The Effects of the Food Stamp Program on Energy Balance and Obesity

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ABSTRACT

The Food Stamp Program (FSP) administered by the U.S. Department of Agriculture (USDA) is the cornerstone of the U.S. federal income and food safety net policy. The FSP has subsidized the food budget for millions of American households for over forty years, spending more than $60 billion per year in recent times. Prior research has demonstrated that women who participate in the FSP are more likely to be overweight or obese than eligible non-participants. This finding raises the concern that the additional income provided by FSP benefits induces participants to eat significantly more calories and gain weight, contributing to the U.S. obesity epidemic. Previous studies of the FSP have yielded mixed results. In this study we develop new conceptual and empirical models linking FSP participation, calorie consumption, physical activity, and weight gain, while controlling for genetic variation, weight history, and other physiological characteristics of individuals. The models enable us to test whether participants gained more weight, ate more calories, or engaged less in physical activity; or if previously omitted variables and individual health characteristics explain the higher prevalence of obesity among female FSP participants. We find a positive relationship between FSP participation and weight gain for a small subset of women. We do not find convincing evidence for the hypothesis that FSP participation causes obesity by increasing caloric consumption, decreasing physical activity, or some combination of the two. Our findings suggest that a positive association between FSP and weight exists, but we find no evidence of a direct causal link from one to the other. The association between weight and FSP likely results from confounding factors that make individuals more likely both to gain weight and to participate in the FSP.

JEL Codes: Q18, H53, I12, I18, I38

Key Words: Food Stamp Program (FSP), Supplemental Nutrition Assistance Program (SNAP), obesity, body mass index (BMI), nutrition assistance.

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1. Introduction

The Food Stamp Program (FSP) administered by the U.S. Department of Agriculture (USDA) has functioned as the mainstay of U.S. food assistance programs for over forty years.[1] In 2010, 40.3 million Americans (13 percent of the population) participated, receiving an average of $134 per person and month. In that year, the USDA delivered nearly 73.6 percent of the $92.7 billion spent on food assistance through Food Stamp benefits.[2] Over the past three decades, paralleling the introduction and evolution of the FSP, the United States has also experienced a marked increase in the prevalence of obesity. Between 1960 and 2009 the percentage of adults in the United States classified as overweight or obese (having a body mass index (BMI) greater than 25) increased from 41.3 percent to 68 percent (Flegal 1998; Levi et al. 2010).

Policy aimed at preventing and reducing obesity has received much more attention and funding since it became a Presidential priority in 2009 (Levi et al. 2010). Given the scale of the FSP, and the national spotlight on obesity, the economic and nutritional consequences of the FSP have been the subject of many studies (Jensen and Wilde 2010). Prior studies have documented a statistical association between FSP participation and obesity. For instance, Gibson (2003) demonstrated that FSP participants are more likely to be overweight or obese than eligible non-participants. This observation raises the question: Is the additional income provided through FSP benefits inducing participants to eat significantly more than they would otherwise, and thus making participants fatter?[3]

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[1] The Food Stamp Program was renamed the Supplemental Nutrition Assistance Program in October, 2008.

[2] Food Stamp Program and USDA expenditures are taken from Food and Nutrition Services program data, available at: http://www.fns.usda.gov/pd/SNAPsummary.htm and http://www.fns.usda.gov/pd/annual.htm.

[3] Lower-income individuals tend to have less-healthy diets and higher food insecurity, so obesity, malnutrition, and food insufficiency need not be mutually exclusive (Townsend *et al.*, 2001; Schoenborn, Adams, and Barnes, 2002; Drewnowski and Specter, 2004; Doak *et al.*, 2005; Dolnick, 2010). In fact, the USDA recently updated and expanded their food insufficiency definitions to better identify those households that actually experience hunger (or

Previous studies that addressed this question have yielded mixed results. Even though the methods used to investigate the relationship between obesity and FSP participation have improved considerably, researchers have not identified a definite causal relationship. Furthermore, the statistical relationship between participation and obesity may have disappeared in recent years. The BMIs of non-participants that once lagged have now caught up to the BMIs of FSP participants, but we do not know whether FSP participation contributed to this change (Ver Ploeg *et al.* 2007).[4]

In this study we model and measure the mechanisms underlying the links between FSP participation, food consumption, and obesity. Our study contributes to the literature in several ways. First, we develop a physiologically consistent model that relates changes in weight to FSP participation and other factors. Second, we construct models of the two primary determinants of changes in weight: calorie intake (energy consumption) and physical activity (energy expenditure). With these two models we test whether FSP participation is associated with an increase in calorie consumption, a decrease in physical activity, or both. Third, we develop a model of participation, in which body weight can influence the choice to participate in the FSP. To our knowledge, no-one has investigated whether individual propensities for obesity influenced the decision to participate in the FSP, which might have distorted previous findings. Lastly, our models include measures of underlying health and psychological conditions and rely on measured rather than self reported weight.

