

**On the Road to Food Security?  
Vehicle Ownership and Access to Food**

By  
Katie Fitzpatrick and Michele Ver Ploeg

Paper Prepared for  
Research on Connections between Health and SES Using PSID Data  
Survey Research Center, Institute for Social Research, University of Michigan

Katie Fitzpatrick (Principal Investigator)  
Economist, Food Assistance Branch  
Economic Research Service, USDA  
1800 M Street, NW, Room N2183  
Washington, DC 20036  
Phone: (202) 694-5339  
Fax: (202) 694-5661  
[kfitzpatrick@ers.usda.gov](mailto:kfitzpatrick@ers.usda.gov)

Michele Ver Ploeg  
Economist, Food Assistance Branch  
Economic Research Service, USDA  
1800 M Street, NW, Room S2087  
Washington, DC 20036  
Phone: (202) 694-5372  
Fax: 202-694-5642  
[sverploeg@ers.usda.gov](mailto:sverploeg@ers.usda.gov)

**Abstract:**

The ability to obtain adequate food is an indicator of a household's capacity to meet its basic consumption needs. We consider the relationship between vehicle ownership and food-related outcomes, including food expenditures and indicators of food distress, using state-level changes in the treatment of vehicles for AFDC/TANF eligibility as an instrument for vehicle ownership. While our results do not uniformly reach statistical significance, they are suggestive that vehicle owners spend less on food, spend more of their food budget on food consumed at home, and experience less food distress. The magnitude of some of our estimates suggests economic conditions and policy trends may bias our estimates. We find our results suggestive of an important role for vehicles to overcome problems with access to food but more work needs to be done to better measure the true effect of vehicle ownership on food-related outcomes before strong policy recommendations can be made.

## **I. Introduction**

The ability to obtain adequate food is an indicator of a household's capacity to meet its basic consumption needs. An estimated 16 percent of US households with children were food insecure in 2007, meaning they were uncertain of their ability to acquire enough food due to a lack of resources (Nord, 2009). These rates indicate not only deleterious effects on the current health of household members, but due to the intergenerational transmission of economic status, these rates also suggest negative effects on the long-term health and economic well-being of these children (Currie, 2009).

Despite the government's \$60 billion investment in domestic food assistance programs, food insecurity, food insufficiency, and other evidence of food distress still exist. Researchers posit a number of reasons for this, ranging from the design of food assistance programs to neighborhood characteristics that reduce access to food retailers. Recently, attention has been directed at the potential spatial mismatch between low-income neighborhoods and full-service grocery stores (USDA, 2009). Residents of so-called "food deserts", particularly those who do not own or have access to a vehicle, may be at higher risk for food insecurity either due to limited access to full-service grocery stores or higher food prices at smaller stores in their neighborhood. Lack of access may also contribute to poorer diet if those who lack access to full-service stores are more reliant on local convenience stores or fast food restaurants. In the long-term, lack of access may cause or exacerbate health problems result from poor diet. If food deserts are related to food insecurity and poorer diet, then vehicle ownership could be an important mechanism to reduce the effects of food deserts.

In this paper, we use Panel Survey of Income Dynamics (PSID) data to consider the relationship between vehicle ownership and food-related outcomes. Because vehicle ownership is related to unobservable characteristics of families that are also correlated with the ability to purchase adequate quantities of food, we use changes to state-level rules governing vehicle assets in cash welfare to instrument for vehicle ownership. This approach allows us to overcome the endogeneity of vehicle ownership and explore outcomes related to food expenditures and food distress that may be affected by vehicle ownership. Specifically, we examine total weekly food expenditures, weekly food expenditures for food consumed at home, food insecurity, and self-reported indicators of food distress.

To preview our findings, while our results on food expenditures do not reach statistical significance, they are suggestive that vehicle owners spend less on food and spend more of their food budget on food consumed at home. Our results are also suggestive that owning a vehicle allows families to reduce the probability of reporting a number of indicators of food distress.

We make several contributions to the literature. We are among the first to apply the work on the spatial mismatch between jobs and housing to the housing-food retailer mismatch in a quasi-experimental approach. Little research exists on how vehicle ownership is related to food spending, food access and food distress. Previous work examining the shopping patterns of lower income consumers and the effects of limited access to large-scale food retailers do not correct for the fact that vehicle ownership may reflect unobservable characteristics of families. And while previous studies have examined how the relaxation of state cash assistance policies affects vehicle ownership, these studies have not explored how higher vehicle ownership rates among poor families may affect family well-being, and in particular, well-being related to food distress.

There are also policy implications to our research. Policies, both in the planning stages and those currently in place, at the local, state, and federal levels attempt to improve food access in some low-income areas.<sup>1</sup> These efforts have primarily focused on encouraging retail development in areas that lack access to healthy food retailers. Less consideration has been given to policies that enable residents of these areas to more easily access stores outside of their neighborhoods.

While the relaxation of state-level rules governing vehicle assets for cash and food assistance were not intended to aid in breaking down food access barriers, it is possible that they have helped those in areas with poor food access. Our analysis provides preliminary evidence about the extent to which vehicle ownership may aid in alleviating food distress.

The remainder of the paper proceeds as follows: Section II provides background for understanding changes to state vehicle exemptions; Section III discusses the previous literature related to access to food; Section IV provides the conceptual framework for understanding how

---

<sup>1</sup> These efforts are promoted as one of four pillars of the First Lady's "Let's Move" initiative to reduce childhood obesity. A prominent part of this campaign is the Health Food Financing Initiative which, through a partnership between the U.S. Departments of Treasury, Agriculture and Health and Human Services, will, if funded, invest \$400 million a year to encourage the development of healthy food retailers in underserved areas and help small retailers, such as convenience stores and bodegas, carry healthier food options (see <http://www.letsmove.gov/healthycommunity.php>).

vehicle ownership may influence measures of food sufficiency; Section V presents the data, methodology, and results; Section VI summarizes and discusses these results.

## **II. AFDC/TANF Vehicle Policies**

Public assistance programs are often targeted at lower income families with children. The primary cash assistance program for families with children was the Aid to Families with Dependent Children program (AFDC), which became Temporary Assistance for Needy Families (TANF ) after welfare reform. Eligibility for this program is, in part, a function of a household's assets, including both financial assets and vehicle equity. The 1981 Omnibus Budget Reconciliation Act (OBRA) imposed a maximum vehicle exemption limit of \$1,500 for AFDC eligibility which remained relatively unchanged until the early 1990s.

Beginning in 1993, the Department of Health and Human Services granted state requests to modify the vehicle policies in their state AFDC programs. States continued to adjust their vehicle policies with the replacement of the AFDC program with TANF in 1996, a program that imposed work requirements for recipients, time limits for receipt of TANF benefits, and gave states greater flexibility to set program rules.<sup>2</sup> Changes to vehicle rules in AFDC/TANF eligibility took several forms. Some states fully excluded one or more vehicles from eligibility criteria, particularly if the vehicle was used for employment. In other states, the exemption limits were raised above the \$1,500 threshold.

Changes to vehicle rules varied over time and across states, as shown in Table 1. In 1994, only 3 states (Connecticut, Hawaii, and Vermont) excluded at least one vehicle from vehicle asset test and only a handful of other states had a higher vehicle exemption limit of \$1,500. By 2001, most states adopted some change to the vehicle rules under TANF.

## **III. Literature Review**

Many factors contribute to food distress and food insecurity among families, including low income, family size, changes in family composition, asset holdings and economic conditions (Gundersen and Oliveira, 2001; Gundersen and Oliveira, 2003; Hofferth, 2004; and Rose, 1999).

---

<sup>2</sup> Further details on the changes to cash welfare programs is available in Blank (2002) and Grogger and Karoly (2005). Many of these changes to vehicle exemption rules were made contemporaneously with welfare reform efforts of the 1990s, both state-level reform through welfare waivers and the imposition of the federal TANF program.

One potential and relatively unexplored additional factor is limited access to a full-service food retailer that offers a full array of grocery products (supermarkets, supercenters, and large grocery stores). These retailers not only carry fresh fruits, fresh vegetables, and other healthy food, but also, on average, offer them at the lowest prices (Broda et al., 2009; Kaufman et al., 1997).

A recent national-level study found that over 11 million low-income people live in areas with limited access to affordable and healthy food, sometimes referred to as food deserts (USDA, 2009). The existence and effects on populations that live in these areas are attracting the attention of researchers and policymakers. New work is also exploring the nexus between environmental and neighborhood factors in explaining differences in the incidence of diet-related disease across racial, ethnic, and socioeconomic groups. Much of this work specifically examines how the availability, prices, and nutritional composition of foods in some low-income neighborhoods affect diet-related disease. The intuition is that populations with easier access to healthy food (e.g. supermarkets, healthier restaurants) should have better diets than populations with easier access to unhealthy food (convenience stores, fast food restaurants). Additionally, over the long-term, limited access to healthy and affordable food exacerbates diseases and conditions related to poor diet, such as obesity and diabetes.

This intuition is confirmed by descriptive evidence. In general, those with better access to a supermarket than a convenience store for groceries spend more on fruits, vegetables, and milk; they also have healthier diets and lower obesity rates (IOM, 2009; Larson et al., 2009; Morland et al., 2002; Powell et al., 2007; Rose and Richards, 2004; USDA, 2009). While these studies provide evidence suggestive of a relationship, they fall short of establishing a causal link.

The few studies that use more rigorous techniques to estimate the link between store access and diet-related health outcomes reach mixed conclusions. Two longitudinal studies in the UK examine the response of shopping behavior and dietary intake when supermarkets open in underserved areas (Wrigley et al., 2003; Cummins et al., 2005). One study finds no change in consumption while the other finds a modest (approximately one-third of a serving) increase in fruit and vegetable consumption. In cross-sectional analysis, Chen et al. (2010) find that consumers with easier access to fast food restaurants experienced slight increases in BMI, while those with easier access to supermarkets had slightly lower BMI. While the magnitudes of the

total effects were relatively small, effect for supermarkets were larger for those who were the closest to supermarkets. Other work shows mixed results with respect to fast food restaurant availability and diet related health outcomes (Anderson and Matsa, 2007; Currie et al., 2010).

