342	**	0.145	-0.219	*	0.133
Home Owner	-0.434	***	0.086	-0.480	**	0.084	-0.445	***	0.085	-0.440	***	0.081
Head is High School Graduate	-0.386	***	0.084	-0.280	**	0.082	-0.368	***	0.083	-0.399	***	0.077
Head has College No Degree	-0.427	***	0.101	-0.331	**	0.103	-0.433	***	0.099	-0.421	***	0.091
Head has College Degree	-0.902	***	0.178	-0.709	**	0.189	-0.984	***	0.222	-0.834	***	0.177
Head is Single Mother	0.505	***	0.093	0.471	**	0.088	0.405	***	0.087	0.513	***	0.082
Head Unemployed Weeks last year	-0.001		0.005	0.014	**	0.005	0.012	**	0.006	0.006	*	0.004
County Unemployment Rate	-0.064		0.039	-0.040		0.040	-0.002		0.051	0.027		0.039
Average Recertification Period	-0.031		0.049	-0.016		0.047	0.024		0.043	0.042		0.036
County FSP Participation Rate	0.051	**	0.026	0.032		0.023	0.055	***	0.022	0.010		0.017
State EBT Penetration Rate	0.000		0.002	0.002		0.001	0.0003		0.001	0.002		0.002
Distance to Closest FSP Office	0.000		0.019	-0.008		0.016	-0.003		0.018	-0.006		0.017
Mean Number of Adults	-0.267	**	0.122	-0.173	*	0.105	0.083		0.102	0.137		0.086
Mean Number of Children	0.058		0.086	0.099		0.075	-0.082		0.067	0.073		0.054
Mean Age of Head	0.437		0.346	0.514	*	0.308	0.021		0.251	0.430		0.195
Mean Head Unemployed Weeks last year	0.033	***	0.009	0.005		0.008	0.007		0.007	0.009		0.006
Mean County Unemployment Rate	0.083	*	0.050	0.076		0.050	0.011		0.038	-0.015		0.035
Mean Average Recertification Period	0.027		0.057	0.032		0.055	-0.047		0.051	-0.050		0.038
Mean County FSP Recipients	-0.020		0.026	-0.001		0.022	-0.018		0.021	0.027		0.018
Mean State EBT Penetration Rate	-0.002		0.002	-0.002		0.002	0.000		0.002	-0.003	*	0.002
Mean Distance to Closest FSP Office	0.014		0.021	0.014		0.017	-0.004		0.020	0.010		0.018
Intercept	-1.291	***	0.273	-1.750	**	0.271	-0.949	***	0.268	-1.003	***	0.274
N	1,729			1,907			1,866			2,156		
Log-Likelihood	-841.53			-864.49			-847.71			-1003.09		

Note: ***, **, and * indicate significance at 1%, 5%, and 10%, respectively.

Table B4: Region Definitions

Region	States
Northeast	Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont, New Jersey, New York and Pennsylvania
North Central	Indiana, Illinois, Michigan, Ohio, Wisconsin, Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota and South Dakota
South Central	Alabama, Kentucky, Mississippi, Tennessee, Arkansas, Louisiana, Oklahoma, and Texas
South Atlantic	Delaware, District of Columbia, Florida, Georgia, Maryland, North Carolina, South Carolina, Virginia, and West Virginia
Pacific	Alaska, California, Hawaii, Oregon, and Washington
Mountain	Arizona, Colorado, Idaho, Montana, Nevada, New Mexico, Utah, and Wyoming

Table B5: Structural Participation Equation Estimation Results with Interaction Effects between Regions and State EBT Penetration Rates

Variable	Parameter		SE
Predicted FSP Benefits ($1,000)	0.562	***	0.123
State EBT penetration rate*Northeast	-0.0002		0.002
State EBT penetration rate*North Central	0.001		0.001
State EBT penetration rate*South Central	0.0002		0.001
State EBT penetration rate*Mountain	-0.0001		0.003
State EBT penetration rate*Pacific	0.009	***	0.003
Northeast	0.512	***	0.127
North Central	0.303	***	0.097
South Central	0.109		0.094
Mountain	0.213		0.190
Pacific	0.236	*	0.134
Number of Adults	-0.056		0.043
Number of Children	0.052		0.050
Age of Head (10 years)	-0.467	***	0.147
Head is African American	0.545	***	0.071
Head is Other Race	0.073		0.115
Head is High School Graduate	-0.670	***	0.070
Head has College No Degree	-0.850	***	0.084
Head has College Degree	-1.112	***	0.136
Head is Single Mother	0.758	***	0.074
County Unemployment Rate	-0.010		0.019
Average Certification Period (months)	0.021		0.020
County FSP Participation Rate	0.048	***	0.010
State EBT Penetration Rate	0.002	**	0.001
Distance to Closest FSP Office (miles)	-0.021	**	0.009
Mean Number of Adults	-0.322	***	0.068
Mean Number of Children	0.049		0.049
Mean Age of Head	0.445		0.150
Mean County Unemployment Rate	0.027		0.026
Mean Average Certification Period	-0.030		0.025
Mean County FSP Participation Rate	0.015		0.012
Mean State EBT Penetration Rate	-0.002	*	0.001
Mean Distance to Closest FSP Office	0.018	*	0.011
Intercept	-2.763	***	0.316
Wald Test on the Joint Significance of 6 Year Dummies	56.86	***	
N	15,875		
Log-Likelihood	-6,554.57		

Note: ***, **, and * indicate significance at 1%, 5%, and 10%, respectively.

Table B6: Structural Participation Equation Estimation Results with Interaction Effects between Household Characteristics and State EBT Penetration Rates

Variable	Parameter		SE
Predicted FSP Benefits ($1,000)	0.798	***	0.123
State EBT penetration rate*Single Mother	-0.004	***	0.001
State EBT penetration rate*White	0.003	***	0.001
State EBT penetration rate*Low Education	-0.002		0.001
State EBT penetration rate*Rural South	0.003	**	0.001
Rural South	-0.289	***	0.093
Number of Adults	-0.047		0.043
Number of Children	-0.029		0.050
Age of Head (10 years)	-0.475	***	0.144
Head is White	-0.497	***	0.072
Head has Low Education Level	0.602	***	0.078
Head is Single Mother	0.857	***	0.078
County Unemployment Rate	-0.009		0.019
Average Certification Period (months)	0.025		0.020
County FSP Participation Rate	0.046	***	0.010
State EBT Penetration Rate	0.004	***	0.001
Distance to Closest FSP Office (miles)	-0.019	**	0.009
Mean Number of Adults	-0.418	***	0.069
Mean Number of Children	0.006		0.049
Mean Age of Head	0.512	***	0.148
Mean County Unemployment Rate	0.029		0.024
Mean Average Certification Period	-0.025		0.024
Mean County FSP Participation Rate	0.024	**	0.012
Mean State EBT Penetration Rate	-0.003	***	0.001
Mean Distance to Closest FSP Office	0.017		0.011
Intercept	-3.627	***	0.305
Wald Test on the Joint Significance of 6 Year Dummies	60.98	***	
N	15,875		
Log-Likelihood	-6,602.70		

Note: ***, **, and * indicate significance at 1%, 5%, and 10%, respectively.

ESSAY 3

The Dynamics of Food Stamp Program Participation: A Lagged Dependent Variable Approach

Introduction

The welfare programs in the U.S. were designed to alleviate poverty by providing a safety net for families during economic downturns. However, these programs continue to be the focus of controversy due to concerns with long-term welfare dependency among recipients. Prolonged periods on welfare may be caused by the adverse effects of the welfare system on recipients' choices and behavior, especially with respect to work and family structure disincentives (Moffitt, 1992). There is evidence that welfare programs reduce work effort among recipients (Moffitt, 1992; Hagstrom, 1996; Hoynes, 1996; Blank and Ruggles, 1996) and are partly responsible for the rising rates of female headship (Moffitt, 1992; Hoynes, 1997). In order to minimize these adverse incentives it is important to understand the mechanisms that drive individuals into welfare and cause some individuals to stay on welfare for long periods of time.

Welfare dynamics, namely entry, exit and reentry patterns among welfare recipients, has received considerable attention in the literature. Research in this area is heavily dominated by duration or hazard models that analyze the probability that a spell will end at some point in time, given that it has not previously ended at the start of the period. Early work on the dynamics of welfare participation using hazard models examined the exit rate from welfare (Ellwood, 1986; O'Neill et al., 1987; Blank, 1989; Fitzgerald, 1991). Given high reentry rates among welfare recipients, especially after the enactment of the Personal Responsibility and Work Opportunity Reconciliation Act (PRWORA) in 1996, later empirical work analyzed welfare reentry patterns

and multiple participation spells (Blank and Ruggles, 1994; Cao, 1996; and Bruce et al., 2004). Studies that use hazard models typically analyze welfare dependence by looking at the degree of duration dependence and allow for the estimation of factors that contribute to ending a particular spell, including the effect of the duration of the spell itself. In these models, evidence in favor of negative duration dependence (the longer an individual stays on welfare the less likely it is for the individual to leave welfare) is typically taken as an indicator of a true state dependence effect. Hazard models that incorporate unobserved heterogeneity do exist in the literature, however these models cannot distinguish between the possible sources of persistence, and therefore are less suitable to explicitly model the serial persistence that exists in welfare dynamics (Cappellari and Jenkins, 2002).

In analyzing welfare dynamics, it is important to capture the interaction between a household's past welfare participation history and its persistence. It is a well-documented empirical fact that welfare recipients in the past are more likely to be on welfare in the future (Blank, 1989; Bane and Ellwood, 1994; Moffitt, 1992; Chay and Hyslop, 1998; Blank and Ruggles, 1996). There are two distinctive explanations often put forward for the observed serial persistence in welfare receipt (Heckman, 1981). On one hand, persistence may be the result of "true" state dependence in which current participation directly influence an individual's propensity to participate in the future by altering the cost or stigma related to welfare participation and shifting the structure of the individual's preferences. True state dependence refers to the concept known as a "welfare trap" in the literature. On the other hand, persistence may also result from unobserved individual heterogeneity, in that individuals have different underlying propensities to experience an outcome in all periods. In this case, current participation does not structurally affect the future propensity to participate, but rather this source of serial correlation can be viewed as "spurious".

Distinguishing state dependence from other sources of welfare persistence is important from a policy perspective. If the relationship between past and current participation in a welfare program is mostly due to state dependence, changing welfare program parameters to prevent people from entering welfare can have long-term benefits in terms of reducing welfare dependency. Policies that discourage participation in welfare may also indirectly encourage work and improve economic well-being among recipients. If most participation is due to persistent individual unobserved heterogeneity, then changing the welfare policy will be less effective in the long-run and can have only temporary effects, and the unobserved causes of welfare participation need to be addressed.

Recently, dynamic binary response panel data models, also known as lagged dependent variable models have been adopted to distinguish between true and spurious state dependence in social assistance dynamics (Andren, 2007; Hansen and Lofstrom, 2009; Hansen, Lofstrom and Zhang, 2006; Cappellari and Jenkins, 2008). These models have only recently received attention in the U.S. to study welfare dynamics. Chay and Hyslop (1998) use panel data from the Survey and Income and Program Participation (SIPP) and Panel Study of Income Dynamics (PSID) to examine married women's labor force participation and recipiency of Aid to Families with Dependent Children (AFDC) welfare benefits. In a more recent study, Chay, Hoynes and Hyslop (2004) use monthly welfare data from California to analyze AFDC receipt dynamics.