This paper is organized as follows. In the next section we describe the motivation for this research and review previous work in the area. In section 3 we outline the conceptual and theoretical underpinnings, and in section 4 we describe the specifications of the models used in

a significant decrease in food intake), as opposed to anxiety over food supply or a temporary shortage without a change in consumption (Economic Research Service, 2009).

[4] BMI stands for body mass index and is calculated as the ratio of weight (kg) to height squared (m^2).

the empirical work. In section 5 we describe the data we employed and in section 6 we discuss the results. Section 7 concludes the paper.

2. Background

Public health officials recognized that the United States has an obesity problem over a decade ago, but the Obama administration has given greater policy attention to the issue. With the help of First Lady Michele Obama, reducing childhood obesity and increasing physical activity became a national priority (Levi et al. 2010). But obesity is a complex issue, and much about the causes, consequences, and underlying mechanisms remains unknown.

Many hypotheses about the causes of the "obesity epidemic" have been suggested. A common thread in many of these hypotheses is the idea that the widespread availability of relatively inexpensive and unhealthy foods encourages individuals to over-consume food and, as a consequence, to gain weight. One popular hypothesis is that the extra income for food afforded by participation in the FSP induces increased caloric intake, which explains the higher prevalence of obesity among women who participate in the FSP. However, the issue is complex, with multiple potential contributing factors such that simple correlation does not establish causation—for example, poverty might cause both FSP participation and obesity (see Smith, 2009, for a review of the literature and evidence on the links between poverty, income assistance, and obesity in the United States).

Given that taxpayers fund the FSP, a Federally administered entitlement program, the suggestion that Food Stamps may have contributed to the obesity problem concerns program administrators and researchers alike. Furthermore, if the FSP promotes obesity, it may also contribute to the development of other costly health conditions associated with obesity (e.g., type

2 diabetes, heart disease, and some cancers) (Colditz 1992; Flegal et al. 2007; American Diabetes Association 2008; Huang et al. 2009). However, the hypothesis that increasing the purchasing power of a low-income household would result in negative health outcomes contradicts the much studied and well documented "health-wealth gradient," that is, the positive association between measures of socio-economic status and good health.[5]

[Figure 1. Rates of Food Stamp Program participation, poverty, and obesity by state]

[Figure 2. Rates of Food Stamp Program participation ... in Mississippi by county.]

Numerous investigations have documented the apparent connection between FSP participation or poverty and obesity, reporting mixed results as to the direction of causation and the magnitude of the effect (see Drewnowski and Specter 2004, and Smith 2009 for reviews of the literature). Gibson (2003) found a significantly increased risk of obesity (defined as having a BMI ≥ 30) for low-income women currently participating in the FSP, and an even larger effect for long-term female FSP participants. In agreement with Gibson (2003), Chen, Yen, and Eastwood (2005) and Baum (2007) also found that FSP participation had a positive and significant relationship with BMI and obesity for women, but not for men. Similarly, Meyerhoefer and Pylypchuk (2008) found that female FSP participants had a 2.5 percent lower chance of being categorized as normal or underweight (BMI < 25). Their result has the same sign, but a much smaller magnitude of effect of FSP participation on obesity than those of similar studies conducted previously (i.e., Townsend et al. 2001; Gibson 2003; Chen, Yen and Eastwood 2005). Zagorsky and Smith (2009) evaluated the change in the BMIs of individuals who had ever participated in the FSP, and found that the BMIs of white women increased more during their FSP participation spell than it did before or after their FSP participation spell. Fan

[5] For more on the relationship between socio-economic status and various health outcomes see Adler and Rehkopf (2008), Adler et al. (1994), Deaton (2001), Herd (2010), Matthews and Gallo (2011), and Wilkinson (1996).