One reason why researchers may reach mixed conclusions could be due to the fact that some low-income consumers, like all consumers, access food retailers outside of their neighborhoods. Ohls et al. (1999) also found that while the average distance to the nearest supermarket for SNAP participants was 1.8 miles in 1994, the average distance to the food store used most often by participants was 4.9 miles. And, this trend may be growing over time. Data from a mid-1990s study of shopping behavior of SNAP participants shows that 77 percent of benefits were redeemed at supermarkets or large grocery stores in 1994 (Ohls et al., 1999) and that in FY2008, this number had grown to 86 percent. In short, at least some low-income consumers can and do shop outside their neighborhood for food purchases.

Still, these averages may mask substantial heterogeneity across low-income consumers. According to Broda (2010), consumers with annual incomes of less than \$8,000 paid slightly higher prices (0.5 - 1.3 percent) for food relative to those with slightly higher incomes (between \$8,000 – 30,000). If the lowest income consumers pay more than those slightly better off, it suggests that access may be a problem for some, particularly those most at risk for food insecurity.

Vehicle ownership may be important in allowing consumers to access full-service grocery retailers. The USDA found that 5.6 percent of U.S. households live more than one-half a mile from a store and do not own a vehicle (USDA, 2009). Nearly 6 percent of households in 2001 reported that they did not always have the food they want or need because it was too hard to get to the store or the store did not have the kinds of foods they wanted (USDA, 2009).<sup>3</sup> With the

---

<sup>3</sup> This data comes from the 2001 Current Population Survey Food Security Supplement (which is the last CPS survey for which such questions are available), the source for the official measure of food security (USDA, 2009). The PSID asks similar questions in 1999, 2001, and 2003. In each of these years, 3 to 4 percent of families the reported difficulty getting to the store contributed to them not having enough or the kinds of foods they wanted. However, among families that reported sometimes or often not having enough to eat, from 19% - 37% reported difficulty getting to the store.

potential spatial mismatch between food retailers and some lower income neighborhoods, vehicle ownership may play a role in overcoming this mismatch.<sup>4</sup>

Those who do not have a car and live far from a store may be at a double disadvantage because vehicle ownership may play an important role in diet-related outcomes. One study that examined the relationship between food access, vehicle ownership and diet-related health found that vehicle ownership was associated with a lower body mass index for people who live in areas with higher density of supermarkets, but higher body mass index for people who live in areas with higher density of fast food restaurants (Inagami et al. 2009).

Our research builds upon this study to examine how vehicle ownership is related to food spending, food access and food distress. We expand by accounting for the endogeneity of the vehicle ownership decision to provide an opportunity for causal inference.

#### **IV. Conceptual Framework**

The literature on food access hypothesizes that some areas lack sources of affordable and healthy food because there is a spatial mismatch between residents of these areas and food retailers: some local areas may have only a few full-service food retailers while others may not have any. This mismatch could be due to a number of supply-side factors, including economies of scale, scope, or agglomeration in the retail food industry; local land use regulations; or neighborhood characteristics (Bitler and Haider, 2010). Or, the spatial mismatch could arise from demand-side factors (e.g. income, population size, preferences). Because supply factors may be relatively fixed in the short- and medium-run, like other research on the topic, we focus on consumer demand.

Before discussing how vehicle ownership should affect food consumption and food distress, it is helpful to consider how families without a vehicle acquire food (relative to driving to large-scale food retailers for grocery purchases) and the potential implications of each food acquisition

---

<sup>4</sup> Vehicle ownership positively affects employment outcomes among families at-risk for welfare receipt or currently receiving welfare by helping these families overcome the mismatch between jobs and housing (Baum, 2009; Gurley and Bruce, 2005; Raphael and Rice, 2002).

method.<sup>5</sup> The first option is to walk to neighborhood food retailers, which may be limited to convenience stores, gasoline stations, or other small food retailers. This transportation mode has several potential effects on food expenditures: for any given budget, families purchase smaller quantities of food due to the higher prices offered by these retailers<sup>6</sup>; families consume diets of lower quality due to the less selection and lower nutritional composition of foods available, particularly if the retailer is a convenience store<sup>7</sup>; and, families purchase smaller quantities of food per shopping trip due to the disutility of transporting purchases back to the residence on foot. In short, families will have less food and it will be of lower quality. With less food in the home, families without slack in their budget may experience periods of food insufficiency if they are unable to fully smooth food consumption between shopping trips; families with slack in their budget families may shop more frequently, increasing the time costs associated with acquiring food, or consume more food away from home.

Public transportation is another option to access food retailers. Relying on public transportation may still limit the number of food retailers available to consumers because transit routes may not reach some areas with large-scale food retailers, operate infrequently, or provide unreliable service. While these consumers may access the same lower prices and nutritional composition of their diets as vehicle owners, these consumers still face difficulties in transporting purchases back to the home. This will result in less quantity of food purchased per shopping trip, increases in the time costs associated with acquiring food, and a higher likelihood of consuming food away from home.

The final option is to rely on friends or other family members with a vehicle for transportation or to hire a taxi.<sup>8</sup> Friends or family members may provide unreliable or infrequent opportunities to

---

<sup>5</sup> According to the American Time Use Survey (ATUS), 90 percent of those who reported grocery shopping traveled to the grocery store by a private vehicle that they owned or someone in the household owned; 4.8 percent traveled by walking or bicycling; 0.3 percent used public transit and 4.8 percent were passengers in a vehicle driven by a non-household member (which could include a taxi).

<sup>6</sup> Higher prices could result from a lack of competition in some neighborhoods, combined with land-use regulations and scarce available lots that limit entry to the market from competitors.

<sup>7</sup> Convenience stores, gasoline stations, and other smaller food retailers sometimes carry healthy food options, but the range of foods sold in these stores is highly varied, while less healthy options (snack foods with high caloric density) are usually readily available (Franco et al., forthcoming; Neckerman et al., 2009; Rose et al.2009; and Sharkey and Horel, 2009).

<sup>8</sup> Grocery delivery services could also be used by those who lack access to supermarkets, but many of these services are effectively unavailable to those without internet access and most do not accept SNAP benefits.



reach large-scale food retailers while taxis are more dependable but potentially expensive. Both options may mean less frequent shopping at full-service stores, which may result in periods of food scarcity. Both may also lead to more frequent but smaller purchases at local food retailers and an increased likelihood of consuming food away from home.

With this framing, vehicle ownership could cause changes in the level and composition of food expenditures, as well as the incidence of food distress, through several channels. First, vehicles allow improved access to large-scale retailers, which often offer lower prices. This should reduce food budgets, conditional on a constant basket of food. Residents can also purchase larger quantities of food per shopping trip, reducing the time costs associated with acquiring food and increasing opportunities for both labor and leisure. With sufficient quantities to smooth consumption until the next shopping trip, food consumed at home should increase. In summary, we predict that vehicle ownership assists families in overcoming the spatial mismatch between housing and food retailers that may exist in some low-income neighborhoods.

Of course, the effect of vehicle ownership on food-related outcomes could be blunted by new vehicle owners requiring additional expenditures in their budget for the fixed costs of owning a vehicle which are not trivial. These costs could include registration and drivers' license fees, insurance costs, repairs, fuel costs, and more. Vehicles purchased by lower income populations may be of lower quality, perhaps increasing maintenance and repair costs, or suffer from low fuel efficiency, increasing gasoline expenses.

Still, evidence from other studies suggests that vehicle ownership could have a sizable impact on the money and time budgets of low-income families. Rose et al. (2009) estimates time and travel costs of using different modes of transportation to travel to supermarkets in New Orleans, Louisiana while Feathers (2003) estimates these costs in Dayton, Ohio. Both find that the costs of traveling to a supermarket incurred when driving one's own car are the least costly relative to other modes of travel.<sup>9</sup> Neither of these studies is nationally representative nor do they include the expenses of vehicle ownership. Both studies, however, indicate that the costs of relying on other modes of transportation to grocery stores can impose nontrivial burdens on families.

---

<sup>9</sup> Costs estimated by Rose et al. (2009) range from \$5.90 per month to drive one's own car, \$21.00 to walk to the store, \$21.90 to ride with a friend or relative, \$38.70 to use a bus, and \$66.60 to use a taxi. Feathers estimates \$0.08 per mile to drive one's own car to \$2.17 per mile for taxi service (2003).

## **V. Data, Methods, and Results**

Vehicle ownership likely reflects unobservable differences in the economic well-being of families, including employment opportunities, access to credit, and neighborhood characteristics. These unobservable differences are likely to be correlated with food expenditures and the incidence of food distress. Those who own vehicles are likely to be better off, all else equal, and likely to both spend more on food and have lower levels of food distress. Thus, a simple estimation of the effect of vehicle ownership on food expenditures or food distress will suggest that vehicle ownership increases food expenditures and reduces food distress. The true effect of vehicle ownership on these outcomes, however, would remain uncertain due to bias.

To overcome this problem, we isolate exogenous variation in vehicle ownership by utilizing changes to vehicle policies in state AFDC/TANF program rules. These changes were shown by Baum and Owens (2010), Hurst and Ziliak (2004), and Sullivan (2004) to boost vehicle ownership among those most likely affected by cash welfare: low-educated single mothers. We build on the results of this work by using state-level changes to AFDC/TANF vehicle exemption rules between 1994 and 2001 as an instrument for vehicle ownership. These policies meet the two tests of a suitable instrument: they are orthogonal to unobservable differences in family well-being and, as we show later, they increased vehicle ownership for affected families.

To focus our analysis on families that are both most affected by changes in vehicle exemption limits and most likely to face difficulty meeting their food needs, we begin with a sample of low-educated families with children. Families with children are our interest for several reasons. First, children are more vulnerable to the negative health consequences of hunger and nutritional deprivation than adults (Olson, 1999). Further, many U.S. anti-poverty programs are targeted to families with children to protect the children from the deleterious effects of poverty. Among these programs, AFDC/TANF program is predominantly a program for single women with children.<sup>10</sup>

---

<sup>10</sup> The Supplemental Nutrition Assistance Program (SNAP), formerly the Food Stamp Program is also a major program supporting poor families with children. SNAP had similar vehicle exemption policy changes as the AFDC/TANF program, although the changes took place from 2001 through 2005, after most states changed vehicle rules for AFDC/TANF. In unreported analysis, we examined state SNAP vehicle policies as exogenous predictors of vehicle ownership but estimates did not show a large or significant enough of an effect of SNAP vehicle exemption policies on vehicle ownership to be suitable as an instrument.