The dynamics of participation in the Food Stamp Program (FSP), the largest transfer program in the U.S., have not been studied using this approach. There exist a number of studies that use simple regression techniques to analyze household experience with public assistance programs as a determinant of FSP entry or exits (Hisnanick and Walker, 2000; Zedlewski and Rader, 2004). These studies use past participation as a proxy for low information costs or lower stigma, and

therefore only address the first source of state dependence while they fail to account for unobserved household characteristics that may cause persistent participation in the FSP. This study fills this gap in the literature and employs dynamic binary response panel data models to study FSP participation dynamics over the period 1990-2005 using Panel Study of Income Dynamics (PSID) data.

The central econometric issues that arise in the dynamic models employed in this study are unobserved heterogeneity and the endogeneity of initial conditions. This paper estimates several dynamic binary choice models that have been developed in the literature to deal with these issues. The first specification is a correlated random effects model developed by Mundlak (1978) and Chamberlain (1984) and addresses only the issue of unobserved heterogeneity while treating the initial conditions exogenous. Second, dynamic random effects probit models are estimated using two alternative approaches developed by Heckman (1981) and Wooldridge (2005). These models address both issues and are therefore the central focus of this study. The estimates from these alternative estimators are compared to assess the robustness of results.

The rest of the paper proceeds as follows. The next section describes the empirical framework. Section 3 presents the data sources used in this study, and section 4 provides the descriptive statistics for the covariates used in the models. Section 5 presents the results, while section 6 discusses policy implications and concludes.

Empirical Model

State dependence can be modeled by introducing a lagged FSP participation indicator into the probability of FSP participation in the current period. In its most general form, a dynamic reduced form model for FSP participation can be expressed as:

(3.1) $$S_{it} = \gamma P_{F,it-1} + X_{it}\beta + a_i + \varepsilon_{it}, \quad P_{F,it} = 1[S_{it} \geq 0]$$

where S_{it} is the underlying latent variable for observed FSP participation $P_{F,it}$, and X_{it} is a vector of individual characteristics, a_i is the individual specific effects or unobserved heterogeneity and ε_{it} is the error term which is normally distributed with mean zero and variance σ_ε^2. Dynamics are assumed to be first-order, meaning that the degree of state dependence from the past is collapsed into a single parameter, measured by γ. $\gamma > 0$ would imply that the likelihood of receiving food stamps in the current period is larger for those with an earlier experience with the program compared to others without such an experience.

Equation (3.1) can be estimated using a standard random effects probit specification. This approach is however problematic due to the restrictive assumption that a_i is uncorrelated with the observed characteristics X_{it} and the difficulty in specifying the distribution of the heterogeneity. In addressing these issues, this paper uses several dynamic estimators that model the probability of participation in the FSP with state dependence as laid out in equation (3.1).

The first estimator is based on a correlated random effects model that follows Mundlak (1978) and Chamberlain (1984) and allows for correlations between a_i and X_{it} by adding the means of the time-varying variables for each household to the model. In order to write the model formally, let X_{it} and Y_i represent the time-varying and time-invariant characteristics, respectively. The FSP participation equation can then be written as:

(3.2) $$S_{it} = \gamma P_{F,it-1} + X_{it}\beta_X + Y_i\beta_Y + \overline{X}_\iota\beta_{\overline{X}} + c_i + \varepsilon_{it}, \quad P_{F,it} = 1[S_{it} \geq 0]$$

where $a_i = \overline{X}_\iota\beta_{\overline{X}} + c_i$ specifies the relationship between the unobserved and observed characteristics, the composite error term $v_{it} = c_i + \varepsilon_{it}$ is independent of X_{it}, and $\varepsilon_{it} \sim N(0, \sigma_\varepsilon^2)$.

Estimation of the correlated random effects model requires an assumption about the relationship between the initial observations $P_{F,i1}$ and c_i. If the initial conditions are exogenous, which is the case only if the start of the process coincides with the start of the observation period for each household, the likelihood function can be decomposed and a standard random effects probit model can be estimated. If this assumption is violated, the initial condition is correlated with unobserved heterogeneity and this method can overstate the degree of state dependence (Chay and Hyslop, 1998). Therefore, estimation requires some assumptions about the initial observation and the unobserved heterogeneity c_i.

There have been two suggested approaches to deal with the problem of initial conditions. One approach was proposed by Heckman (1981) who suggested approximating the initial value of the latent variable by a linear reduced form equation:

$$S_{i1} = Z_{i1}\pi + \theta c_i + \varepsilon_{i1}, \quad P_{F,i1} = 1[S_{i1} \geq 0] \tag{3.3}$$

where Z_{i1} includes X_{i1}, Y_{i1}, and a vector of exogenous instruments, $\zeta_i = \theta c_i + \varepsilon_{i1}$ is correlated with c_i, but uncorrelated with ε_{it} for $t \geq 2$. Exogeneity of initial conditions implies that $\theta = 0$, and can be tested accordingly. Combining this static probit equation with the dynamic panel probit equation for later periods, a full information maximum likelihood approach can then be applied to obtain parameter estimates.[13]

An alternative and not as computationally intensive technique to estimating the full model was proposed by Wooldridge (2005). In this approach, the solution to the initial conditions problem is to specify the distribution of the unobserved heterogeneity, conditional on the initial condition. Therefore, rather than modeling the joint distribution of $(P_{F,i1}, \ldots, P_{F,iT})$ conditioning on the set

[13] Heckman's method is implemented using the STATA command redprob developed by Stewart (2006).

of explanatory variables, Wooldridge models the distribution of $(P_{F,i2}, \dots, P_{F,iT})$ conditioning on the set of explanatory variables and the binary receipt indicator for the initial year. According to this specification, the dynamic equation becomes:

$$(3.4) \qquad S_{it} = \gamma P_{F,it-1} + X_{it}\beta_X + Y_i\beta_Y + \bar{X}_\iota\beta_{\bar{X}} + \eta_0 + \eta_1 P_{F,i1} + u_i + \varepsilon_{it}, \quad P_{F,it} = 1[S_{it} \geq 0]$$

where $c_i = \eta_0 + \eta_1 P_{F,i1} + \bar{X}_i'\delta + u_i + \varepsilon_{it}$. The parameters are then estimated by maximum likelihood.[14]

The Heckman and Wooldridge estimators use different approaches to solve the initial conditions problem. The Heckman approach models initial conditions directly and specifies the joint distribution of all outcomes of the endogenous variables. It is based on maximum likelihood estimation using the full set of sample observations allowing cross-correlation between the main and initial period equations. As such, the Heckman approach can accommodate more flexible error structures (Baltagi, 2005). However the difficulty with the Heckman model is that it requires appropriate instruments for the initial conditions, which are often difficult to find. In the absence of appropriate instruments, identification of the model relies on non-linearities in functional form. On the other hand, the Wooldridge approach does not require instruments for identification, but it relies on the assumption that the distribution of the individual effects conditional on the exogenous individual characteristics is correctly specified. The substantial computational advantage of the Wooldridge estimator has made it very popular in the literature. Further, there is evidence that these estimators lead to very similar results (Arulampalam and Stewart, 2007). Therefore, the choice between the Heckman and Wooldridge estimators mainly depends on ease of implementation and computational speed.

[14] Wooldridge's method was carried out using the standard random effects probit command xtprobit in STATA.

Variables and Data

The reduced form FSP participation equation includes four groups of covariates that influence the decision to receive FSP benefits. Family demographic and structure characteristics include number of adults, number of children, home ownership, number of weeks spent unemployed by the household head, as well as the age, gender, marital status and race of household head.[15] Family educational assets are measured by discrete indicators of education level of the household head (no high-school degree, high-school degree, some post-secondary education but no college degree, and a college degree). Location attributes are measured by county unemployment rates, distance to the closest welfare office, the number of household receiving food stamps in the county of residence, and an indicator of residence in the rural South. Variables describing the FSP policy environment are state-level average recertification periods and state-level shares of FSP participants that received an erroneous overpayment and underpayment of FSP benefits.

Identification of the model estimated using the Heckman approach requires suitable instruments for initial conditions. Appropriate instruments should explain FSP receipt probabilities in the initial period but should not have a direct effect on the current year probability of FSP receipt. Without these, identification of the model relies on non-linearities in functional form. Heckman (1981) suggested that when modeling employment dynamics, initial conditions could be instrumented by using information prior to labor market entry. Following some earlier studies (Arulampalam et al., 2000; Stewart, 2007), this study uses pre-sample information about family background and early labor market experiences as instruments. Specifically, the instruments

[15] Family income is not included due to possible endogeneity issues since workforce participation decisions are likely to be made jointly with welfare participation decisions by the household (Keane and Moffitt, 1998). Instead a number of covariates that determine labor force participation and therefore income (such as family composition, gender, educational attainment, etc.) are included in the analysis.

include a dummy variable indicating whether the household head lived with both parents until the age of 16[16], and indicators for the first full-time occupation held by the household head.[17] Having lived with both parents while growing up is generally associated with a stable family environment that leads to better socioeconomic outcomes. The first occupation is also an indicator of the socioeconomic status of the household head at the start of his/her adult life. As such, these will directly influence the probability of falling into welfare, and will only influence future participation through its impact on the first welfare spell. The validity of these instruments is questionable; however it can be argued that county unemployment rates included in the initial conditions equation can aid in identification since they will influence only initial year receipt probabilities, and will only affect future participation through their impact on participation in the first period.

The primary source of data for the analysis comes from the Panel Study of Income Dynamics (PSID) waves of 1990-2005. PSID is a long-term panel that started in 1968 with a sample of roughly 5,000 households (3,000 nationally representative households and an over sampling of 2,000 low-income households). The original families and the families of their offspring were followed. Thus, by 2001 over 7,000 families are included in the sample. The analysis is conducted on a sample of low-income households with annual income less than twice the official poverty line to capture the population that is the most likely to be eligible to participate in the

[16] The survey question that corresponds to this variable is: "Were you living with both your natural parents most of the time until you were age 16?"

[17] Household head's first occupation was grouped into four categories: managerial, professional or self-employed (professional, technical, kindred workers, managers, officials, proprietors and self-employed businessmen); clerical and sales worker, craftsmen or operatives (clerical and sales workers, craftsmen, foremen, kindred workers, and operatives); laborer or service worker (laborers, service workers, farm laborers, and farmers), and miscellaneous occupations (armed services and protective workers), with laborer or service workers taken as the reference category in estimation.

FSP.[18] Specifically, the sample was constructed as follows. First, in each period households that have an annual income less than twice the official poverty line are selected. Second, information on these households in other periods (even if they are not low-income households in other periods) is added to these period specific low-income household samples, which are then stacked together to construct the panel. This results in a panel of households that have an annual income less than twice the official poverty line in at least one survey period.

A unique strength of the PSID data is that information on residence is available at both the zip code and the county level, enabling the estimation of the impacts of local conditions and neighborhood characteristics on social assistance. First, a measure of distance to the nearest FSP office is employed for each household as the distance from zip code of the household to the zip code of the closest FSP office.[19] Second, the number of FSP recipients at the county-level obtained from the U.S. Census Bureau of Small Area Income and Poverty Estimates (SAIPE), county unemployment rates obtained from the Bureau of Labor Statistics (BLS), and an indicator of residence in the rural South generated using the Beale codes obtained from the USDA are employed to account for the neighborhood conditions in the county in which the household resides.

Information on state-level certification periods was obtained from the FSP Quality Control (FSPQC) database which is generated from monthly quality control reviews of FSP cases. The

[18] The gross income test for eligibility requires that a household's before tax income the previous month must be at or below 130% of the poverty line. However, monthly incomes are not reported in the PSID, making it difficult to assess eligibility. Following a number of previous studies, a low-income sample based on annual incomes is constructed to capture the households that are the most likely to be eligible to participate in the FSP. This assumption is further supported by the data: about 90 percent of FSP participants are also low-income households.