(2010) used the NLSY79 and propensity score matching techniques to estimate the effect of FSP participation on BMI for low-income women. Controlling for pre-participation weight and other socio-economic and demographic factors with the propensity score matching technique, Fan (2010) found that participation in the FSP had no significant effect on BMI or obesity among low-income women. The authors of the studies described above controlled for many individual characteristics including race, education, gender, marital status, homeownership, state of residence, and household income and composition.

Another vein of the FSP literature has investigated the links between FSP participation and the intake of specific nutrients, also with mixed results (Devaney and Moffitt 1991; Butler and Raymond 1996; Rose, Habicht and Devaney 1998; Wilde, McNamara and Raney 1999). While Devaney and Moffitt (1991) and Wilde, McNamara, and Ranney (1999) found positive and significant effects of FSP participation on the availability or consumption of protein, calories, total fats, sugars, and several vitamins and nutrients, Butler and Raymond (1996) found no effect.

Ver Ploeg et al. (2007) found that, in recent years, non-participants have "caught-up" to FSP participants and that, in the NHANES survey, a "BMI gap" between white female participants and non-participants was no longer apparent. Similarly, using NHANES I, II, III, and 1999-2006 surveys, Jolliffe (2010) demonstrated that the low-income population ($\leq$ 130 percent of poverty) has never had a higher prevalence of overweight (BMI $\geq$ 25) than high-income individuals. However, low-income individuals who are overweight are more likely to be severely overweight. Using quantile regression techniques, Jolliffe (2010) modeled the income-BMI gradient at the BMI weight category cut-offs for underweight (BMI < 18.5), overweight (25 $\leq$ BMI < 30), and obese (BMI $\geq$ 30). He found that the income-BMI gradient is positive for underweight individuals and negative for overweight and obese individuals, implying that an increase in income tends to improve BMI for individuals at any point in the BMI distribution. Smith (2009) concluded that links between poverty, public assistance, and obesity run in multiple directions, and that no single public health policy can address the obesity problem, especially if we neglect to take into account the potential effects of non-obesity policies (e.g., the FSP, urban planning, or education standards).

In this paper we build on the foundation of this prior work by building a more complete conceptual model of the underlying physiological and behavioral determinants of obesity, from which we derive corresponding statistical models that allow us to discriminate among alternative hypotheses. In particular we estimate individual behavioral equations for elements of the structure, including the choice to participate in the FSP as a potential consequence as well as a potential cause of obesity. And, unlike some previous studies we use data on actual weight rather than self-reported weight.

3. Theoretical and Conceptual Models

This section describes the theoretical and conceptual models we used to investigate the pathways that link FSP participation and obesity. These include (a) a model of the effect of participation in the FSP on weight gain, (b) a model of the effect of participation in the FSP on physical activity and calorie consumption, and (c) a model of the effect of obesity on the propensity to participate in the FSP.

a. Model of Weight Gain

Most of the previous research on the effect of the FSP on obesity investigates the impact of FSP participation on BMI, omitting many other factors that determine the body weight of an individual. Furthermore, previous research could not identify whether participants had gained more weight than non-participants, only if they weighed more for their height (i.e., had a greater BMI) than non-participants. The question remains, does participation in the FSP result in greater weight gain, over the course of a spell of participation, than participants would have experienced otherwise? To test this hypothesis requires a model of the determinants of changes in body weight that captures the possibility that participation in the FSP is associated with greater weight gain all else constant.

On a day-to-day basis the amount of energy stored depends on the amount energy consumed (*EC*) relative to energy expended (*EE*),

$$\begin{aligned} ES &= EC - EE \\ &= EC - \left(EE_{RMR} + EE_{PA} + EE_{TEF} + EE_{AT} \right) \end{aligned} \tag{1}$$

Total energy expended has four elements. First, EE_{RMR} represents the energy expended from the "resting metabolic rate" (RMR), which is the amount of energy needed to sustain life for a human at rest.[6,7] The relative amounts of fat-free-mass (FFM) and fat-mass (FM) largely determine EE_{RMR}. Second, EE_{PA} represents the energy expended in physical activity and movement, which is determined primarily by total body weight and the amount of physical activity. Third, EE_{TEF} represents energy expended during digestion or the "thermic effect of eating." Last, EE_{AT} represents the energy expended in adaptive thermogenesis, which is the energy expended to maintain a normal body temperature (Sherwood 2007).

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[6] The medical literature generally refers to Equation (1) as the "energy balance" equation.