In additional analysis, we expand the sample to all low-educated families, regardless of the presence of children. In all specifications, we follow the literature by comparing the behavioral response of families headed by single mothers to other families. Our identifying variation comes from state-level changes for affected single mothers, relative to other families with children. For identification, we require that differential trends in vehicle ownership do not exist between different types of families.

### *Data*

We use data from the Panel Survey of Income Dynamics (PSID) from 1994 through 2001. The PSID is a longitudinal study of a representative sample of U.S. individuals and the family units in which they reside (Institute for Social Research, 2010). The study began in 1968 with 4,800 families and collected data annually through 1997, at which time data collection began to be collected biennially. In 1997, the PSID also began the Child Development Survey (CDS), a survey collecting more extensive information on a subset of PSID children ages 0-12.<sup>11</sup> Together, the PSID and the CDS offer a rich set of data to understand how changes in vehicle ownership affect measures of food distress for adults and children within families over time.

We follow families over the 1994 through 2001 period, limiting our sample to families with a low-educated head, defined as those with less than 14 years of education, and a head who is between the ages of 18 and 55. We drop any family that changes the head over this period or moves across states. In our main analysis, we keep only families with at least one child in both 1994 and 2001 to create a balanced panel. We adjust all monetary values to constant 2005 dollars.

Our primary outcomes of interest are weekly family food expenditures and measures of food distress in the family, specifically involving child-level food distress. The PSID offers food expenditure data on a longitudinal basis from 1994 through 2001--the years that cover the period in which state vehicle policies were changing. Food expenditures are measured on a weekly basis for total food spending and separately for food at home, away from home and food for delivery.<sup>12</sup>

---

<sup>11</sup> Since 1997, the CDS collected two additional interviews on children in this cohort: the CDS-II in 2002 and the CDS-III in 2007.

<sup>12</sup> The PSID includes the value of food stamp benefits in food expenditures.

In contrast to food expenditure outcomes, indicators of food distress in the PSID are not collected until the 1999 survey. The food distress measures include the full set of food security questions plus additional questions on whether the family had sufficient supplies of food and money for food. These measures are explained in more detail below when the results are discussed.

The CDS-II allows for examination of additional child-level outcomes. Linking 2001 PSID families to children in the CDS-II provides the opportunity to examine children's food consumption patterns for broad food groups and indicators of diet-related health outcomes. Because these measures are only available in 2002, we only examine these outcomes descriptively based on the family vehicle ownership status and changes in vehicle ownership status, in order to provide context to the food expenditures and food distress results.

We report the demographic characteristics of our sample in Table 2. Single mothers and other families with children differ in their fixed characteristics: single mothers are much more likely to be nonwhite than other family heads and more likely to have less than 12 years of education (rather than 12 years of education or more). Single mothers also differ in some of their time-varying characteristics: single mothers are, on average, approximately 3 years younger and have slightly younger children. Both types of families, however, have, on average, slightly more than 2 children. Perhaps as a result of all of these characteristics, single mothers are less likely to be employed in 1994 and have lower asset wealth, as evidenced by lower rates of homeownership. We will control for these differences in observable characteristics with a number of covariates, as well as include family fixed effects in some estimates.

Table 2 also provides some preliminary evidence for the effect of state AFDC/TANF exemption policies on vehicle ownership. Single mothers display lower rates of vehicle ownership in 1994 (43 percent versus 89 percent) but show substantial growth by 2001. After state AFDC/TANF exemptions were in place, vehicle ownership by single mothers rose to 61 percent, an 18 point increase. In contrast, rates for other families with children grew by approximately 5 points.

## Results

### *Food Expenditure Estimates*

We first estimate how vehicle ownership affects expenditures on food, the portion of food expenditures for food consumed at home, and the ratio of food expenditures to food needs with an instrumental variable approach. In the first stage, shown below in Equation 1, we use state AFDC/TANF vehicle policies to estimate the effect of these policies on car ownership. We measure state-level AFDC/TANF policies by replicating Sullivan's (2004) approach that parameterizes both state vehicle AFDC/TANF policy options open for adjustment: categorically exempting vehicles and raising the vehicle exemption limit. In Equation 2, we use the isolated exogenous variation in vehicle ownership to estimate the effect of vehicle ownership on food expenditure measures.

Our methodological approach can be summarized by the following equations:

1. 
$$Vehicle_{ist} = \alpha + \beta_1 Exemption_{st} + \beta_2 Exemption_{st} * ExemptionValue_{st} + \beta_3 SingleMom_i * Exemption_{st} + \beta_4 SingleMom_i * Exemption_{st} * ExemptionValue_{st} + \gamma_1 X_{ist} + \gamma_2 S_{st} + \varepsilon_{ist}$$
2. 
$$FoodSpending_{ist} = \phi + \lambda Vehicle_{ist} + \beta_1 Exemption_{st} + \beta_2 Exemption_{st} * ExemptionValue_{st} + \theta_1 X_{ist} + \theta_2 S_{st} + \nu_{ist}$$

where *Vehicle* is a dichotomous variable indicating whether a household owns a vehicle; *FoodSpending<sub>ist</sub>* represents the food expenditure outcome measures of interest; *Exemption<sub>st</sub>* is a dichotomous variable indicating the state has a limit on vehicles; *ExemptionValue<sub>st</sub>* is the real dollar value of the vehicle exemption for a state that has a limit on vehicles; *SingleMom<sub>i</sub>* is an indicator that the family is headed by a single female.

We create a number of outcomes related to food expenditures. We examine both the total weekly food expenditures of the family, as well as the ratio of the total weekly food expenditures to the USDA's Thrifty Food Plan (TFP). The TFP is the basis for SNAP benefits and varies across family characteristics based on the age and gender of individual family members, as well as overall family size.<sup>13</sup> Therefore, this ratio measures the weekly food expenditures relative to an

---

<sup>13</sup> The TFP is adjusted in June of each year and we use these June values to standardize these measures. The TFP calculates an individual's needs, taking into account gender and age. In addition, it provides adjustments for

absolute level of food needs. For most consumers, particularly middle- and upper-income consumers, the ratio will be greater than one as they will purchase more than a minimal level of food. We hypothesize that vehicle ownership will decrease total food expenditures as low-income shoppers are able to access a wider selection of food stores with lower food prices.

These outcomes are shown in Table 3. Weekly food expenditures are roughly \$100/week for single mothers and \$130/week for other types of families. Relative to the TFP, most families spend 1.5 times the TFP on food, suggesting that families choose higher food consumption levels than the minimum. Comparing vehicle and non-vehicle owners, single mothers that own vehicles spend less on food overall and less relative to the TFP. The same pattern is not evident for other types of families with children.

We also examine outcomes related to weekly food expenditures for food consumed in the home. In addition to this total weekly level, we create two additional measures: the ratio of weekly food expenditures for food consumed in the home to all weekly food expenditures and the ratio of weekly food expenditures for food consumed in the home by a measure of total weekly family income needs, based on the USDA's low-cost budget plan.<sup>14</sup> We expect an increase in food consumption at home as the relative price of food at home decreases relative to food for delivery or food away from home because vehicles allow families to access cheaper sources of food at home (supermarkets).

Table 3 also provides outcomes for food at home. Families tend to spend at least half of their food expenditures on food at home, although there is variation by family type and vehicle ownership status. Most families also spend less than 20 percent of their total income needs on food expenditures for food at home. For both types of families, vehicle owners spend more of their total weekly food expenditures on food for home consumption.

We also control for a number of time-varying aspects of both the family and the state:  $S_{st}$  is a matrix of time-varying state policies related to car ownership (gasoline tax rate, vehicle

---

diseconomies of scale in small families and economies of scale in larger families. For a full discussion of the TFP calculation see (<http://www.cnpp.usda.gov/Publications/FoodPlans/MiscPubs/TFP2006Report.pdf>).

<sup>14</sup> This measure represents a poverty threshold, based on annual food needs as determined by the USDA's Low-Cost Food Plan.

registration fees, drivers' license fees, vehicle inspection fees and requirements), time-varying state-level low-income policies (maximum AFDC/TANF and Food Stamp benefit levels for a family of three, maximum federal and state EITC based on the number of children in the family, and state-level implementation of either a major AFDC waiver or TANF), and state economic conditions (unemployment rate and its square); and  $X_{it}$  is a matrix of time-varying observable family characteristics (single mother head, age of the family head and its square, number of children and its square, number of children under age 5 and its square). We include family fixed effects allowing us to control for food preferences and eating habits. Finally, to the extent possible with the publicly-available data, we control for geographic effects (size of the largest city in the county and urban area) to control for both the need for a vehicle and differences in the availability of large-scale food retailers, which may be indicative of accessibility and price competition. Standard errors are clustered by state.

Results from the estimation of Equation 1 are in Panel A of Table 4. We find vehicle ownership was 16 points lower for low-educated single mothers in states that did not completely exempt a vehicle from the AFDC/TANF eligibility rules than comparable single mothers in a state that completely exempted a vehicle. The estimate is highly statistically significant ( $t=-2.54$ ). There is also small but statistically insignificant increase in vehicle ownership arising from increases in vehicle exemption limits. This result is comparable to estimates by Baum and Owens (2010), Hurst and Ziliak (2004), and Sullivan (2004) that use different treatment and control groups, as well as different covariates.<sup>15</sup>

In Panel A of Table 5, we provide our main food expenditure results of interest from estimating the full model. For comparison, we present results for vehicle ownership without correcting for endogeneity, the reduced form estimates, and the full IV estimate. All estimates that do not correct for this endogeneity are positive for the outcomes we consider, suggesting that vehicle owners spend more on food than non-owners.

---

<sup>15</sup> Hurst and Ziliak (2006) found that every \$1,000 increase in the vehicle exemption policy increase the likelihood a female headed household with children owns a vehicle by 14.6 percentage points. Sullivan (2006) found that moving from a \$1,500 vehicle exemption to a full vehicle exemption increased vehicle ownership by 20 percentage points. Baum and Owens (2010) found that a change from no exemption or a \$1,500 exemption to a \$4,500 exemption increased vehicle ownership among single mothers from 52.9 to 57.7 percent (2010).

We first consider weekly food expenditures. The IV approach suggests that vehicle ownership is associated with a \$69 reduction in weekly food spending, although the results are not statistically significant. This large but imprecise reduction in weekly food spending could be suggestive of vehicle ownership allowing families to access food retailers with lower prices.