[19] If the household resides in a zip code where there is a FSP office, distance is zero miles, otherwise, it is measured as distance to the nearest FSP office within the same state.

FSPQC database was also used to construct the state-level percentages of FSP caseloads that received an overpayment or underpayment of FSP benefits due to administrative errors.

Descriptive Statistics

Figure 3.1 presents FSP participation rates and trends in annual transition rates into and out of FSP receipt for the sample across the study period. The entry rate in a given year t is the number of households not in receipt at survey year $t-1$ who are in receipt at t, divided by the total number of households not in receipt at $t-1$, expressed as a percentage. The exit rate is the number of households in receipt at survey year $t-1$ who are no longer in receipt at t, divided by the total number in receipt at $t-1$, expressed as a percentage. Trends in entry and exit rates determine trends in FSP participation rates. For instance, a downward trend in FSP participation rates may reflect an upward trend in exit rates or a downward trend in entry rates.

The most notable trend in Figure 3.1 is the declining FSP participation rates until late 1990s. Figure 3.1 shows that during this period exit rates contribute to changing participation rates more than entry rates. For instance, while exits increased between 1994 and 1996, the major increase in the FSP exit rate followed the passage of the 1996 PRWORA Legislation, resulting in a significant drop in participation rates after 1996. After 1999, with declining exit rates and increasing entry rates, participation rates start following an upward trend.

Figure 3.2 presents the raw persistence rate, measured as one minus the exit rate from the FSP, expressed as a percentage. High persistence rates imply that the probability of receiving food stamps in a given period is higher for those who received FSP benefits than those who did not receive food stamps in the previous period. As figure 3.2 shows, in any given year, at least sixty

percents of those who have received food stamps in the previous period continue to receive FSP benefits in the current period.

Descriptive statistics for other covariates are provided in table 3.1 for FSP participants in all periods, in at least one period and for those who have not participated in the program in the entire period.[20] Major differences exist with respect to household characteristics when comparing FSP participants and non-participants. The typical food stamp receiving household has a smaller number of adults and more children than a non-participating household. For instance, families that received food stamps in at least one period have an average of 1.6 adults and 1.5 children and those that participated in all periods has 1.4 adults and 2.2 children whereas the average non-participant family has 1.7 adults and 1.2 children. Taking the more educated spouse to be the head of household for married families and the reported head for families with other marital status, the food stamp receiving households appear to have younger household heads. The average age of the household head is 45 years for FSP participants in all periods, 43 years for FSP participants in at least one period, and 47 years for non-participants. The head of the average FSP participant family was unemployed longer (4.2 weeks for participants in all periods and 3.6 for participants in at least one periods) than the head of the average non-participating family (2.9 weeks).

As expected, a larger percentage of food stamp receiving households do not own their homes, are headed by an African-American or a single mother compared to non-participants. In fact, the percentage of homeowners receiving food stamps in all periods is half the percentage of homeowners not participating in the program. 91 percent of households who were on food

[20] Descriptive statistics are not presented for each year separately since means and standard deviations of covariates do not show significant variation over time.

stamps in all periods were African-American whereas the proportion of FSP participants in at least one period with an African-American head is 63 percent and only 50 percent of never-participants are headed by an African-American. Single mother headed households constitute 62 percent of families participating in the FSP in all periods, 39 percent of those who receive food stamps in at least one period, and only 25 percent of non-participant families. Food stamp receiving households also have heads with lower levels of educational attainment than heads of non-participating households.

With respect to economic and policy variables, differences between FSP participants and non-participants appear to be smaller. The percentage of households residing in the rural South is slightly higher for those who receive food stamps in all periods, but almost the same for those who participate in at least one period and the non-participant sample. Surprisingly, families who participate in the FSP in all periods reside in a county with lower unemployment rates than those households who never participate in the program. Similarly, FSP recipients in at least one period live slightly closer to the nearest welfare office than non-participants. Finally, state-level policy variables, namely average recertification periods and FSP benefit overpayment and underpayment rates are identical between FSP participants and non-participants.

Descriptive statistics for the background variables used in the initial period participation equation in Heckman's model are presented in table 3.2. On average, the households in the initial period reside in a county with a 6.3 percent unemployment rate. Heads who were in professional or managerial positions or were self-employed constituted 4 percent of the sample. Finally, a large percentage of the household heads in the sample lived with parents while growing up.

Results

This section presents estimation results for the dynamic random effects models employed in the study. The coefficient estimates for the models are presented in table 3.3. Since the initial conditions equation is auxiliary to the Heckman estimator, only parameter estimates for the instruments used in the initial period equation are reported in table 3.3 and other parameter estimates of the initial period FSP participation equation are provided in Appendix C. The discussion focuses on the Wooldridge and Heckman models, while results from the correlated random effects probit specification are also presented to compare estimates.

Also, as the coefficients from the nonlinear models do not have a straightforward interpretation, these results are supplemented by average partial effects (APEs) for key covariates employed in the models (table 3.4). The APEs are computed by calculating individual marginal effects using individual characteristics and averaging these over the sample. APEs are arguably more appropriate than taking the marginal effects at the mean of the independent variables as sample mean characteristics might not realistically represent the actual households (Bartus, 2005). For a continuous variable, the APE can be estimated by taking the derivative of the predicted probability with respect to the variable in question. For dummy variables, the APE is calculated by first predicting the probability when the dummy variable is one and predicting the probability when the dummy variable takes the value of zero, and then averaging the difference between the two probabilities over the households in the sample.[21]

[21] APEs for the correlated random effects model and the Wooldridge model were generated using the STATA routine margeff, developed by Tamas Bartus of Boston College, whereas APEs for the Heckman model were generated manually.

Based on results in table 3.3, various tests regarding the assumptions in the models, namely state dependence, unobserved heterogeneity and endogeneity of initial conditions can be performed. First, the coefficient of lagged FSP participation status is positive and strongly significant in all the estimated models, which indicates that there is positive state dependence in FSP participation. Second, a test of the exogeneity of the initial conditions can be performed in the Wooldridge and Heckman estimators. In Wooldridge's estimator, the estimate on the initial value of FSP participation status is statistically significant, and with regard to the Heckman estimator, the exogeneity of the initial condition requires that $\theta = 0$, which is also strongly rejected. Third, the importance of allowing for unobserved heterogeneity through individual random effects is shown by the rejection of the hypothesis that $\rho = 0$ in all models.

The existence of unobserved heterogeneity and endogenous initial conditions implies that state dependence will be overestimated in the correlated random effects model. This is confirmed by the coefficient estimate on lagged FSP participation: it is 1.46 in the Wooldridge model and 1.43 in Heckman's model compared to 1.72 in the correlated random effects model that assumes exogenous initial conditions. Turning to the magnitude of the effect of lagged FSP participation, APEs in table 3.4 suggest that past receipt of food stamps increases the probability of receiving food stamps in a given period by 38 percent using the Wooldridge estimates and by 39 percent using the Heckman estimates. This represents a substantially smaller estimate than the persistence rate (52 percent) obtained from the correlated random effects probit that only controls for unobserved heterogeneity.

In order to examine whether this is also the case with respect to annual persistence rates and how they vary over time, the dynamic probit model was extended to include interaction terms between lagged FSP participation and year dummies. Parameter estimates, presented in table C2

in Appendix C, indicate that state dependence interacted with year dummies turns out statistically significant for most of the years in the Wooldridge model (except for 1993, 2003 and 2005) whereas only the years 1997 and 2001 interacted with lagged FSP participation appear to have statistically significant impacts in the Heckman model. Figure 3.3 presents estimates of annual persistence rates from a pooled probit model that does not account for unobserved heterogeneity and endogenous initial conditions, a correlated random effects probit specification that only controls for unobserved heterogeneity, and the Heckman and Wooldridge models that account for both unobserved heterogeneity and endogeneity of initial conditions. As expected, the Heckman and Wooldridge approaches yield smaller estimates of persistence rates than those obtained from models that do not account for unobserved heterogeneity and/or initial conditions. In fact, in any given year controlling for unobserved factors and endogenous initial conditions reduces the estimated persistence rate by almost half.

Figure 3.3 also indicates that persistence rates declined significantly after 1996. Commonly referred to as the 1996 Welfare Reform, the PRWORA Legislation replaced the Aid to Families with Dependent Children (AFDC) program with the Temporary Assistance to Needy Families (TANF). The welfare measures implemented through PRWORA focused on moving families off cash welfare; however existing literature suggests that TANF and FSP participation are strongly linked (Mills et al., 2001; Ziliak et al., 2000; Quint and Widom, 2000; Currie and Grogger, 2001). Another important policy change in the second half of the 1990s was the switch from paper coupons to Electronic Benefits Transfer (EBT) cards in delivering food stamps, which was completed in all states in 2004. A major reason for this transition was to induce eligible families to participate in the FSP by reducing the social stigma associated with using food stamps. These policy changes are likely to have a significant impact on household FSP participation

propensities, and may explain the sudden drop in persistence rates after 1996. In order to test whether this was the case, the Heckman and Wooldridge specifications were estimated for the pre-welfare reform and post-welfare reform periods separately. These specifications also include state-level EBT penetration rates, measured by the percentage of food stamps delivered via electronic cards in a given year, to account for the possible effect of EBT systems on household FSP participation behavior.

Estimation results, reported in tables C3 and C4 in Appendix C, indicate that there is indeed a significant drop in FSP participation persistence rates after the implementation of welfare reform measures. For instance, the estimate of state dependence from the Wooldridge model is 1.4 in the pre-welfare reform and 0.98 in the post-welfare reform period. In order to test whether there was indeed a structural change in persistence rates after 1996, a fully interacted model that includes an indicator variable for post-welfare reform and interactions between this indicator and all the covariates in the model was estimated using the Wooldridge and Heckman specifications. Parameter estimates from these models (reported in table C5 in Appendix C) indicate that all the post-welfare reform parameters are jointly statistically significant ($p=0.01$ in the Wooldridge model and $p=0.05$ in the Heckman model). This implies that there was indeed a structural break in FSP participation dynamics following the implementation of welfare reform measures.

Turning to other parameter estimates, overall results are similar in terms of statistical significance between the Heckman and Wooldridge models, but magnitudes vary. With respect to household characteristics, most of the variables hypothesized to have an influence on the probability of FSP benefit take-up turn out significant with expected signs. Variables that reflect economic disadvantage such as minority status, single motherhood, and educational attainment are found to play a significant role in the decision to participate in the FSP. Other variables such

as number of children and time spent unemployed by the household head increase the probability of FSP receipt while the age of head and home ownership has a negative effect on the probability of receiving food stamps. Among the variables describing the location attributes, only county unemployment rates and distance to the closest office (only in the Wooldridge model) are associated with statistically significant effects on the probability of FSP participation: residents of counties with higher unemployment rates are more likely to be on the FSP and larger distances to the FSP office lowers the probability of take-up. Finally, contrary to expectations state-level policy variables do not appear to play a role in the probability of receiving food stamps. This implies that household level controls, especially experience with the program and location attributes explain most of the FSP participation probabilities in the models employed in this study.

These differences in FSP utilization propensities raise the question of whether persistence rates also vary by household characteristics. In the literature, it is often noted that economically disadvantaged households are more likely to be trapped in welfare. In order to evaluate this hypothesis, dynamic probit models that include interaction effects between lagged FSP participation and key variables that determine economic well-being such as single motherhood, racial status, educational attainment and residence in the rural South are estimated. Parameter estimates, presented in table C6 in Appendix C, indicate that structural differences with respect to state dependence in FSP participation exist only between households with a non-White head and a White head. The extent of state dependence, computed as the APEs associated with lagged FSP participation among these subgroups, show that having a non-White household head add to the economic strain of low-income households. In fact, non-White household heads are at least 3 percent more likely to stay on FSP if they have received food stamps in the previous period than

White household heads. This implies that welfare persistence is stronger among these households.