The lack of precision in these estimates could arise from time variation in the family's food needs that are not captured by the inclusion of family fixed effects or other demographic covariates. To account for this, we standardize weekly food expenditures by the family's needs, as determined by the TFP. The ratio of weekly food expenditures to the TFP in Column 2 of Table 5 suggest a decline of 0.68 in weekly food expenditures relative to needs when families with children transition into vehicle ownership. While the point estimate is imprecise, this suggests less than a one standard deviation decline from 1994 levels in weekly food expenditures relative to need.

Estimates for total weekly food expenditures, while not precise are consistent with the idea that total food spending declines with vehicle ownership, as our conceptual framework suggested. The lack of statistical significance, however, prevents drawing any strong conclusions. One interpretation for the negative point estimate on food expenditures is that families are accessing full-service grocery stores with lower prices. If true, new vehicle owners are not only accessing the cheaper prices at full-service grocery stores but, perhaps, also changing the degree of substitutability between food at home and food away from home. A different interpretation of these results, however, is that families are reducing food expenditures because of the financial difficulties related to vehicle ownership.

We examine this first interpretation by examining the components of food expenditures. Our conceptual framework predicts that when families with limited access to full-service grocery stores transition into vehicle ownership, spending on food at home should increase while spending on food away from home should decrease. We find a positive but imprecisely estimated point estimate of food expenditures for food consumed in the home (Column 3 of Table 5). In



results not shown, we find reductions in food expenditures for food either consumed away from home or food delivery.<sup>16</sup>

We standardize food at home expenditures in several ways.<sup>17</sup> First, we look at the share of total weekly food expenditures spent on food consumed at home. We find large, positive and statistically significant effects (Column 4 of Table 5). Vehicle owners consume 82 percent of their food spending on food consumed at home. This estimated effect is very large and may be inflated by the effects of the improved economy and welfare reform, which may have differentially impacted our population of interest. We also standardize weekly expenditures on food at home by a measure of total weekly family income needs, based on the USDA's low-cost budget plan. We find a nearly statistically significant ( $p=0.114$ ) estimate of 0.18 increase on food at home relative to income needs. This is a large portion of budgets for lower-income families.

While many of these results are not significant, possibly due to small sample sizes, they do suggest that owning a vehicle allows families to reduce their overall food spending and shift food expenditures towards food consumption in the home. The magnitude of some results – for example the share of total weekly food expenditures spent on food consumed in the home – are perhaps too large to take at face value and more work remains to investigate omitted variables and sources of bias.<sup>18</sup> Still, the direction of this change in behavior could be associated with improvements in diet-related health as food away from home is estimated to have a negative relationship with diet quality (Todd et al, 2010). It is possible that vehicle owners may see improvements in diet and diet-related health if the vehicle allows them to overcome access barriers, just as the research summarized earlier shows a relationship between access to full-service grocery retailers and improved diet quality.

---

<sup>16</sup> The point estimate on food away from home is -30.85 but it is not significant ( $p=0.194$ ). The point estimate for food delivery is -17.99 and is significant at the 0.05 level.

<sup>17</sup> We also estimate food at home expenditures by the TFP. Estimates are positive but just miss conventional significance levels ( $p=0.13$ ).

<sup>18</sup> One possible reason could be the employment and income gains of low-educated single mothers over this period. We did additional checks to focus on a sample of continuously employed families. These estimates are similar enough to our main estimates that lead us to believe employment and income gains are not driving these results. For example, the estimate on the portion of total weekly food expenditures spent on food consumed in the home is 0.609 ( $p<0.05$ ). While this estimate is smaller than our main estimate, it is still quite large.

We tested this theory in unreported estimates by replacing food expenditure outcomes with self-reported health status of the family head. While results are again, insignificant, we find declines in the likelihood the family head reports poor health status for vehicle ownership. This provides another indication that access to healthier food through vehicle ownership may allow for improved diet and perhaps improved management of diabetes and other diet-related health conditions.

#### *Expenses related to car ownership*

We examine the characteristics of the vehicles owned in 2001, as well as the expenses related to vehicle ownership, in Table 6 to see if the financial difficulties related to vehicle ownership could crowd out food budgets. Overall, vehicle owners purchased their vehicle in 1998 and paid, on average, \$7,303 for the vehicle. Roughly one-third of families also had a car loan. Approximately one-third of families purchased the vehicle new and the average model year for the vehicle was a 1995 model.

We group families into two types: “Changers” (families that did not own a car in 1994 but did in 2001) and “Always Owners” (families that owned a car in both 1994 and 2001).<sup>19</sup> Families with children that transitioned into vehicle ownership between 1994 and 2001 tended to own cheaper and older cars than families that owned a vehicle continuously between 1994 and 2001. New vehicle owners were less likely to have a vehicle loan, perhaps because they experienced difficulty in receiving credit from banks and other institutions.

As Table 6 highlights, the expenses related to vehicle ownership could crowd out other portions of the budget for those with mean level of expenses. For “Changers”, vehicle ownership, on average, adds \$1,000 annually to expenses just for insurance costs and, if the vehicle was purchased with a loan, adds \$322 a month in loan payments. Moreover, with lower quality vehicles owned by “Changers”, there may be more volatility in expenses. For instance, while there is wide variation in repair expenses for those with any repairs in the month of the interview, large expenses drive up the mean repair costs. Large negative shocks, such as a large repair bill, may be related to food distress.

---

<sup>19</sup> We ignore the handful of families that owned a car in 1994 but did not own a car in 2001.

Both the accessibility to a greater variety of food retailers from vehicle ownership and the stress that it can put on the family budget could work jointly to decrease food spending overall and shift spending to at-home consumption. For example, it may lead families to reduce their food budgets overall by taking consuming more food at home and allowing them to search for the lowest food prices. We cannot separate these effects in our analysis.

### *Expanding the Sample*

Because we believe that small sample sizes limit our ability to arrive at statistically significant conclusions, we incorporate additional years of data into our sample by using data from 1994, 1997<sup>20</sup>, 1999, and 2001 and allow the panel of families with children to be unbalanced.<sup>21</sup> With this expanded sample, the pattern of results is similar and some estimates near conventional significance levels. In particular, food expenditures for food consumed in the home rises by \$83 and nearly achieves significance ( $p=0.120$ ); the ratio of food at home expenditures to the Thrifty Food Plan is also positive and significant; the ratio of food at home expenditures to all food spending is greater than one but significant. We take this as evidence that with a larger sample size in our main estimates, we may find more precise estimates.

### *Effect on Food Consumption Patterns of Children*

If families with children are accessing food retailers with a better selection of healthy foods, we should see improvements in the diets of children in families that changed their vehicle ownership status over this period, relative to those that did not change. The CDS first provides these outcomes in 2002 so we cannot use the panel data methods to examine how vehicle ownership affects children's food consumption patterns. Instead, we compare the consumption patterns of children in 2002 by family type. We group families as before into "Changers" and "Always Owners", but also add an additional type of family, "Never Owners", defined as children in families that did not own a car in 1994 or 2001. We hypothesize that children's consumption of healthy or perishable foods such as fruit, eggs, meat, and milk will be positively related to household vehicle ownership.

---

<sup>20</sup> The 1997 sample did not collect vehicle information on families, so we use data from 1994 and 1999 to impute vehicle ownership by examining vehicle ownership in 1994 and information on the vehicle acquisition date in the 1999 survey.

<sup>21</sup> We also tried expanding the sample to all families with low-educated adult heads, regardless of the presence of children, in 1994 and 2001. The pattern of results remains the same but do not uniformly arrive at significant results. Additionally, some results are too large to be plausible.

Summary statistics of children’s self-reported consumption of various food groups over the past week are provided in Table 7. While children in “Changer” families consume slightly more of each food group per week than “Never Owners”, these estimates are not statistically different. Children in all three types of families appear to report roughly the same consumption patterns over the past week, except for dairy products and vegetables which are significantly higher for “Always Owner” families and sweets or deserts which are significantly lower for “Always Owner” families.

There are several possible interpretations of these results. First, and perhaps most obvious, is that vehicle ownership does not change the consumption patterns of children in families that recently gained access to a car. This may be because adults are not actually accessing food retailers of higher quality and lower prices, the purchase habits of adults do not change when they access higher quality food retailers, or the consumption habits of children do not change when a parent owns a car. Additionally, because these interviews were conducted during the school year, reported food consumption may lack a great deal of variation due to the food offerings in school feeding programs.<sup>22</sup> With little change in the food consumption patterns, it is difficult to attribute the significant differences in diet-related health outcomes to changes in diet arising from improved access to large-scale food retailers.<sup>23</sup>

#### *Food Distress Estimates*

We now move into food insecurity outcomes and other indicators of food distress. Because these measures are only available in 1999, 2001, 2003 (after many of the changes to AFDC/TANF vehicle policies occurred) we do not utilize the fixed effects specification employed above.<sup>24</sup> Instead, we examine measures of food distress in 2001, comparing single mothers in states that exempted at least one vehicle in their AFDC/TANF program to single mothers in states that did not exempt at least one vehicle.<sup>25,26</sup> Because we cannot rely on fixed family effects to control for

---

<sup>22</sup> This is true regardless if the child participates in free- or reduced-price meal programs. Schools will offer meals that comply with USDA standards to receive reimbursement rates for full-price, reduced-price, and free-meal programs. These meals must meet certain standards, although children are not required to eat all foods offered.

<sup>23</sup> It is also possible that overall improvements in the economic well-being of the family are driving the reduced frequency of reporting feeling sick or having a stomachache.

<sup>24</sup> The CDS-I which surveyed children in 1997 did collect information about food distress and food insecurity. We choose not to use these CDS-I outcomes because relying only on CDS children significantly reduces our sample size and does not provide much opportunity to families to obtain a car after the vehicle rules were amended.