Regional differences may also exist with respect to state dependence in FSP utilization patterns. These differences may arise from a variety of factors such as regional differences in welfare policies and economic conditions (Figlio et al., 1999). For instance, the Southern region of the U.S. experience more persistent poverty and food insecurity than other regions and may therefore experience higher persistence rates of FSP participation. In order to analyze the differential impact the system had on different regions, the structural participation equation was estimated using an extended specification with interaction effects between lagged FSP participation and region dummies that include the Northeast, North Central, South Central, South Atlantic, Pacific and Mountain, with South Atlantic taken as the reference category[22].

Figure 3.4 presents the Kernel density estimates of household level partial effects associated with lagged FSP participation in each region[23]. These densities are presented for all regions for comparison even though parameter estimates (provided in table C8 in Appendix C) indicate that regions that experience structural differences in persistence in FSP participation (compared to the reference region South Atlantic) are the Northeast and South Central regions based on the Wooldridge model and only the Northeast region based on the Heckman model. This is further confirmed by the distribution of household level estimates that are strikingly similar for the Northeast and South Central regions and different from the other regions with the exception of the North Central region. Although this region displays more similarities to the Northeast and

[22] A list of the states that constitute each region is provided in table C7 in Appendix C.

[23] Kernel density estimates were obtained using a Gaussian kernel with the default optimal bandwidth, i.e. the width that would minimize the mean integrated squared error (between the true and estimated densities).

South Central regions than to the South Atlantic region, surprisingly parameter estimates do not show a structural difference between the North Central region and the South Atlantic region.

From a policy perspective, it is important to evaluate whether the observed persistence in FSP participation is structural or due to unobserved heterogeneity. Decomposing state dependence into its components is typically done by estimating a model that does not account for unobserved heteroegenity and endogenous initial conditions to derive predicted transition probabilities and comparing these probabilities to those obtained from the Heckman or Wooldridge model (Hansen and Lofstrom, 2009). Structural state dependence is then defined as the ratio of the persistence probabilities with and without controls for unobserved heterogeneity and initial conditions, and the remaining portion of state dependence is spurious.

Table 3.5 summarizes the sources of state dependence for the full sample and households with a White and non-White head as well as for the six regions considered in this study. It is important to note that for households with a non-White and White head, only estimates based on the Wooldridge model are provided since interaction effects were statistically significant only in this model. On the other hand, all six regions are presented in order to make comparisons to the reference region used in the estimation (South Atlantic). For the full sample, approximately 67-69 percent of the observed persistence in FSP participation is "structural" and 31-33 percent is "spurious" and due to unobserved heterogeneity. With respect to persistence by minority status, households headed by non-White persons appear to suffer more (approximately 70 percent) than those with a White head (62 percent) from structural persistence in FSP participation. This suggests that a welfare trap does exist for all low-income households, but it is larger for low-income households headed by minorities. The implication of this is that changes in FSP policies

are not likely to have a major influence on participation. Instead, policies directed at people getting households off welfare are more likely to be successful among these populations.

State dependence in FSP participation is also mostly structural in the six regions considered in this study although some notable differences exist across regions. The extent of a "welfare trap" is significantly larger in the Northeast and South Central regions (with more than 70 percent using either model) when compared to the South Atlantic region (with around 62-66 percent). On the other hand, the degree of structural persistence in other regions is similar to the base category South Atlantic. According to Andren (2007), regional differences in persistence rates may be caused by a number of factors including regional welfare generosity. For instance, in regions with relatively high participation rates, the negative signal attached to receiving welfare may be smaller than in regions with relatively lower participation rates. In this case, the degree of structural state dependence will be higher in regions with high participation rates. Indeed, the highest participation rates are observed in the Northeast and South Central regions (with 35 and 34 percent, respectively) that also experience the largest welfare trap. This implies that policies that lower participation rates will be more efficient in the regions with a higher degree of structural state dependence than those with a lower degree of structural persistence.

On a final note, the parameter estimates of the instruments for the initial period FSP receipt indicate none of the exclusion instruments are individually statistically significant. However, as mentioned above county unemployment rates in the initial period can aid in identification as they proxy for exogenous economic conditions in the initial period and therefore are likely to influence only initial period receipt probabilities directly. The parameter estimate associated with initial period county unemployment rate is statistically significant and has a positive impact on the propensity to participate in the FSP in the first period.

This finding certainly raises questions about the validity of the Heckman estimates; however the remarkably similar results obtained in the Wooldridge and Heckman model are reassuring. This implies that the Heckman estimates were either identified by non-linearities in functional form or jointly by the instruments included in the initial conditions equation. Still, in an effort to explore the robustness of the results to the choice of instruments, a number of alternative specifications were estimated relying on different identification strategies. Heckman estimates associated with lagged FSP participation and the initial period instruments from these alternative models are presented in table 3.6. Model 1 relies on county unemployment rates, model 2 adds state unemployment rates to the identification strategy, while model 3 and model 4 use county unemployment rates and other background variables such as parents' economic status and the number of years the household head worked full-time since 18 years old until the year 1990 as instruments. County unemployment rates affect initial period FSP participation probabilities in all models. On the other hand, state unemployment rates and the number of years worked full-time by the household turn out statistically significant in the models they are included. Having lived with both parents affects initial period participation only in model 3. Finally, the state dependence estimate is almost identical across these specifications.

As an alternative identification strategy, FSP participation status in the year 1989 may be used in the 1990 FSP participation equation, and excluded from the participation equations in later periods. However, this instrument would be valid if there is only first-order dynamics in FSP participation, an assumption that can be tested using a model with additional lags. The Wooldridge approach assumes first order dynamics, and therefore cannot be used to test for higher order dynamics. The Heckman specification can handle additional lags; however this requires simultaneous estimation of multiple equations, which makes the model computationally

very intensive.[24] One solution is to estimate a correlated random effects probit model with additional lags but this approach assumes exogenous initial conditions and will overestimate state dependence if initial conditions are endogenous. Therefore a test of higher order dynamics in the context of Heckman or Wooldridge models that account for unobserved heterogeneity and endogenous initial conditions is left for future research.

Discussion and Conclusions

This study employs dynamic random effects probit models to analyze the dynamics of participation in the FSP using PSID data for the years 1990 to 2005 to capture the observed serial persistence in FSP participation. The principal focus is to control for unobserved household-specific effects and the endogeneity of initial conditions that arise in dynamic models, which are addressed using two alternative specifications developed by Heckman and Wooldridge. Results show that FSP receipt in the previous period is an important determinant of current FSP receipt which implies the existence of strong path dependence in FSP participation. The estimated state dependence is close to 0.4 in both the Heckman and Wooldridge model, implying that FSP receipt in the previous period increases the propensity to participate in the FSP in the current period by forty percent. Further, there is a considerable correlation between unobserved heterogeneity and the initial condition which overstates the degree of the state dependence in FSP participation substantially when ignored. In fact, in any given year controlling for unobserved factors and endogenous initial conditions reduces the estimated persistence rate by almost half.

[24] The STATA program redprob was developed to handle only first order dynamics. An alternative estimation method for Heckman models with higher order dynamics is to use simulated maximum likelihood techniques but the difficulty of finding valid exclusion restrictions for multiple equations makes the approach unattractive.

Annual trends in persistence rates indicate that the estimated degree of state dependence in FSP participation declined significantly after 1996, mostly due to the increasing exit rates from the FSP following the passage of the 1996 PRWORA Legislation. Perhaps the most significant policy change in the history of U.S. welfare policy, the PRWORA legislation focused on moving families off cash welfare but also had a major impact on FSP participation patterns. One of the major goals of the new legislation was to decrease long-term welfare dependency among welfare recipients, which appears to be the case with respect to the FSP.

For some groups of low-income households, the degree of state dependence in FSP participation is higher than others. In particular, welfare persistence is observed to be stronger for households headed by non-White persons when compared to families with a White head. Further, these households also appear to have higher FSP utilization propensities, implying that they are more likely to participate in the FSP, and once they participate they tend to stay on the program. This finding supports the widely cited claim that economically strained households are more likely to suffer from welfare dependence. Policies could be aimed at reducing the risk of falling into poverty and therefore welfare among these populations, however a deeper understanding of the underlying causes of welfare persistence is required for effective policy formulation.

An important policy question this study addresses is whether persistence in FSP participation is caused by the existence of a "welfare trap" where past receipt of food stamps acts to change recipients' behavior and hence their propensity to participate in the program in the future or is due to unobserved household heterogeneity in that households have different underlying propensities to participate in the program in all periods. Results suggest that the source of state dependence in FSP participation among low-income households is mostly structural implying that a welfare trap does exist for these households. Further, the degree of structural state

dependence is stronger for low-income households headed by minorities. These results imply that FSP policies aimed at reducing the duration of FSP receipt through changes in benefit levels or the opportunity costs of participation will be more effective in reducing dependence among these households than among other households.

Regional differences also exist with respect to sources of state dependence in FSP participation. While state dependence is mostly structural in all regions, the extent of a welfare trap is larger in the Northeast and South Central regions than other regions. It is possible that regional welfare generosity (as indicated by high participation rates) plays a role in the observed structural persistence, which implies that policies that lower participation rates may also reduce structural state dependence in FSP participation in regions with high participation rates.

Finally, this study assumes first-order dynamics, meaning that the degree of state dependence from the past is collapsed into a single parameter. Higher order dynamics can be allowed in the Heckman specification; however this requires simultaneous estimation of multiple equations since there will be multiple initial conditions depending on the order of dynamics. This makes the model computationally very intensive, which can be estimated using simulated maximum likelihood techniques but the difficulty of finding valid exclusion restrictions for multiple equations makes the approach unattractive (Cappellari et al., 2009). The Wooldridge approach offers a computationally simple alternative; however dynamics are assumed to be first-order in the Wooldridge model, which future research could extend to handle higher order dynamics.