<sup>25</sup> Unlike the previous set of estimates, we drop changes in vehicle exemption limits from the instrument set for several reasons. First, as results from equation 1 in Table 4 indicate, changes in vehicle exemption limits have a

time invariant family characteristics, we incorporate fixed demographic and geographic characteristics of families into the specification. The model we estimate follows:

3.  $Vehicle_{is} = \alpha + \beta_1 \Delta Exemption_s + \beta_2 SingleMom^* Exemption_s + \gamma X_{is} + \delta S_s + \varepsilon_{is}$
4.  $FoodDistress_{is} = \phi + \beta_1 Exemption_s + \lambda Vehicle_{is} + \theta X_{is} + \nu_{is}$

where *Vehicle* is a dichotomous variable indicating if a family owns a vehicle; *FoodDistress* represents measures of interest related to food distress and food insecurity;  $\Delta Exemption$  represents the change in a state's decision to exempt vehicles in the state AFDC/TANF program between 1994 and 2001;  $S_s$  is a matrix of state-level low-income policies (maximum AFDC/TANF and Food Stamp benefit levels for a family of three, maximum federal and state EITC based on the number of children in the family), state vehicle policies (gas tax rate, car registration fees, and vehicle inspection programs) and state unemployment rate and,  $X_i$  is a matrix of observable family characteristics (family headed by a single mother, age of the head, indicators if the head possess exactly 12 years of schooling or if the head possess 13 years of schooling, indicator for whether an adult in the family is employed, nonwhite head, number of children, number of children under age 5).<sup>27</sup> We also include a set of geographic indicators for the size of the largest city in the county and urban area. Standard errors are clustered by state.

We include a number of measures that indicate levels of food distress. These include the family's food security status through the family's raw food security score and if the family is highly food secure. The other measures of food distress we examine include whether the respondent indicates that having enough money for food is a problem, whether the respondent indicates that sometimes or often the family purchased food that did not last and did not have money to purchase additional food, whether the family could afford balanced meals, and whether they couldn't afford balanced meals for the children in the family.

---

limited effect on the decision to own a vehicle. In fact, when limiting the sample to families with children, the point estimate is insignificant. Furthermore, without a complete exemption, applicants still suffer the transaction costs of determining the vehicle's equity or fair market value, as well as any stigma associated with owning a car of little value. Moreover this process can induce uncertainty in the decision to even begin the application process. Thus, we would expect changes in vehicle limits to have a much smaller, if not negligible, effect on vehicle ownership compared to a complete exemption.

<sup>26</sup> We do not use 1999 data because we want to examine child-level outcomes in a survey year that can be linked to the CDS-II. We do not use 2003 data because there were no changes to state TANF policy after 2001.

<sup>27</sup> We include a dummy to indicate that an adult in the family was employed to control for the increase in labor force participation caused by welfare reform because all observations occur after the implementation of TANF.

Summary statistics for these outcomes, by family type and vehicle ownership status, are included in Table 3. As shown, food insecurity is a relatively uncommon: raw food security scores are quite, low on average.<sup>28</sup> Families classified as highly food secure (raw food security score of 0) compose a large portion of the sample, particularly for vehicle owners. For non-vehicle owners, less than half of families with children are classified as highly food secure.

Other indicators of food distress also suggest that some families with children face difficulties in meeting their food needs. More than half of non-vehicle owners report having enough money for food is a problem and approximately half of non-vehicle owners (53.3 percent of single mothers and 48.4 percent of other families with children) report worrying about running out of food. Only roughly one-third of vehicle owners share these problems with their food. These patterns are similar with other measures of food distress, with non-vehicle owners reporting more problems maintaining their food consumption.

The first stage results from estimating Equation 3 are in Panel B of Table 4. Compared to other families with children, families headed by single mothers increased their vehicle ownership by 9 points in states that changed their vehicle exemption policy between 1994 and 2001. This estimate is again consistent with evidence from other work discussed previously.

We turn to our main results of interest in Table 5. For each outcome, we again provide the result from the estimate including the endogenous vehicle ownership estimate, the reduced form estimate, and the full 2SLS approach. As a whole, estimates that do not correct for the endogeneity of vehicle ownership tend to be smaller than the 2SLS point estimates. Although they results do not always achieve statistical significance, this gives some indication that the direction of bias for treating vehicle ownership as exogenous is as we suspected—that is vehicle owners are better off.

We begin with measures indicating the most severe form of food distress -- measures of food insecurity – in Columns 1 and 3 of Table 5. Our estimates suggest that owning a vehicle is

---

<sup>28</sup> Raw food security scores for families with children can range from 0 to 18. To be classified as low food security or very low food security, the family must have a raw score of 3 or higher.

associated with more than a three point drop in the raw food security score, although it is not statistically significant. As a point of reference, the raw food security measure ranges from zero to 18 for those with children; a score of one or two indicates marginal food security, a score between three and seven indicates low food security, and a score of eight or higher indicates very low food security. Thus, a three point drop for these families suggests a large reduction in their food security classification.

We explore this further by transforming the raw food security measure into a dichotomous variable equal to one if the family is classified as highly food secure. While again the outcome is not significant, the point estimate suggests a 44 point reduction in the propensity of a family to be anything but food secure when they own a vehicle.

We then move to other indicators of food distress that could specifically relate to food access problems most likely to be affected by a vehicle. While these are not measures of food security, a positive answer to any of these questions indicates some level of sub-optimal well-being. Consistent with the idea that vehicle ownership assists in reaching both more reliable and lower cost food that can be purchased in larger quantities, each of these point estimates are negative although not significant.

The first of these indicators is whether money for food is a problem for the family. The point estimate is large and negative, although imprecisely estimated. We find similar results for whether the family sometimes or often purchases food that did not last and they do not have enough money to purchase more, as well as for whether the family can afford balanced meals. The final outcome we consider relates to food distress among children. We find a negative and imprecisely estimated point estimate for reports that families couldn't afford balanced meals for children due to money.<sup>29</sup>

---

<sup>29</sup> We also perform estimates of reports of feeling low-cost food to children due to money. The point estimate is large: an 89 point reduction in this outcome. However, the estimate is insignificant ( $p=0.256$ ).

### *Expanding the Sample*

In order to get greater precision in our estimates, we expand the sample to all low-educated families, regardless of the presence of children. These estimates are similar in magnitude to the results for families with children but are more precisely estimated.<sup>30</sup> We find an estimated decline in the raw food security score of more than three points and statistically significant 75 point increase in the probability a family will be classified as highly food secure when they are vehicle owners.<sup>31</sup>

Other results also provide support for our primary estimates of food distress. We find large, negative, and significant estimates for these measures: a 74 point reduction in families reporting money for food is a problem, a 74 point reduction in families reporting that they sometimes or often worry about food running out before getting money to purchase more food, and a 65 point reduction in reports of sometimes or often purchasing food that did not last and not having money to get more. The only estimate that remains imprecisely estimated is whether they cannot afford balanced meals. These estimates are in the hypothesized direction, but again, their large size makes us skeptical that vehicle ownership is the sole factor in the results.

We cannot measure child-related outcomes because not all families have children. However, we examine similar questions asked of adults. We find a significant 39 point reduction in the probability adults cut the size or skipped meals because there wasn't enough money for food. The point estimate for families reporting that adults eat less than they felt they should because there wasn't enough money for food suggests a 19 point reduction, although it is imprecisely estimated.

The similarity between the point estimates in the two samples leads us to believe that the lack of significance in the main estimates is largely due to small sample sizes. Still, the estimates are quite large and more work needs to be done to investigate sources of bias that contribute to our large estimates. In the next section, we examine if broader changes in economic well-being of those who transitioned into vehicle ownership may explain these results.

---

<sup>30</sup> The first stage estimate for car ownership is larger than before: an estimated 15 point increase in vehicle ownership as a result of state change toward completely exempting vehicles from the eligibility calculation.

<sup>31</sup> Care should be taken when interpreting this result as the food security scale ranges from zero to 18 for families with children but 0 to 10 for families without children.



### *Economic Well-Being*

We investigate the economic well-being of families in both 1994 and 2001 to determine the characteristics of families that transitioned into car ownership between 1994 and 2001 relative to those that either always owned a car or never owned a car. The goal of this is to examine the economic characteristics of families who purchased a car during this period and determine if their broader improvements in well-being explain the large coefficient estimates.

As in the earlier analysis of child food consumption patterns, we divide families into “Changers”, “Never Owners” and “Always Owners” in Table 6. These families exhibit a clear ranking. “Always Owners” families are better off than other types of families in both 1994 and 2001.” Families that always owned a vehicle exhibit high employment rates, low rates of receipt of AFDC/TANF and food stamps, and higher mean and median family income than other types of families. Similarly, families that change vehicle ownership appear better off than those who never owned a vehicle in both periods.

The summary statistics in Table 9 suggest is that the families that changed their car ownership over this period were not from the worst off families in 1994. Instead, while they had fairly high rates of receipt of public assistance in 1994, these were families that were most likely to benefit from the economic conditions and policy changes that occurred during the welfare reform era. In addition to gaining ownership of a vehicle, many of their other economic characteristics improved over this period, perhaps even due to their vehicle ownership.<sup>32,33</sup> While the estimates on food expenditures and food distress we measure are large, they may be biased upwards by the trends in economic outcomes among upwardly mobile families that gained vehicle ownership over this period. In fact, the only outcome in which “Changers” appear worse off in 2001 than in 1994 is debt. “Changers” increase their debt by approximately \$4,000, which suggests that this mobility is associated with increased access to credit. This may entirely be due to a vehicle loan as this figure is nearly identical to the price paid for a vehicle for “Changers” (Table 6).

---

<sup>32</sup> For example, owning a vehicle assists residents in lower income neighborhoods to overcome the spatial mismatch between jobs and housing. With a car, residents can commute to a job or a better job in a distant area more easily.

<sup>33</sup> The heterogeneity in the experiences of families with children during the welfare reform period is consistent with evidence by Bitler et al. (2006).

## **VI. Summary and Discussion**

Our primary results do not show strong evidence that vehicle ownership reduces weekly food expenditures, encourages consumption of food at home, or reduces food distress. We believe that investigations into this research question would benefit from both additional work and improved data for several reasons. First, although results did not tend to reach statistical significance levels, we find evidence consistent with the idea that vehicle ownership is associated with reduced food spending overall and increased spending for food at-home. This is consistent with the hypothesis that consumers with vehicles are able to access lower prices and that their food spending is shifted away from food away from home or delivery. Evidence from other studies suggests that vehicle ownership could have a sizable improvement on the money and time budgets of low-income families while grocery shopping (Feathers, 2003; Rose et al., 2009).

The shift in spending towards at-home food consumption and away from food purchased at restaurants or for delivery may have future implications for health because food away from home has been found to have lower dietary quality and increased caloric intake (Todd et al., 2010). The PSID data do not allow us to directly assess whether vehicle ownership improves diet quality, although it does provide data to calculate adult BMI. We find that self-reported health improves among heads of families who own vehicles, although not significantly. Child eating patterns do not improve, but children in households with vehicles have similar patterns of consumption of broad food groups as children without vehicles.