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Figure 3.1: Annual Trends in FSP Receipt, 1990-2005

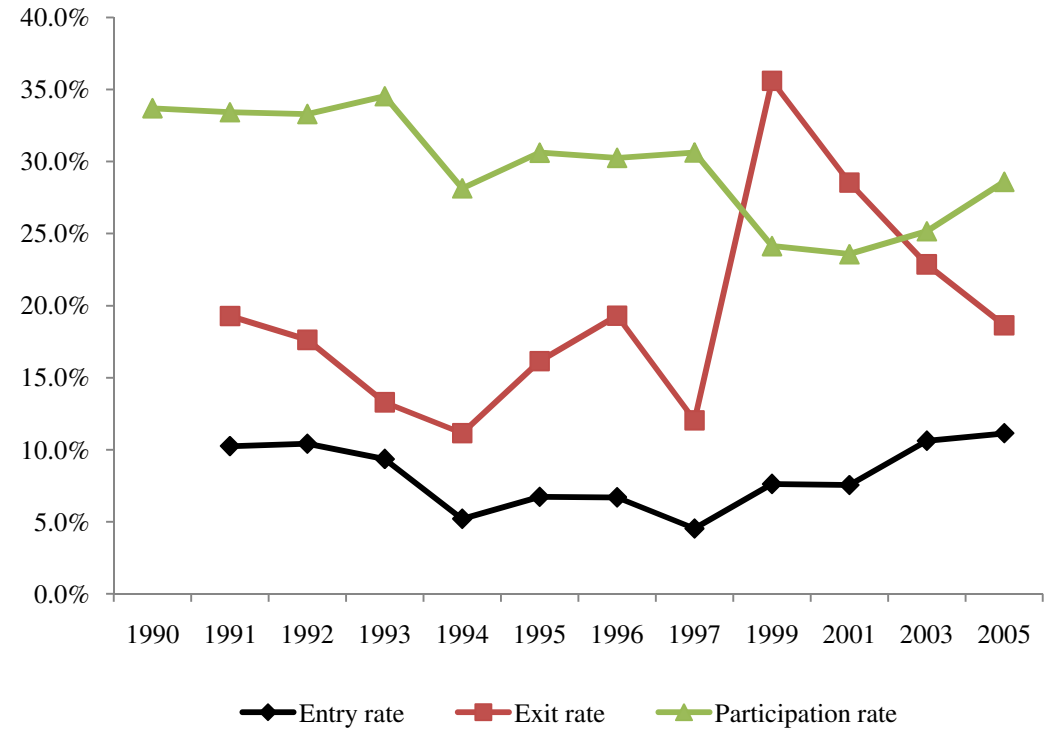

Figure 3.2: Raw Persistence Rates, 1991-2005

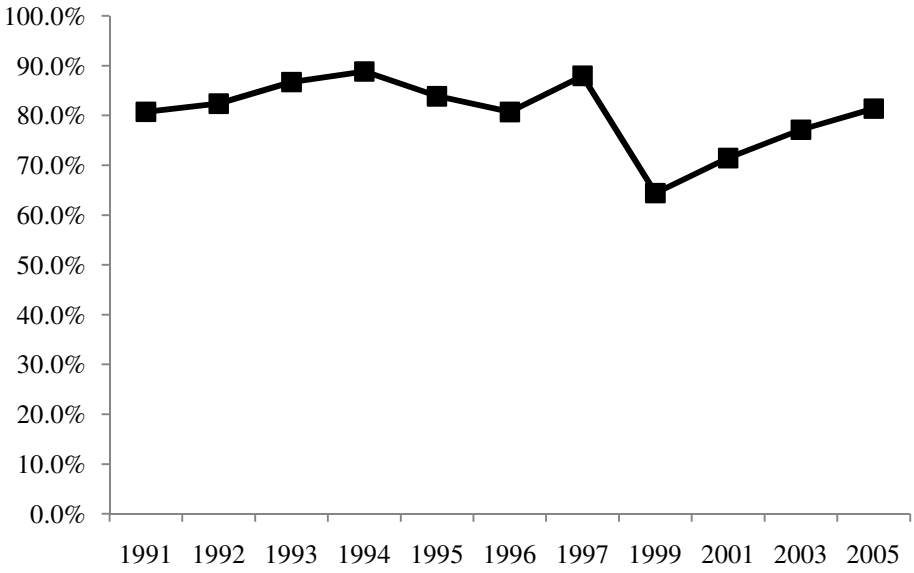

Table 3.1: Descriptive Statistics

Variable	Participating in all Periods		Participating in at least one Period		Never Participating	
	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev
Rural South	0.18	0.39	0.14	0.34	0.13	0.34
Number of Adults	1.42	0.67	1.64	0.81	1.65	0.82
Number of Children	2.15	2.03	1.52	1.54	1.16	1.44
Age of Head (10)	4.53	1.42	4.26	1.58	4.66	1.85
Head is White	0.06	0.23	0.30	0.46	0.43	0.49
Head is African American	0.91	0.29	0.63	0.48	0.50	0.50
Head is Other Race	0.03	0.18	0.07	0.26	0.07	0.26
Home Owner	0.17	0.38	0.26	0.44	0.36	0.48
Head has no High School Degree	0.72	0.45	0.48	0.50	0.44	0.50
Head is High School Graduate	0.16	0.37	0.34	0.47	0.34	0.47
Head has College no Degree	0.12	0.32	0.15	0.36	0.17	0.37
Head has College Degree	0.00	0.00	0.03	0.16	0.06	0.23
Head is Single Mother	0.62	0.49	0.39	0.49	0.25	0.44
Head Unemployed Weeks	4.22	10.85	3.60	10.87	2.87	9.78
County Unemployment Rate (%)	6.28	1.62	6.65	2.70	6.44	2.64
State Average Certification Period (months)	10.70	1.89	10.14	2.17	10.08	2.17
County FSP Recipients (100,000)	1.92	2.47	1.24	1.90	1.12	1.89
Distance to Closest FSP office (miles)	4.84	5.56	4.48	5.00	4.80	5.15
State Overpayment Rate (%)	0.12	0.05	0.12	0.04	0.12	0.04
State Underpayment Rate (%)	0.08	0.03	0.08	0.03	0.08	0.03
Number of Observations	212		13,491		25,974	

[a] Head is defined to be the more educated spouse.

Table 3.2: Descriptive Statistics, Initial Period Instruments

Variable	Mean	Std Dev
Head's first occupation: Professional, managerial or self-employed	0.04	0.20
Head's first occupation: Clerical and sales worker, crafts or operatives	0.39	0.49
Head's first occupation: Laborer or service worker	0.49	0.50
Head's first occupation: Miscellaneous	0.08	0.27
Head Lived with Both Parents until Age of 16	0.69	0.46
Head Years Worked Full-time since 18 years old	16.06	14.97
Number of Observations	2,817	

[a] Head is defined to be the more educated spouse.

Table 3.3: Dynamic Random Effects Probit Results

Variable	Initial Conditions Exogenous			Initial Conditions Endogenous					
	Correlated Random Effects Probit			Wooldridge			Heckman		
	Parameter		SE	Parameter		SE	Parameter		SE
FSP Participation at *t-1*	1.718	***	0.028	1.455	***	0.044	1.430	***	0.061
FSP Participation at *t=1990*				0.847	***	0.061			
Rural South	0.067	*	0.040	0.050		0.060	-0.029		0.099
Number of Adults	-0.006		0.026	-0.064	*	0.034	-0.033		0.048
Number of Children	0.143	***	0.019	0.162	***	0.026	0.136	***	0.038
Age of Head (10 years)	-0.224	***	0.055	-0.202	***	0.069	-0.195	*	0.104
Head is African American	0.142	***	0.029	0.132	***	0.043	0.165	***	0.067
Head is Other Race	0.087	*	0.048	0.238	***	0.076	0.229	**	0.104
Home Owner	-0.354	***	0.031	-0.316	***	0.042	-0.410	***	0.064
Head is High School Graduate	-0.183	***	0.030	-0.198	***	0.045	-0.331	***	0.068
Head has College No Degree	-0.277	***	0.039	-0.273	***	0.060	-0.372	***	0.098
Head has College Degree	-0.397	***	0.065	-0.340	***	0.096	-0.436	***	0.166
Head is Single Mother	0.369	***	0.034	0.344	***	0.050	0.522	***	0.073
Head Unemployed Weeks	0.008	***	0.001	0.007	***	0.002	0.007	***	0.002
County Unemployment Rate (%)	0.058	***	0.009	0.058	***	0.012	0.048	***	0.017
State Average Recertification Period (months)	0.031	***	0.011	0.015		0.015	0.015		0.022
County FSP Recipients (100,000)	0.014		0.022	-0.019		0.027	-0.001		0.036
Distance to Closest FSP Office (miles)	-0.015	***	0.006	-0.026	***	0.008	-0.023		0.014
State Overpayment Rate (%)	-1.056	*	0.649	0.076		0.815	-0.542		1.134
State Underpayment Rate (%)	-1.376		0.952	-1.562		1.254	-2.050		1.836
Mean Number of Adults	-0.017		0.034	0.051		0.044	-0.018		0.064
Mean Number of Children	-0.019		0.023	-0.055	*	0.032	0.031		0.047
Mean Age of Head	0.212	***	0.056	0.185	***	0.071	0.147		0.107
Mean Head Unemployed Weeks	0.008	***	0.003	0.017	***	0.005	0.011		0.008

Table 3.3 – continued

Mean County Unemployment Rate	-0.015		0.011	-0.008		0.015	0.023		0.021
Mean State Average Recertification Period	-0.041	***	0.014	-0.055	***	0.019	-0.074	***	0.028
Mean County FSP Recipients	0.009		0.023	0.046		0.031	0.041		0.041
Mean Distance to Closest FSP Office	0.013	**	0.006	0.020	**	0.009	0.010		0.016
Mean State Overpayment Rate	3.953	***	0.896	3.108	***	1.222	6.266	***	1.725
Mean State Underpayment Rate	-2.813	**	1.282	-0.626		1.800	-3.173		2.578
Intercept	-1.524	***	0.111	-1.732	***	0.192	-1.264	***	0.281
ρ	0.140	***	0.018	0.270	***	0.024	0.405	***	0.037
θ							1.178	***	0.135
Initial Period Instruments									
County Unemployment Rate							0.079	***	0.016
Head's first occupation: Professional, managerial or self-employed							-0.283		0.260
Head's first occupation: Clerical and sales worker, crafts or operatives							-0.096		0.083
Head's first occupation: Miscellaneous							-0.162		0.156
Head lived with Parents until Age of 16							-0.128		0.080
N	23,948			16,509			36,212		
Log-Likelihood	-8,510.27			-5,274.89			-4,246.78		

Note: ***, **, and * indicate significance at 1%, 5%, and 10%, respectively.

Table 3.4: APEs for Selected Variables

Variable	Correlated Random Effects Probit		Wooldridge		Heckman	
FSP Participation at *t-1*	0.522	***	0.380	***	0.394	***
FSP Participation at *t=1990*			0.181	***		
Rural South	0.013	*	0.008		-0.005	
Number of Adults	-0.001		-0.010	*	-0.006	
Number of Children	0.027	***	0.026	***	0.025	***
Age of Head (10 years)	-0.043	***	-0.032	***	-0.037	*
Head is African American	0.028	***	0.021	***	0.032	***
Head is Other Race	0.017	*	0.039	***	0.046	**
Home Owner	-0.068	***	-0.051	***	-0.078	***
Head is High School Graduate	-0.035	***	-0.032	***	-0.062	***
Head has College No Degree	-0.051	***	-0.044	***	-0.068	***
Head has College Degree	-0.071	***	-0.054	***	-0.077	***
Head is Single Mother	0.077	***	0.060	***	0.113	***
Head Unemployed Weeks	0.002	***	0.001	***	0.001	***
County Unemployment Rate (%)	0.011	***	0.009	***	0.009	***
State Average Recertification Period (months)	0.006	***	0.002		0.003	
County FSP Recipients (100,000)	0.003		-0.003		-0.0002	
Distance to Closest FSP Office (miles)	-0.003	***	-0.004	***	-0.004	
State Overpayment Rate (%)	-0.203	*	0.012		-0.103	
State Underpayment Rate (%)	-0.264		-0.248		-0.391	

Note: ***, **, and * indicate significance at 1%, 5%, and 10%, respectively.