Vehicle ownership may be related with lower incidence of indicators of food distress, particularly when comparing families with children to those without children. The lack of significance could be due our attempt to understand the relationship between vehicle ownership, which is common, and food distress, which is fairly uncommon and may be a dynamic event for families.<sup>34</sup> Data with more detailed information about how people travel to stores, what stores are available near them or how far they have to travel to get to a large-scale food store could help more precisely estimate the nature of this relationship. In short, our analysis would be improved if we had better measures of whether families face food store access problems.

---

<sup>34</sup> Ribar and Hamrick find that four-fifths of those who were food insufficient in one year were not food insufficient two years later (2003)

As noted above, vehicle ownership may also improve employment prospects for low-educated female heads, which could have implications for food distress, as well, through improved income. While our checks on continuously employed samples do not suggest that employment explains our results, we may be including a general trend towards improving incomes, even among the employed. These facts suggest further investigation into the best sample selection criterion may be warranted. However, it may be impossible to distinguish between the general improvement in economic conditions and rapid change in low-income policy in the late 1990s from the vehicle ownership questions.

#### *Policy Implications*

Consistent with prior research (Baum and Owens, 2010; Hurst and Ziliak, 2004; and Sullivan, 2004), we find evidence that changes in AFDC/TANF policies toward vehicle exemptions rules for eligibility had the effect of increasing vehicle ownership among low-educated female headed families. These results indicate that the policies had some success in increasing vehicle ownership rates among eligible groups, a result that may improve other outcomes such as employment.

Our weak results with respect to the impact of vehicle ownership on food distress do not allow us to make strong policy implications. These findings are relevant for current policy discussions surrounding areas that lack access to healthy and affordable foods. The proposed Healthy Food Financing Initiative (HFFI) would provide \$400 million in Federal funds to encourage the development of healthy food retailers in underserved communities. In some more remote areas, or areas where the market is too small to support food retailers, it may make more sense to encourage more readily available transportation to access existing retailers. A policy that encourages vehicle ownership or offsets the costs of transportation could be beneficial for low-income families who have limited access to food retailers.

Other creative policy solutions to overcome spatial mismatches are possible and many localities are experimenting with novel methods to assist residents to access full-service food retailers or fresh fruits and vegetables. One example is Baltimore's Virtual Supermarket Project. This program allows residents of some areas to shop for groceries online at local libraries and pick up their groceries the following day at the library (Schleiter, 2010). Another example is New York

City, which has a multi-pronged approach to improving healthy food access and demand for healthy foods in underserved areas. These programs include the Food Retail Expansion to Support Health (FRESH) program, which through zoning policies and financial incentives aims to encourage the development of grocery stores in underserved areas, Green Carts, which are mobile fruit and vegetable carts that operate in underserved areas; Healthy Bodegas, which works with small corner stores to encourage them to carry healthier food options; and the Health Bucks program, which gives coupons that can be used at local farmers' markets. Thorough evaluations of these programs will be important to help answer the underlying question motivating our analysis – can improvements in physical access to supermarkets reduce food insecurity, particularly among families with children?

#### *Future Research*

We hypothesized that vehicle ownership could reduce food distress because it would allow those with limited access to food in their own neighborhoods to travel to lower-priced, full service food stores outside of their neighborhood. Our lack of specific information on the retail food environment in the neighborhoods of our sample members and, therefore, our inability to control for neighborhood food environments could explain our weak results. National data on the food retail environment currently exist only on the county-level, a level of aggregation that is too large to precisely identify neighborhoods with limited access.<sup>35</sup> As part of the HFFI development, census tract-level information on the food environment will be available. This information could be merged with data on food distress and vehicle ownership to better test our hypothesis. Future research will explore possibilities for such a data linkage.

Some of the data limitations are due to a lack of correspondence in PSID data that is available during the time period for which we are most interested. For example, the lack of information on vehicle ownership in between 1994 and 1999 is a problem that hampered our ability to link changes in state AFDC/TANF vehicle policies to vehicle ownership. Further, questions about food distress and food security were not available over this time period. The sample size for our group of interest, low-education female headed families was relatively small, especially because we are concerned with fairly rare events in the general population (households becoming car

---

<sup>35</sup> Even smaller-area data are available at the 1 kilometer grid level using 2006 store-level data matched to 2000 Census data (USDA, 2009). But in order to match these data with the PSID, more precise information about the respondents' addresses and may be too problematic for confidentiality reasons.

owners and their food distress status). While these data limitations are not insurmountable, more work needs to be done to better measure the true effect of vehicle ownership on our outcomes of interest.

Table 1. State Changes in AFDC/TANF Vehicle Exemption Policies, 1994-2001

<u>State</u>	<u>1994</u>	<u>1996</u>	<u>1999</u>	<u>2001</u>
Alabama	\$1,500	exempt	exempt	exempt
Alaska	1,500	1,500	exempt	exempt
Arizona	1,500	1,500	exempt	exempt
Arkansas	1,500	1,500	exempt	exempt
California	4,500	4,500	4,650	4,650
Colorado	1,500	1,500	exempt	exempt
Connecticut	exempt	exempt	exempt	9,500
Delaware	4,500	4,650	4,650	4,650
District of Columbia	1,500	1,500	4,650*	exempt
Florida	1,500	1,500	8,500	8,500
Georgia	4,600	4650*	4,650*	4,650
Hawaii	exempt	exempt	exempt	exempt
Idaho	1,500	1,500	4,650*	4,650*
Illinois	1,500	1,500	exempt	exempt
Indiana	1,000	1,000	5000	5,000
Iowa	3,000	3,000	3,889	4,042
Kansas	1,500	1,500	exempt	exempt
Kentucky	1,500	1,500	exempt	exempt
Louisiana	1,200	1,200	10,000	exempt
Maine	1,500	exempt	exempt	exempt
Maryland	1,500	1,500	exempt	exempt
Massachusetts	1,500	5,000*	5,000	10,000* or 5,000
Michigan	1,500	exempt	exempt	exempt
Minnesota	1,500	1,500	7,500	7,500
Mississippi	1,500	1,500	4,650*	4,650
Missouri	1,500	exempt	exempt	exempt
Montana	1,500*	exempt	exempt	exempt
Nebraska	1,500	exempt	exempt	exempt
New Hampshire	1,500	1,500	exempt	exempt
New Jersey	1,500	1,500	9,500*	9,500*
New Mexico	1,500	1,500	exempt	exempt
Nevada	1,500	exempt	exempt	exempt
New York	1,500	1,500	4,650*	4,650*
North Carolina	1,500	5000*	exempt	exempt
North Dakota	1,500	exempt	exempt	exempt
Ohio	1,500	4,600*	exempt	exempt
Oklahoma	1,500	5,000	5,000	5,000
Oregon	1,500	9,000	10,000	10,000
Pennsylvania	1,500	1,500	exempt	exempt
Rhode Island	1,500	1,500	1,500 or 4,600*	1,500 or 4,650*
South Carolina	1,500	1,500	10,000*	exempt
South Dakota	1,500	4,650	4,650	exempt
Tennessee	1,500	1,500	4,600	4,600
Texas	1,500	1,500	4650*	4650*
Utah	1,500	8,000	8,000	8,000*
Vermont	exempt	exempt	exempt	exempt
Virginia	1,500	7,500	7,500	7,500
Washington	1,500	1,500	5,000	5,000
West Virginia	1,500	1,500	exempt	exempt
Wisconsin	1,500	2,500	10,000*	10,000
Wyoming	1,500	1,500	12,000*	12000*

Notes: AFDC/TANF values taken from Powers (1998), Sullivan (2004), and Urban Institute's Welfare Rules Database. Limits and exemptions reflect the restrictions that apply to the majority of the recipients in a given state in that year. All limits refer to the limit on equity value, except values followed by \* which refers to the market value.

Table 2. Demographic Characteristics of Low-Educated Families with Children

	Single Mothers		Other Families With Children	
<u>Fixed Characteristics</u>				
Nonwhite Head	0.866		0.422	
	(0.341)		(0.494)	
Family Head Has 12 Years of Education	0.495		0.705	
	(0.501)		(0.456)	
Family Head Has 13 Years of Education	0.173		0.129	
	(0.379)		(0.335)	
<u>Time Varying Characteristics</u>				
	<u>1994</u>	<u>2001</u>	<u>1994</u>	<u>2001</u>
Vehicle Ownership	0.426	0.607	0.890	0.945
	(0.496)	(0.489)	(0.313)	(0.228)
Age of the Head	30.728	37.856	33.888	40.851
	(6.095)	(6.189)	(5.461)	(5.401)
Number of Kids	2.322	2.245	2.222	2.007
	(1.293)	(1.232)	(1.104)	(1.026)
Number of Children Under Age 5	0.837	0.406	0.681	0.233
	(0.992)	0.698	(0.726)	(0.511)
Employed Adult in Family	0.649	0.847	0.936	0.959
	(0.479)	(0.361)	(0.246)	(0.198)
Homeowner	0.178	0.271	0.629	0.782
	(0.384)	(0.445)	(0.484)	(0.414)
Unemployment Rate	5.746	4.942	5.746	4.754
	(1.247)	(0.665)	(1.247)	(0.771)
Urban	0.139	0.157	0.288	0.284
	(0.346)	(0.365)	(0.453)	(0.451)
Size of Largest City in County				
More than 500,000	0.252	0.249	0.188	0.202
100,000-499,999	0.119	0.096	0.136	0.130
50,000-99,999	0.248	0.270	0.514	0.524
Less than 49,999	0.139	0.016	0.288	0.284
Number of Families	229		590	

Notes: Data from the 1994 and 2001 Panel Survey of Income Dynamics for families with children, headed by adults with less than 14 years of education. See text for further description.