Figure 3.3: Annual Trends in Estimated Welfare Persistence

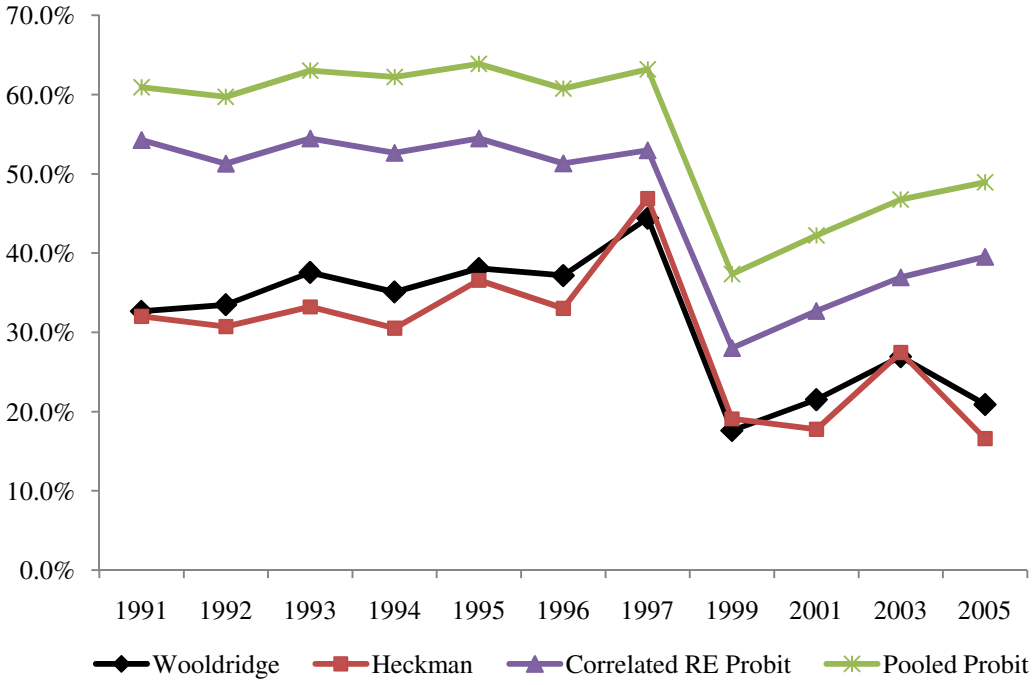

Figure 3.4: Distribution of Household-Level State Dependence Estimates by Region

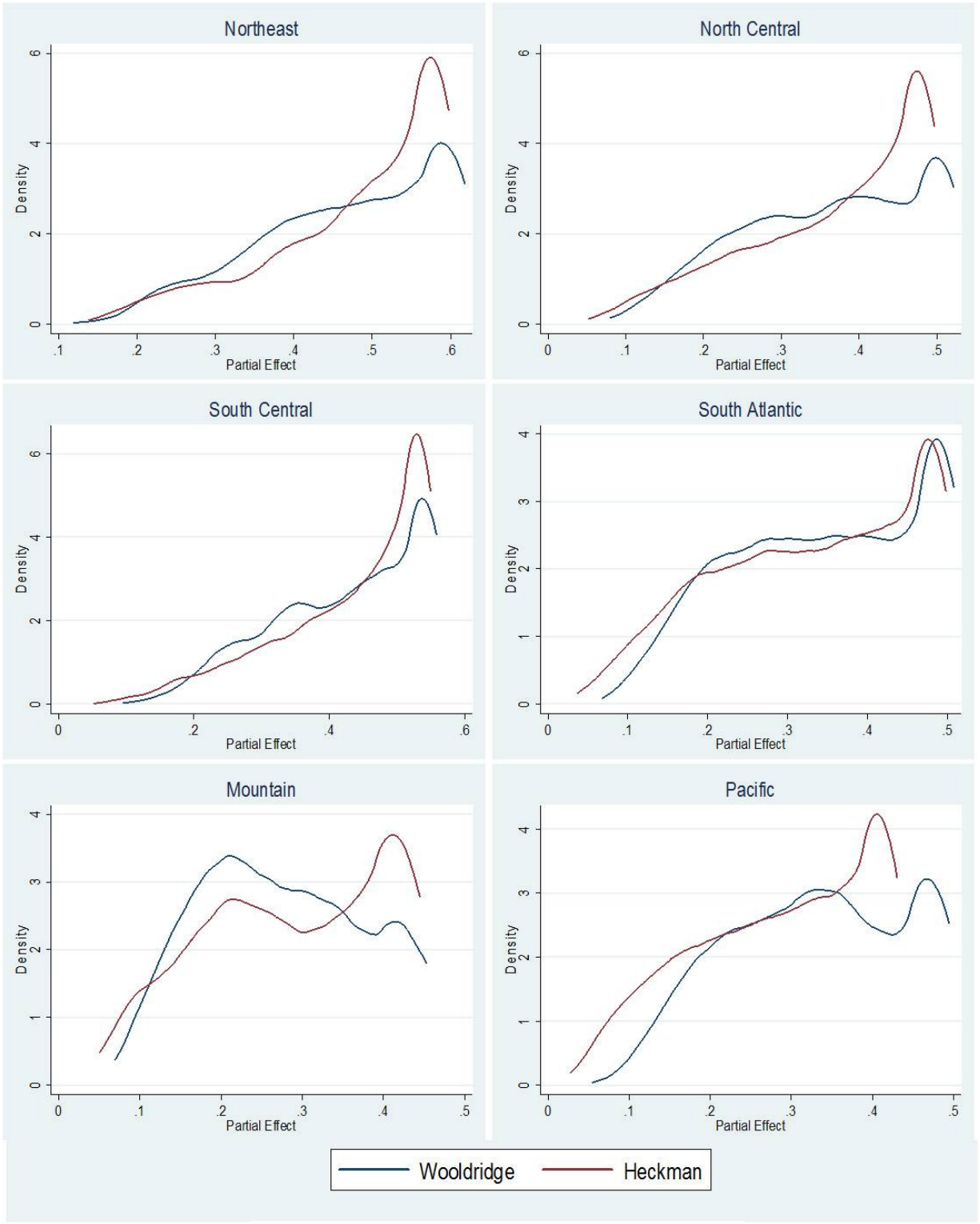

Table 3.5: Sources of State Dependence

Subgroup/Region	Wooldridge		Heckman	
	Structural	Spurious	Structural	Spurious
Full Sample	66.7%	33.3%	68.8%	31.2%
Non-White	69.8%	30.2%		
White	62.1%	37.9%		
Northeast	71.3%	28.7%	73.0%	27.0%
North Central	64.1%	35.9%	64.9%	35.1%
South Central	71.3%	28.7%	72.6%	27.4%
Mountain	57.8%	42.2%	60.3%	39.7%
Pacific	60.1%	39.9%	51.8%	48.2%
South Atlantic	65.5%	34.5%	62.8%	37.2%

Table 3.6: Selected Results from Heckman Models with Alternative Instruments

Variable	Model 1			Model 2			Model 3			Model 4		
	Parameter		SE	Parameter		SE	Parameter		SE	Parameter		SE
State Dependence												
FSP Participation at *t-1*	1.424	***	0.061	1.425	***	0.061	1.429	***	0.063	1.394	***	0.070
Initial Period Instruments												
County Unemployment Rate	0.080	***	0.016	0.090	***	0.017	0.081	***	0.016	0.080	***	0.017
State Unemployment Rate				-0.098	**	0.047						
Head Years Worked Full-time since 18 years old										-0.007	*	0.004
Head Lived with Parents							-0.136	*	0.081	-0.099		0.088
Parents Poor							0.037		0.097			
Parents Rich							-0.021		0.081			

Note: ***, **, and * indicate significance at 1%, 5%, and 10%, respectively.

Appendix C

Table C1: Initial Period FSP Participation Equation

Variable	Parameter		SE
Rural South	0.208		0.145
Number of Adults	-0.164	***	0.055
Number of Children	0.241	***	0.035
Age of Head (10 years)	0.015		0.027
Head is African American	0.264	***	0.093
Head is Other Race	0.293	**	0.132
Home Owner	-0.592	***	0.098
Head is High School Graduate	-0.228	**	0.105
Head has College No Degree	-0.336	***	0.108
Head has College Degree	-0.832	***	0.285
Head is Single Mother	1.054	***	0.105
Head Unemployed Weeks	-0.002		0.004
County Unemployment Rate	0.079	***	0.016
State Average Recertification Period (months)	-0.057	***	0.023
County FSP Recipients (100,000)	0.051	*	0.028
Distance to Closest FSP Office (miles)	-0.013		0.009
State Overpayment Rate	11.832	***	1.629
State Underpayment Rate	-6.140	***	2.180
Head's first occupation: Professional, managerial or self-employed	-0.283		0.260
Head's first occupation: Clerical and sales worker, crafts or operatives	-0.096		0.083
Head's first occupation: Miscellaneous	-0.162		0.156
Head lived with Parents until Age of 16	-0.128		0.080
Intercept	-1.829	***	0.370

Note: ***, **, and * indicate significance at 1%, 5%, and 10%, respectively.

Table C2: Dynamic Random Effects Probit Results with Interaction Effects between Lagged FSP Participation and Year Dummies

Variable	Initial Conditions Exogenous						Initial Conditions Endogenous					
	Pooled Probit			Correlated Random Effects Probit			Wooldridge			Heckman		
	Parameter		SE	Parameter		SE	Parameter		SE	Parameter		SE
FSP Participation at *t-1*	1.880	***	0.048	1.848	***	0.052	1.323	***	0.079	1.410	***	0.101
FSP Participation at *t=1990*							-0.250		0.164			
FSP Participation at *t-1** Year 1992	-0.026		0.078	-0.091		0.082	0.843	***	0.060	-0.015		0.132
FSP Participation at *t-1** Year 1993	0.074		0.079	0.003		0.084	0.076		0.103	0.052		0.144
FSP Participation at *t-1** Year 1994	0.169	*	0.089	0.085		0.095	0.212	**	0.110	0.074		0.168
FSP Participation at *t-1** Year 1995	0.185	**	0.086	0.104		0.092	0.317	***	0.126	0.259		0.179
FSP Participation at *t-1** Year 1996	0.101		0.086	0.017		0.092	0.368	***	0.130	0.202		0.186
FSP Participation at *t-1** Year 1997	0.205	**	0.103	0.100		0.110	0.392	***	0.135	0.945	***	0.278
FSP Participation at *t-1** Year 1999	-0.573	***	0.096	-0.709	***	0.103	0.696	***	0.171	-0.334		0.249
FSP Participation at *t-1** Year 2001	-0.487	***	0.099	-0.602	***	0.107	-0.335	**	0.161	-0.530	**	0.259
FSP Participation at *t-1** Year 2003	-0.397	***	0.098	-0.510	***	0.105	-0.198		0.175	-0.040		0.289
FSP Participation at *t-1** Year 2005	-0.380	***	0.098	-0.487	***	0.105	0.076		0.184	-0.653	**	0.286
Year 1992	-0.073		0.052	-0.063		0.055	-0.261		0.188	-0.122		0.090
Year 1993	-0.047		0.054	-0.032		0.057	-0.157	**	0.068	-0.060		0.102
Year 1994	-0.268	***	0.061	-0.258	***	0.065	-0.149	**	0.075	-0.191		0.119
Year 1995	-0.182	***	0.057	-0.172	***	0.060	-0.389	***	0.087	-0.077		0.120
Year 1996	-0.214	***	0.060	-0.205	***	0.065	-0.280	***	0.086	-0.220		0.138
Year 1997	-0.244	***	0.071	-0.233	***	0.076	-0.349	***	0.095	-0.475	**	0.196
Year 1999	-0.167	**	0.073	-0.156	**	0.078	-0.366	***	0.114	-0.190		0.204
Year 2001	-0.087		0.074	-0.103		0.081	-0.247	**	0.126	0.113		0.216
Year 2003	-0.050		0.074	-0.075		0.082	-0.252	*	0.142	-0.167		0.246
Year 2005	0.084		0.080	0.078		0.088	-0.480	***	0.155	0.333		0.254
Rural South	0.064	**	0.033	0.078	**	0.039	0.052		0.059	-0.024		0.098
Number of Adults	0.000		0.024	-0.004		0.025	-0.059	*	0.033	-0.027		0.048
Number of Children	0.139	***	0.017	0.154	***	0.018	0.163	***	0.026	0.146	***	0.038
Age of Head (10 years)	0.018		0.059	0.021		0.063	0.045		0.099	-0.085		0.155
Head is African American	0.143	***	0.024	0.173	***	0.028	0.148	***	0.043	0.166	***	0.067
Head is Other Race	0.097	**	0.043	0.119	***	0.048	0.203	***	0.075	0.226	**	0.103
Home Owner	-0.284	***	0.025	-0.339	***	0.029	-0.305	***	0.042	-0.412	***	0.064
Head is High School Graduate	-0.139	***	0.024	-0.170	***	0.029	-0.185	***	0.044	-0.327	***	0.069
Head has College No Degree	-0.202	***	0.031	-0.244	***	0.037	-0.246	***	0.060	-0.355	***	0.097