Table 3. Food-Related Outcomes, by Family Type and Vehicle Ownership

	<u>Vehicle Owners</u>		<u>Non-Vehicle Owners</u>	
	Single Mothers	Other Families With Children	Single Mothers	Other Families With Children
<u>Food Expenditure Outcomes</u>				
Weekly Food Expenditures	100.025 (46.810)	146.820 (67.274)	110.218 (60.886)	121.855 (76.791)
Ratio of Weekly Food Expenditures to TFP	1.357 (0.811)	1.590 0.762	1.452 (0.840)	1.326 (0.723)
Weekly Food Expenditures for Food at Home	63.962 47.818	107.529 (53.567)	46.001 (55.010)	72.104 (77.316)
Portion Food at Home to Total Weekly Food Expenditures	0.611 (0.294)	0.734 (0.188)	0.390 (0.359)	0.544 (0.333)
Weekly Food at Home Expenditures to Income Needs	0.174 (0.131)	0.250 (0.126)	0.124 (0.141)	0.156 (0.154)
<u>Food Distress Outcomes</u>				
Raw Food Security Score	1.475 (2.915)	0.429 (1.548)	2.722 (3.519)	2.387 (3.783)
Highly Food Secure	0.669 (0.472)	0.880 (0.326)	0.411 (0.495)	0.387 (0.495)
Money for Food is a Problem	0.331 (0.472)	0.192 (0.328)	0.589 (0.495)	0.613 (0.495)
Sometimes or Often Worried about Running Out of Food Before We Had Money to Get More	0.288 (0.454)	0.096 (0.295)	0.533 (0.502)	0.484 (0.508)
Sometimes or Often Bought Food that Didn't Last and Didn't Have Money to Get More	0.245 (0.431)	0.071 (0.258)	0.478 (0.502)	0.548 (0.506)
Couldn't Afford Balanced Meals	0.165 (0.373)	0.062 0.241	0.278 (0.450)	0.194 (0.402)
Sometimes or Often Relied on Low-Cost Food to Feed Children	0.180 (0.385)	0.051 (0.220)	0.256 (0.439)	0.194 (0.402)
Couldn't Afford Balanced Meals for Children	0.129 (0.337)	0.034 (0.181)	0.189 (0.394)	0.129 (0.341)

Notes: Data from 1994 and 2001 Panel Survey of Income Dynamics (PSID) for families with children, headed by adults with less than 14 years of education. See text for further description. Food expenditure outcomes from data in both 1994 and 2001; food distress outcomes from 2001 data only.



Table 4. First stage results of the effect of state AFDC exemption laws on vehicle ownership

Panel A. Estimates Using Family Fixed Effects

	<u>Vehicle Ownership</u>
Exemption	-0.022 (0.041)
Single Mother * Exemption	-0.163** (0.064)
Exemption Value	0.002 (0.005)
Single Mother * Exemption Value	0.010 (0.012)
Single Mother	0.089** (0.043)
Number of Observations	1,584
Number of Families	792

Panel B. Estimates Using Change in Vehicle Exemption Policies between 1994 and 2001

	<u>Vehicle Ownership</u>
Change in Exemption * Single mother	0.09* (0.05)
Change in Exemption	0.05* (0.02)
Single mother	-0.18*** (0.04)
Number of Observations	792

Notes: Data from 1994 and 2001 Panel Survey of Income Dynamics (PSID). Sample includes families with children, headed by a low-educated adult, aged 18 to 55. Both estimates include controls for state-level vehicle policies, state-level low-income policies, state-level economic conditions, and family demographic characteristics. See text for further details on the covariates and the estimation approach. All standard errors clustered by state. Statistical significance denotes as follows: \*\*\* indicates 0.01, \*\* indicates 0.05, and \* indicates 0.1.

Table 5: Estimated Effect of Vehicle Ownership on Food Expenditures

	(1)			(2)			(3)			(4)			(5)		
	Weekly Food Spending			Ratio of All Food to Thrifty Food Plan			Food at Home			Ratio of Food at Home to All Food Spending			Ratio of Food at Home to Needs		
	Naïve	Red. Form	IV	Naïve	Red. Form	IV	Naïve	Red. Form	IV	Naïve	Red. Form	IV	Naïve	Red. Form	IV
Vehicle	2.91 (6.42)	-69.29 (52.75)		0.10 (0.10)	-0.68 (0.62)		14.27 (8.81)	42.81 (44.36)		0.11 * (0.06)	0.82*** (0.28)		0.03 (0.02)	0.18 (0.12)	
Exemption	8.09 (11.40)	3.93 (11.62)	2.82 (13.80)	0.20 (0.16)	0.15 (0.16)	0.14 (0.18)	-0.23 (7.10)	1.24 (7.83)	2.02 (11.44)	-0.03 (0.04)	0.01 (0.04)	0.02 (0.07)	0.00 (0.02)	0.01 (0.02)	0.02 (0.03)
Single Mom * Exemption		12.41* (6.79)			0.13 (0.10)			-5.66 (8.37)			-0.15** (0.07)			-0.02 (0.02)	
Exemption Value	-0.07 (1.45)	0.21 (1.49)	0.23 (1.70)	-0.01 (0.02)	-0.01 (0.02)	-0.01 (0.02)	-0.41 (0.97)	-0.37 (0.97)	-0.55 (1.40)	-0.00 (0.01)	-0.01 (0.01)	-0.01 (0.01)	-0.00 (0.00)	-0.00 (0.00)	-0.00 (0.00)
Single Mom * Exemption Value		-1.13 (1.64)			-0.01 (0.03)			-0.46 (1.44)			0.01 (0.01)			-0.00 (0.00)	
Single Mom	-3.29 (13.12)	-7.47 (13.25)	-1.65 (12.52)	0.06 (0.19)	0.02 (0.19)	0.10 (0.17)	23.01* (12.57)	26.93* (13.96)	22.33** (10.32)	0.16*** (0.06)	0.22*** (0.07)	0.15** (0.07)	0.06* (0.03)	0.07** (0.03)	0.05** (0.03)
Number of Observations	1,572			1,512			1,577			1,567			1,577		
Number of Families	792			792			792			792			792		

Notes: Data from 1994 and 2001 Panel Survey of Income Dynamics (PSID). Sample includes families with children, headed by a low-educated adult, aged 18 to 55. Estimates calculated using a family fixed-effects specification, which include controls for state-level vehicle policies, state-level low-income policies, state-level economic conditions, and time-varying family demographic characteristics. See text for further details on the covariates and the estimation approach. All standard errors clustered by state. Statistical significance denotes as follows: \*\*\* indicates 0.01, \*\* indicates 0.05, and \* indicates 0.1.

Table 6. Family Vehicle Outcomes in 2001, by Family's Vehicle Ownership Decisions

	<u>All Vehicle Owners</u>	<u>Always Owners</u>	<u>Changers</u>
Panel A. Characteristics of Vehicles			
Price of Car, in Thousands	7.303 (10.572)	7.792 (10.947)	4.032 (6.802)
New Car	0.348 (0.477)	0.371 (0.483)	0.202 (0.404)
Year Purchased	1998.460 (2.584)	1998.384 (2.640)	1998.955 (2.122)
Model Year	1995.428 (4.128)	1995.756 (4.022)	1993.244 (4.184)
Panel B. Expenses Related to Vehicle Ownership			
Annual Insurance Payment	898.078 (2402.760)	890.235 (2566.848)	951.215 (508.669)
Car Loan	0.349 (0.477)	0.360 (0.480)	0.278 (0.450)
Monthly Car Loan Payment, For Those with Car Loans	368.500 (143.200)	144.442 (110.277)	321.672 (124.925)
Gasoline Expenses in Current Month	0.981 (0.138)	0.985 (0.124)	0.956 (0.207)
Gasoline Expenses in Current Month, for Those with Gasoline Expenses	179.262 (183.117)	188.486 (192.001)	117.906 (84.600)
Any Vehicle Repairs in Current Month	0.486 (0.500)	0.492 (0.500)	0.444 (0.444)
Repair Expenses in Current Month, For Those with Repair Expenses	276.490 (357.619) [110.277]	261.410 (348.741) [110.277]	384.314 (404.233) [245.366]
Parking Expenses in Current Month	0.046 (0.210)	0.041 (0.199)	0.078 (0.269)
Parking Expenses in Current Month, For Those with Parking Expenses	45.142 (49.482)	44.203 (49.578)	48.364 (52.957)

Notes: Data from 1994 and 2001 Panel Survey of Income Dynamics (PSID). Sample includes families with children, headed by a low-educated adult, aged 18 to 55. All vehicle characteristics reported on the first vehicle, if a family owns more than one vehicle. Median values for some outcomes are included in square brackets

Table 7. Child Outcomes, by Family's Vehicle Ownership Decisions

	<u>Always Owners</u>	<u>Changers</u>	<u>Never Owners</u>
Number of Days in the Past Week Consumed :			
Meat	5.179 (1.922)	5.213 (1.799)	5.083 (1.934)
Dairy Products	4.993* (1.930)	4.557 (2.070)	4.431 (1.758)
Fruit	4.747 (1.995)	4.902 (2.022)	4.724 (1.871)
Vegetables	3.919** (2.148)	3.393 (2.282)	3.576 (2.253)
Grains	5.531 (1.775)	5.574 (1.688)	5.283 (1.738)
Foods High in Protein, Except Meat	3.508 (2.051)	3.633 (2.217)	3.183 (2.244)
Sweets or Desserts	4.698** (1.987)	5.377 (1.872)	5.150 (1.912)
Diet-Related Health Outcomes			
BMI Category:			
Normal Weight	58.48%	53.25%	72.50%***
Overweight	24.15%*	22.08%	18.75%***
Obese	17.37%*	24.68%	8.75%***
Anemia	0.034 (0.182)	0.021 (0.144)	0.050 (0.218)
Primary Care-Giver Rates Child Health as Very Good or Excellent	0.765 (0.424)	0.817 (0.389)	0.532*** (0.501)
Child Self-Reported Health. At Least Approximately Once a Week:			
Child Feels Sick	0.187*** (0.390)	0.141 (0.350)	0.329*** (0.473)
Child Feels Dizzy	0.100 (0.301)	0.113 (0.318)	0.184 (0.390)
Child Has Head Aches	0.369 (0.483)	0.338 (0.476)	0.329 (0.473)
Child Has Stomach Ache	0.195*** (0.396)	0.141 (0.350)	0.276*** (0.450)

Notes: Families classified by their Vehicle Ownership Changes between 1994 and 2001. Child outcomes tabulated from CDS-II. Asterisks denote two-sample t-tests for "Always Owners" relative to "Changers" and "Never Owners" relative to "Changers." Statistical significance denotes as follows: \*\*\* indicates 0.01, \*\* indicates 0.05, and \* indicates 0.1.

Table 8: Estimated Effect of Vehicle Ownership on Indicators of Food Distress

	(1)			(2)			(3)			(4)			(5)			(6)		
	Food security Raw Score			Highly Food Secure			Money for food Is a problem			Often or sometimes, bought food that didn't last & no \$ for more			Could not afford a balanced meal			Could not afford balanced meal for kids because of \$		
	Naïve	Red. Form	IV	Naïve	Red. Form	IV	Naïve	Red. Form	IV	Naïve	Red. Form	IV	Naïve	Red. Form	IV	Naïve	Red. Form	IV
Vehicle	-0.89** (0.40)		-3.41 (4.30)	0.24*** (0.06)	0.43 (0.60)		-0.24*** (0.06)	-0.43 (0.61)		-0.23*** (0.07)	-0.27 (0.51)	-0.05 (0.04)	-0.21 (0.44)		-0.02 (0.03)	-0.53 (0.47)		
Change in Exemption Policy * Single Mother		-0.32 (0.34)			0.04 (0.06)			-0.04 (0.06)			-0.03 (0.05)			-0.02 (0.04)			-0.05 (0.03)	
Change in Exemption Policy	-0.36** (0.16)	-0.35** (0.17)	-0.19 (0.30)	0.06 (0.04)	0.07* (0.04)	0.05 (0.05)	-0.06 (0.04)	-0.07* (0.04)	-0.05 (0.05)	-0.06** (0.03)	-0.07** (0.03)	-0.06 (0.04)	-0.07*** (0.02)	-0.06*** (0.02)	-0.05* (0.03)	-0.05*** (0.02)	-0.04** (0.02)	-0.02 (0.03)
Single Mother	0.62*** (0.21)	0.66*** (0.22)	0.03 (0.91)	-0.11** (0.04)	-0.14*** (0.05)	-0.06 (0.14)	0.11** (0.05)	0.14*** (0.05)	0.06 (0.14)	0.08** (0.04)	0.12** (0.05)	0.07 (0.12)	0.07** (0.03)	0.07** (0.03)	0.03 (0.10)	0.06** (0.03)	0.04* (0.03)	-0.05 (0.10)
Number of Observations	792			792			792			792			792			792		

Notes: Data from 2001 Panel Survey of Income Dynamics (PSID). Sample includes families with children, headed by a low-educated adult, aged 18 to 55. Estimates calculated include controls for state-level vehicle policies, state-level low-income policies, state-level economic conditions, and time-varying family demographic characteristics. See text for further details on the covariates and the estimation approach. All standard errors clustered by state. Statistical significance denotes as follows: \*\*\* indicates 0.01, \*\* indicates 0.05, and \* indicates 0.1.

Table 9. Family Economic Well-Being, by Family's Vehicle Ownership Decisions

	Always Owners		Changers		Never Owners	
	1994	2001	1994	2001	1994	2001
Adult in Family Employed	0.959 (0.199)	0.974*** (0.159)	0.733 (0.445)	0.900 (0.302)	0.429*** (0.498)	0.670*** (0.473)
Receipt of AFDC/TANF in Last Year	0.062*** (0.241)	0.012** (0.109)	0.422 (0.497)	0.044 (0.207)	0.604** (0.492)	0.286*** (0.454)
Receipt of Food Stamps in Last Year	0.141*** (0.348)	0.055*** (0.228)	0.652 (0.479)	0.244 (0.432)	0.813 (0.392)	0.681*** (0.469)
Family Income, in Thousands	51.291*** (34.958) [48.098]	68.463*** (62.896) [61.755]	19.444 (19.939) [12.655]	30.620 (22.305) [24.812]	11.325*** (10.634) [7.755]	17.554*** (18.534) [14.384]
Debt, in Thousands	5.529 (23.251)	5.758 (17.889)	2.840 (8.983)	6.809 (18.135)	0.324*** (1.140)	0.649*** (2.691)
Monthly AFDC/TANF Benefits, if Received AFDC/TANF in Last Year	332.830* (212.589)	279.092 (196.948)	438.046 (220.466)	333.926 (207.339)	438.046 (220.466)	333.926* (207.339)
Monthly Food Stamp Benefits, if Received Food Stamps in Last Year	308.434 (158.784)	229.265 (164.841)	328.635 (115.147)	318.029 (227.221)	328.635 (115.147)	318.029 (227.221)

Notes: Data from 1994 and 2001 Panel Survey of Income Dynamics (PSID). Sample includes families with children, headed by a low-educated adult, aged 18 to 55. Families classified by their Vehicle Ownership Changes between 1994 and 2001. Statistical significance denotes as follows: \*\*\* indicates 0.01, \*\* indicates 0.05, and \* indicates 0.1.

## References

- Anderson, M. and D.A. Matsa (2007). "Are Restaurants Really Supersizing America?" Department of Agricultural and Resource Economics Working Paper No. 1056. University of California-Berkeley. <http://are.berkeley.edu/Papers/anderson08.pdf>.
- Baum, C.L. and M.F. Owens (2010). "The Effect of Vehicle Asset Rules on Vehicle Assets". Department of Economics and Finance Working Paper Series, Middle Tennessee State University, February, 2010.
- Bitler, Marianne, Hilary Hoynes, and Jonah Gelbach. 2006. "What Mean Impacts Miss: Distributional Effects of Welfare Reform Experiments." *American Economic Review* 96(4): 988-1012.
- Broda, C., Leibtag, E., and Weinstein, D.E. (2009). "The Role of Prices in Measuring the Poor's Living Standard," *Journal of Economic Perspectives*, 23 (2): Spring, 000-000.
- Chen, S.E., Florax, R.J.G.M., and Snyder, S.D. (2009). "Obesity, Fast Food, and Grocery Stores: Evidence from Geo-referenced Micro Data," *National Poverty Center Working Paper*, <http://www.npc.umich.edu/news/events/food-access/index.php>.
- Currie, J., S. DellaVigna, E. Moretti, and V. Pathania (2009). "The Effect of Fast Food Restaurants on Obesity", National Bureau of Economic Research Working Paper No. 14721, <http://www.nber.org/papers/w14721>.
- Feather, P.M. (2003). "Valuing Food Store Access: Policy Implications for the Food Stamp Program". *American Journal of Agricultural Economics*, 85(1): 162-172.
- Gundersen, C. and V. Oliveira (2001). "The Food Stamp Program and Food Insufficiency". *American Journal of Agricultural Economics*, 83(4): 875-887.
- Hofferth, S.L. (2004). "Persistence and Change in Food Security of Families with Children: 1997-1999. Economic Research Service E-FAN-04-001, U.S. Department of Agriculture.
- Hurst, Erik and James P. Ziliak. 2006. "Do Welfare Asset Limits Affect Household Saving? Evidence from Welfare Reform." *Journal of Human Resources* 41(1): 46-71.
- Inagami, S., D.A. Cohen, A.F. Brown, and S.M. Asch, (2009). "Body Mass Index, Neighborhood Fast Food and Restaurant Concentration, and Car Ownership". *Journal of Urban Health*, 86(5): 683-695.
- Kaufman, P.R., J.M. MacDonald, S.M.Lutz, and D.M. Smallwood (1997). "Do the Poor Pay More for Food? Item Selection and Price Differences Affect Low-Income Household Food Costs". Agricultural Economic Report No. 759. Economic Research Service, U.S. Department of Agriculture.

- Larson, N.I., Story, M.T., and Nelson, M.C. (2009). "Neighborhood environments: Disparities in access to healthy foods in the U.S." *American Journal of Preventive Medicine*, 36(1): 74-81.e10.
- Morland, Kimberly, Steve Wing, and Ana Diez Roux. 2002. "The Contextual Effect of the Local Food Environment on Residents' Diets: The Atherosclerosis Risk in Communities Study." *American Journal of Public Health* 92(11): 1761-1768.
- Ohls, J.C., Ponza, M., Moreno, L., Zambrowski, A., and Cohen, A. (1999). *Food Stamp Participants' Access to Food Retailers*, Report submitted to U.S. Department of Agriculture, Food and Nutrition Service, by Mathematica Policy Research, Inc.
- Olson, C. M. (1999). "Nutrition and Health Outcomes Associated with Food Insecurity and Hunger". *Journal of Nutrition*, 129: 521-524.
- Powell, Lisa M. Christopher Auld, Frank J. Chaloupka, Patrick M. O'Malley, Lloyd D. Johnston. 2007. "Associations Between Access to Food Stores and Adolescent Body Mass Index." *American Journal of Preventive Medicine* 33(4): S301-S307.
- Rose, D. (1999). "Economic Determinants and Dietary Consequences of Food Insecurity in the United States". *Journal of Nutrition*, 129:517-520
- Rose, D., Bodor, J.N., Swalm, C.M., Rice, J.C., Farley, T.A., Hutchinson, P.L. (2009). "Deserts in New Orleans? Illustrations of Urban Food Access and Implications for Policy. National Poverty Center Working Paper: <http://www.npc.umich.edu/news/events/food-access/index.php>.
- Rose, D. and Richards, R. (2004). "Food Store Access and Household Fruit and Vegetable Use Among Participants in the US Food Stamp Program," *Public Health Nutrition* 7(8): 1081-1088.
- Schleter, Brian. "Virtual Supermarket Program Provides Food Access to Underserved Communities." March 17, 2010. Health Department, City of Baltimore. Accessed May 4, 2010 at [http://www.baltimorehealth.org/press/2010\\_03\\_17\\_VS\\_PR.pdf](http://www.baltimorehealth.org/press/2010_03_17_VS_PR.pdf).
- Sullivan, James X. 2006. "Welfare Reform, Saving, and Vehicle Ownership: Do Asset Limits and Vehicle Exemptions Matter?" *Journal of Human Resources* 41: 72-105.
- Todd, J.E., L. Mancino, and B.H. Lin (2010). "The Impact of Food Away from Home on Adult Diet Quality". Economic Research Report No. ERR-90. Economic Research Service, U.S. Department of Agriculture. February, 2010.
- U.S. Department of Agriculture (2009). *Access to Affordable and Nutritious Food: Measuring and Understanding Food Deserts and Their Consequences*. Report to Congress. June,



2009. Administrative Publication No (AP-036),  
[www.ers.usda.gov/Publications/AP/AP036/](http://www.ers.usda.gov/Publications/AP/AP036/).

Williams, D.R. and C. Collins (2001). “Racial Residential Segregation: A Fundamental Cause of Racial Disparities in Health”, Public Health Reports, 116: 404-416.