Table C2 – continued

Head has College Degree	-0.327	***	0.056	-0.388	***	0.064	-0.303	***	0.095	-0.437	***	0.164
Head is Single Mother	0.325	***	0.027	0.389	***	0.032	0.343	***	0.049	0.526	***	0.073
Head Unemployed Weeks	0.006	***	0.001	0.006	***	0.001	0.007	***	0.002	0.007	***	0.002
State Average Recertification Period (months)	0.000		0.010	0.00005		0.011	0.008		0.016	0.002		0.023
County FSP Recipients (100,000)	0.018		0.020	0.022		0.021	-0.011		0.028	0.005		0.038
Distance to Closest FSP Office (miles)	-0.009	*	0.005	-0.010	*	0.005	-0.026	***	0.008	-0.020		0.014
State Overpayment Rate	-0.004		0.594	0.119		0.627	-0.156		0.842	-0.371		1.180
State Underpayment Rate	-0.211		0.935	-0.502		0.988	-1.252		1.371	-0.893		1.991
Mean Number of Adults	-0.024		0.029	-0.028		0.032	0.045		0.044	-0.022		0.064
Mean Number of Children	-0.037	*	0.020	-0.026		0.022	-0.058		0.031	0.019		0.046
Mean Age of Head	-0.026		0.060	-0.031		0.064	-0.060		0.100	0.039		0.157
Mean Head Unemployed Weeks	0.010	***	0.003	0.012	***	0.003	0.017	***	0.005	0.011		0.008
Mean County Unemployment Rate	0.006		0.010	0.010		0.011	-0.008		0.017	0.021		0.024
Mean State Average Recertification Period	-0.002		0.012	-0.001		0.013	-0.046	**	0.020	-0.060	**	0.029
Mean County FSP Recipients	-0.003		0.021	-0.005		0.023	0.038		0.031	0.035		0.042
Mean Distance to Closest FSP Office	0.009		0.006	0.009		0.006	0.021	**	0.009	0.008		0.016
Mean State Overpayment Rate	1.988	***	0.788	2.155	***	0.868	2.809	**	1.230	6.022	***	1.756
Mean State Underpayment Rate	-3.066	***	1.158	-3.622	***	1.271	-1.696		1.852	-4.607	*	2.680
Intercept	-1.405	***	0.110	-1.469	***	0.126	-1.427	***	0.204	-1.166	***	0.297
ρ				0.133	***	0.017	0.254	***	0.025	0.397	***	0.038
θ												
Initial Period Instruments												
County Unemployment Rate										0.079	***	0.016
Head's first occupation: Professional, managerial or self-employed										-0.288		0.261
Head's first occupation: Clerical and sales worker, crafts or operatives										-0.096		0.084
Head's first occupation: Miscellaneous										-0.163		0.156
Head lived with Parents until Age of 16										-0.130	*	0.080
N	25,974			25,974			16,509			36,212		
Log-Likelihood	-9,177.79			-9,137.91			-5,320.56			-4,220.92		

Note: ***, **, and * indicate significance at 1%, 5%, and 10%, respectively.

Table C3: Dynamic Random Effects Probit Results, Pre-Welfare Reform

Variable	Wooldridge			Heckman		
	Parameter		SE	Parameter		SE
FSP Participation at *t-1*	1.394	***	0.054	1.340	***	0.068
FSP Participation at *t=1990*	0.995	***	0.080			
Rural South	0.006		0.071	0.020		0.105
Number of Adults	-0.013		0.046	0.027		0.058
Number of Children	0.187	***	0.036	0.179	***	0.046
Age of Head (10 years)	-0.147		0.111	-0.194		0.148
Head is African American	0.151	***	0.051	0.259	***	0.074
Head is Other Race	0.211	***	0.086	0.257	**	0.117
Home Owner	-0.359	***	0.050	-0.472	***	0.069
Head is High School Graduate	-0.228	***	0.052	-0.356	***	0.073
Head has College No Degree	-0.322	***	0.071	-0.512	***	0.104
Head has College Degree	-0.354	***	0.114	-0.461	***	0.185
Head is Single Mother	0.429	***	0.058	0.654	***	0.082
Head Unemployed Weeks	0.005	**	0.002	0.007	***	0.003
County Unemployment Rate	0.054	***	0.014	0.054	***	0.018
State Average Recertification Period (months)	-0.006		0.025	-0.004		0.031
State EBT Penetration Rate	-0.001		0.002	-0.003		0.002
County FSP Recipients (100,000)	-0.020		0.033	-0.006		0.040
Distance to Closest FSP Office (miles)	-0.032	***	0.011	-0.025		0.016
State Overpayment Rate	0.632		1.003	0.768		1.273
State Underpayment Rate	-1.034		1.717	-2.666		2.246
Mean Number of Adults	0.007		0.057	-0.078		0.074
Mean Number of Children	-0.068	*	0.041	0.015		0.054
Mean Age of Head	0.129		0.112	0.159		0.150
Mean Head Unemployed Weeks	0.020	***	0.005	0.013	**	0.007

Table C3 – continued

Mean County Unemployment Rate	0.002		0.018	0.024		0.023
Mean State Average Recertification Period	-0.042		0.029	-0.072	**	0.036
Mean State EBT Penetration Rate	-0.005		0.004	0.000		0.005
Mean County FSP Recipients	0.043		0.036	0.044		0.045
Mean Distance to Closest FSP Office	0.026	**	0.012	0.013		0.018
Mean State Overpayment Rate	2.144		1.408	4.499	***	1.836
Mean State Underpayment Rate	-1.324		2.223	-2.058		2.928
Intercept	-1.662	***	0.229	-1.254	***	0.312
ρ	0.334	***	0.030	0.473	***	0.039
θ				1.120	***	0.124
Initial Period Instruments						
County Unemployment Rate				0.073	***	0.016
Head's first occupation: Professional, managerial or self-employed				-0.253		0.262
Head's first occupation: Clerical and sales worker, crafts or operatives				-0.092		0.083
Head's first occupation: Miscellaneous				-0.117		0.153
Head lived with Parents until Age of 16				-0.149	*	0.079
N	25,023			12,937		
Log-Likelihood	-4,158.82			-4,175.35		

Note: ***, **, and * indicate significance at 1%, 5%, and 10%, respectively.

Table C4: Dynamic Random Effects Probit Results, Post-Welfare Reform

Variable	Wooldridge			Heckman		
	Parameter		SE	Parameter		SE
FSP Participation at *t-1*	0.978	***	0.087	0.961	***	0.183
FSP Participation at *t=1997*	0.754	***	0.107			
Rural South	0.084		0.095	-0.043		0.243
Number of Adults	-0.064		0.060	-0.117		0.121
Number of Children	0.182	***	0.048	-0.027		0.100
Age of Head (10 years)	0.202		0.183	-0.024		0.401
Head is African American	0.186	**	0.078	0.396	**	0.192
Head is Other Race	0.101		0.121	0.513		0.413
Home Owner	-0.315	***	0.070	-0.151		0.156
Head is High School Graduate	-0.197	***	0.072	-0.324	*	0.183
Head has College No Degree	-0.367	***	0.095	-0.368		0.257
Head has College Degree	-0.481	***	0.154	-0.577		0.407
Head is Single Mother	0.190	**	0.083	0.357	*	0.205
Head Unemployed Weeks	0.015	***	0.003	0.011		0.008
County Unemployment Rate	0.053	***	0.022	0.103	*	0.057
State Average Recertification Period (months)	0.021		0.026	0.066		0.059
State EBT Penetration Rate	0.001		0.001	-0.002		0.002
County FSP Recipients (100,000)	0.001		0.086	-0.263		0.217
Distance to Closest FSP Office (miles)	-0.015		0.013	-0.040		0.034
State Overpayment Rate	-4.317	*	2.496	-3.010		5.758
State Underpayment Rate	4.037		3.138	3.110		7.320
Mean Number of Adults	-0.010		0.080	0.042		0.169
Mean Number of Children	-0.051		0.057	0.228	*	0.133
Mean Age of Head	-0.226		0.185	0.003		0.405
Mean Head Unemployed Weeks	0.005		0.007	0.011		0.019

Table C4 – continued

Mean County Unemployment Rate	-0.028		0.025	-0.016		0.078
Mean State Average Recertification Period	-0.014		0.030	-0.043		0.070
Mean State EBT Penetration Rate	-0.002		0.002	-0.002		0.004
Mean County FSP Recipients	0.042		0.086	0.433	**	0.224
Mean Distance to Closest FSP Office	0.008		0.014	0.018		0.037
Mean State Overpayment Rate	4.933		3.127	6.765		7.286
Mean State Underpayment Rate	-9.659	**	4.143	-19.297	*	11.232
Intercept	-1.360	***	0.284	-1.602	**	0.733
ρ	0.278	***	0.051	0.542	***	0.090
θ				1.094	***	0.287
Initial Period Instruments						
County Unemployment Rate				-0.031		0.040
Head's first occupation: Professional, managerial or self-employed				0.705	*	0.404
Head's first occupation: Clerical and sales worker, crafts or operatives				-0.159		0.185
Head's first occupation: Miscellaneous				-0.100		0.310
Head lived with Parents until Age of 16				0.082		0.177
N	4,993			11,189		
Log-Likelihood	-1,783.89			-822.30		

Note: ***, **, and * indicate significance at 1%, 5%, and 10%, respectively.

Table C5: Dynamic Random Effects Probit Results from a Fully Interacted Model with Post-Welfare Reform Parameters

Variable	Wooldridge			Heckman		
	Parameter		SE	Parameter		SE
FSP Participation at *t-1*	1.506	***	0.046	1.460	***	0.065
FSP Participation at *t=1990*	0.851	***	0.062			
Rural South	0.050		0.066	-0.032		0.105
Number of Adults	-0.004		0.043	0.023		0.059
Number of Children	0.190	***	0.034	0.167	***	0.048
Age of Head (10 years)	-0.132		0.105	-0.226		0.146
Head is African American	0.140	***	0.046	0.176	***	0.070
Head is Other Race	0.204	***	0.080	0.191	*	0.109
Home Owner	-0.345	***	0.046	-0.430	***	0.067
Head is High School Graduate	-0.219	***	0.048	-0.359	***	0.072
Head has College No Degree	-0.305	***	0.066	-0.443	***	0.103
Head has College Degree	-0.346	***	0.104	-0.490	***	0.175
Head is Single Mother	0.390	***	0.054	0.578	***	0.077
Head Unemployed Weeks	0.005	***	0.002	0.006	**	0.003
County Unemployment Rate	0.052	***	0.014	0.042	**	0.019
State Average Recertification Period (months)	-0.003		0.023	0.006		0.031
State EBT Penetration Rate	-0.003	*	0.001	-0.002		0.002
County FSP Recipients (100,000)	-0.022		0.032	0.007		0.040
Distance to Closest FSP Office (miles)	-0.031	***	0.010	-0.024		0.017
State Overpayment Rate	0.466		0.957	0.325		1.304
State Underpayment Rate	-1.262		1.611	-2.575		2.254
Mean Number of Adults	-0.016		0.052	-0.076		0.073
Mean Number of Children	-0.067	*	0.038	0.011		0.055
Mean Age of Head	0.116		0.106	0.183		0.148
Mean Head Unemployed Weeks	0.017	***	0.005	0.011	*	0.006

Table C5 – continued

Mean County Unemployment Rate	-0.004		0.017	0.028		0.023
Mean State Average Recertification Period	-0.037		0.026	-0.061	*	0.036
Mean State EBT Penetration Rate	0.001		0.002	0.001		0.002
Mean County FSP Recipients	0.048		0.035	0.031		0.045
Mean Distance to Closest FSP Office	0.026	**	0.011	0.011		0.018
Mean State Overpayment Rate	1.908		1.300	4.147	**	1.780
Mean State Underpayment Rate	-1.312		2.033	-2.473		2.809
Intercept	-1.596	***	0.204	-1.176	***	0.285
ρ	0.288	***	0.024	0.473	***	0.039
θ				1.120	***	0.124
Wald Test on the Joint Significance of 32 Post-Welfare Reform Parameters	73.45	***		49.98	**	
Initial Period Instruments						
County Unemployment Rate				0.077	***	0.016
Head's first occupation: Professional, managerial or self-employed				-0.273		0.256
Head's first occupation: Clerical and sales worker, crafts or operatives				-0.096		0.083
Head's first occupation: Miscellaneous				-0.163		0.154
Head lived with Parents until Age of 16				-0.128		0.079
N	16,514			36,212		
Log-Likelihood	-5,238.27			-4,223.11		

Note: ***, **, and * indicate significance at 1%, 5%, and 10%, respectively.

Table C6: Dynamic Random Effects Probit Results with Interaction Effects between Lagged FSP Participation and Household Characteristics

Variable	Initial Conditions Exogenous			Initial Conditions Endogenous					
	Correlated Random Effects Probit			Wooldridge			Heckman		
	Parameter		SE	Parameter		SE	Parameter		SE
FSP Participation at *t-1*	1.706	***	0.062	1.445	***	0.096	1.509	***	0.137
FSP Participation at *t-1**Single Mother	-0.191	***	0.050	-0.046		0.076	-0.102		0.103
FSP Participation at *t-1**White	0.208	***	0.050	0.165	**	0.072	0.132		0.095
FSP Participation at *t-1**Low Education	0.041		0.060	-0.039		0.092	-0.093		0.133
FSP Participation at *t-1**Rural South	-0.065		0.067	0.102		0.097	0.076		0.149
FSP Participation at *t=1990*				0.839	***	0.061			
Rural South	0.104	**	0.045	0.012		0.070	-0.068		0.115
Number of Adults	-0.015		0.025	-0.067	**	0.033	-0.037		0.048
Number of Children	0.150	***	0.018	0.161	***	0.026	0.134	***	0.038
Age of Head (10 years)	-0.185	***	0.047	-0.198	***	0.069	-0.182	*	0.104
Head is White	-0.226	***	0.032	-0.207	***	0.048	-0.238	***	0.071
Home Owner	-0.351	***	0.029	-0.326	***	0.042	-0.417	***	0.064
Head has Low Education Level	0.176	***	0.036	0.204	***	0.057	0.251	***	0.095
Head is Single Mother	0.463	***	0.038	0.367	***	0.061	0.570	***	0.088
Head Unemployed Weeks	0.006	***	0.001	0.007	***	0.002	0.008	***	0.002
County Unemployment Rate	0.045	***	0.008	0.058	***	0.012	0.047	***	0.017
State Average Recertification Period (months)	0.017		0.011	0.016		0.015	0.015		0.023
County FSP Recipients (100,000)	0.022		0.020	-0.023		0.027	-0.004		0.036
Distance to Closest FSP Office (miles)	-0.011	**	0.005	-0.026	***	0.008	-0.022		0.014
State Overpayment Rate	0.207		0.606	-0.001		0.813	-0.602		1.131
State Underpayment Rate	-2.198	***	0.897	-1.368		1.250	-1.789		1.834
Mean Number of Adults	-0.013		0.032	0.058		0.044	0.000		0.064
Mean Number of Children	-0.028		0.021	-0.048		0.032	0.042		0.047

Table C6 – continued

Mean Age of Head	0.187	***	0.048	0.197	***	0.071	0.164		0.107
Mean Head Unemployed Weeks	0.011	***	0.003	0.018	***	0.005	0.011		0.008
Mean County Unemployment Rate	-0.006		0.010	-0.004		0.015	0.028		0.021
Mean State Average Recertification Period	-0.020		0.013	-0.059	***	0.019	-0.075	***	0.028
Mean County FSP Recipients	-0.003		0.022	0.050	*	0.031	0.049		0.040
Mean Distance to Closest FSP Office	0.009		0.006	0.019		0.009	0.006		0.016
Mean State Overpayment Rate	2.856	***	0.828	3.121	***	1.215	6.160	***	1.728
Mean State Underpayment Rate	-1.356		1.202	-0.329		1.785	-2.913		2.572
Intercept	-1.804	***	0.106	-1.953	***	0.189	-1.663	***	0.277
ρ	0.120	***	0.017	0.268	***	0.024	0.396	***	0.038
θ									
Initial Period Instruments									
County Unemployment Rate							0.081	***	0.015
Head's first occupation: Professional, managerial or self-employed							-0.380		0.244
Head's first occupation: Clerical and sales worker, crafts or operatives							-0.104		0.081
Head's first occupation: Miscellaneous							-0.161		0.152
Head lived with Parents until Age of 16							-0.141	*	0.078
N	23,948			16,509			36,212		
Log-Likelihood	-9,254.91			-5,283.24			-4,259.73		

Note: ***, **, and * indicate significance at 1%, 5%, and 10%, respectively.

Table C7: Region Definitions

Region	States
Northeast	Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont, New Jersey, New York and Pennsylvania
North Central	Indiana, Illinois, Michigan, Ohio, Wisconsin, Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota and South Dakota
South Central	Alabama, Kentucky, Mississippi, Tennessee, Arkansas, Louisiana, Oklahoma, and Texas
South Atlantic	Delaware, District of Columbia, Florida, Georgia, Maryland, North Carolina, South Carolina, Virginia, and West Virginia
Pacific	Alaska, California, Hawaii, Oregon, and Washington
Mountain	Arizona, Colorado, Idaho, Montana, Nevada, New Mexico, Utah, and Wyoming

Table C8: Dynamic Random Effects Probit Results with Interaction Effects between Lagged FSP Participation and Region Dummies

Variable	Initial Conditions Exogenous			Initial Conditions Endogenous					
	Correlated Random Effects Probit			Wooldridge			Heckman		
	Parameter		SE	Parameter		SE	Parameter		SE
FSP Participation at *t-1*	1.542	***	0.047	1.374	***	0.067	1.344	***	0.100
FSP Participation at *t-1**Northeast	0.495	***	0.086	0.374	***	0.122	0.330	**	0.164
FSP Participation at *t-1**North Central	0.149	**	0.067	0.043		0.094	-0.005		0.133
FSP Participation at *t-1**South Central	0.220	***	0.063	0.164	*	0.089	0.165		0.126
FSP Participation at *t-1**Mountain	-0.069		0.133	-0.170		0.194	-0.164		0.255
FSP Participation at *t-1**Pacific	0.164	**	0.085	-0.042		0.123	-0.206		0.172
FSP Participation at *t=1990*				0.816	***	0.060			
Northeast	-0.008		0.059	0.116		0.091	0.389	***	0.143
North Central	-0.060		0.047	0.129	*	0.072	0.287	***	0.114
South Central	0.007		0.045	0.126	*	0.069	0.217	**	0.107
Mountain	0.018		0.080	0.129		0.122	0.157		0.178
Pacific	-0.152	**	0.063	0.065		0.099	0.111		0.148
Number of Adults	-0.009		0.025	-0.066	**	0.034	-0.034		0.048
Number of Children	0.156	***	0.018	0.163	***	0.026	0.140	***	0.038
Age of Head (10 years)	-0.170	***	0.047	-0.189	***	0.069	-0.179	*	0.105
Head is African American	0.168	***	0.030	0.188	***	0.047	0.256	***	0.074
Head is Other Race	0.116	**	0.048	0.230	***	0.077	0.235	**	0.107
Home Owner	-0.339	***	0.029	-0.302	***	0.042	-0.381	***	0.063
Head is High School Graduate	-0.172	***	0.029	-0.198	***	0.045	-0.342	***	0.070
Head has College No Degree	-0.245	***	0.037	-0.277	***	0.060	-0.377	***	0.098
Head has College Degree	-0.402	***	0.063	-0.339	***	0.096	-0.447	***	0.167
Head is Single Mother	0.372	***	0.032	0.337	***	0.050	0.504	***	0.074
Head Unemployed Weeks	0.007	***	0.001	0.007	***	0.002	0.007	***	0.002

Table C8 – continued

County Unemployment Rate	0.046	***	0.008	0.058	***	0.012	0.049	***	0.017
State Average Recertification Period (months)	0.020	*	0.011	0.018		0.015	0.019		0.023
County FSP Recipients (100,000)	0.026		0.021	-0.018		0.027	0.001		0.036
Distance to Closest FSP Office (miles)	-0.011	**	0.005	-0.026	***	0.008	-0.023		0.014
State Overpayment Rate	0.229		0.608	0.064		0.814	-0.504		1.141
State Underpayment Rate	-2.153	**	0.899	-1.440		1.253	-1.885		1.847
Mean Number of Adults	-0.020		0.032	0.052		0.044	-0.016		0.065
Mean Number of Children	-0.030		0.022	-0.054	*	0.032	0.039		0.047
Mean Age of Head	0.158	***	0.048	0.169		0.071	0.127		0.107
Mean Head Unemployed Weeks	0.011	***	0.003	0.017	***	0.005	0.013	*	0.008
Mean County Unemployment Rate	-0.006		0.010	-0.012		0.015	0.014		0.021
Mean State Average Recertification Period	-0.019		0.013	-0.054	***	0.020	-0.073	***	0.030
Mean County FSP Recipients	-0.010		0.022	0.032		0.031	0.023		0.041
Mean Distance to Closest FSP Office	0.012	*	0.006	0.022		0.009	0.013		0.016
Mean State Overpayment Rate	2.639	***	0.931	2.878	**	1.390	5.876	***	1.986
Mean State Underpayment Rate	-0.442		1.385	1.142		2.091	0.130		2.980
Intercept	-1.716	***	0.117	-1.960	***	0.217	-1.747	***	0.327
ρ	0.134	***	0.017	0.268	***	0.024	0.416	***	0.037
θ									
Initial Period Instruments									
County Unemployment Rate							0.076	***	0.016
Head's first occupation: Professional, managerial or self-employed							-0.275		0.260
Head's first occupation: Clerical and sales worker, crafts or operatives							-0.124		0.085
Head's first occupation: Miscellaneous							-0.163		0.156
Head lived with Parents until Age of 16							-0.125		0.080
N	26,064			16,531			36,212		
Log-Likelihood	-9,275.81			-5,268.78			-4,207.25		

Note: ***, **, and * indicate significance at 1%, 5%, and 10%, respectively.