[7] Basal metabolic rate (BMR), resting metabolic rate (RMR), and resting energy expenditure (REE) are often used interchangeably, but BMR has specific measurement criteria. BMR is the amount of energy expended when a person is lying down in a thermoneutral environment, not moving, has not eaten in 12 hours (i.e., "postabsorptive"), and has recently awoken from a full-night sleep (Gropper, Smith and Groff 2009).

Energy expenditure from adaptive thermogenesis and the thermic effect of feeding account for a small fraction total energy expenditure, probably less than 20 percent in most people. The energy expended sustaining life (i.e., resting metabolism), and energy expended in physical activity and movement primarily determine total energy expenditure. Thus, in addition to calorie consumption, age, gender, physical activity, diet, existing health conditions (e.g., diabetes or asthma), the relative amounts of FFM and FM, and total body weight also partially determine weight gain (Sherwood 2007; Gropper, Smith and Groff 2009; Phinney 2009). Individuals gain body weight when daily energy stores are positive for a sustained period of time:

$$ES > 0 \Leftrightarrow EI - EE_{RMR} > EE_{PA} + EE_{TEF} + EE_{AT} \qquad (2)$$

Using the RMR prediction formulas for men and women given by Equations (3) and (4), respectively, along with self-reported weight one year ago, we calculated EE_{RMR}^{t-1}. That is, we calculated the minimum energy requirements of individuals based on their self-reported weight one year prior to the medical examination, and current weight measurement (Gropper, Smith and Groff 2009).[8]

$$EE_{RMR}^{t-1} = 24.0 \cdot BW_{kg}^{t-1} \qquad (3)$$

$$EE_{RMR}^{t-1} = 21.6 \cdot BW_{kg}^{t-1} \qquad (4)$$

Using EE_{RMR}^{t-1} and current calorie consumption (the average of the two 24-hour diet recall measurements) we calculated the "calorie surplus" for each individual, i.e.,

[8] We also used several other RMR prediction equations including the Mifflin St. Jeor, Oxford, and WHO/FAO/UNU/Schofield prediction equations. The results were qualitatively the same and are available from the authors upon request (Frankenfield, Roth-Yousy and Compher 2005; Henry 2005; Gropper, Smith and Groff 2009). Frankenfield, Roth-Yousy, and Compher (2005) found that the Mifflin St. Jeor equation predicted RMR with less error than the Harris-Benedict, WHO/FAO/UNU/Schofield, or Owen RMR prediction equations. Henry (2005) found that the WHO/FAO/UNU/Schofield often over-estimates RMR, and presented the new Oxford RMR equations.

$$CS = EC^{t} - EE_{RMR}^{t-1} \quad (5)$$

The calorie surplus roughly measures the difference between energy consumption and basic energy requirements (i.e., the left-hand side of Equation (2)), and thus, significantly determines the change in energy stores over a period of time. Therefore, a change in body weight over a given period of time depends on the surplus of calories (*CS*), energy expended in physical activity (*A*), individual characteristics (*Z*), and possibly, participation in the FSP:

$$ES = f\left(CS, A, Z, FSP\right) \quad (6)$$

In this equation the variable *FSP* captures an effect of participation in the FSP on body weight that is not associated with physical activity, the surplus of calories (which itself may be affected by FSP), or individual characteristics (which are exogenous here). For instance, becoming unemployed may trigger FSP participation and also reduce the opportunity for weight lifting or other muscle building exercises. A loss of muscle mass will reduce basal metabolism and cause weight gain if energy intake and expenditure remain unchanged.

In our empirical application, in the vector, *Z*, we included individual characteristics that reflect genetic (e.g., race), physiological (e.g., number of births or a thyroid condition), and behavioral (e.g., smoking and television viewing time) determinants of body weight in addition to several measures of socio-economic status. Epidemiological, public health, psychological, and sociological research suggests that socio-economic status has a significant effect on health outcomes and posits several pathways by which socio-economic status affects health. Many of these individual characteristics have not been controlled for previously. Another contribution of our model is that it controls for both factors that determine whether an individual has an energy surplus or deficit (i.e., energy intake and energy expenditure), and that it does not hold either component constant when determining energy stores (i.e., body weight).

b. Models of Energy Consumption and Energy Expenditure in Physical Activity

Participation in the FSP could also affect obesity if, over the course of a participation spell, participants (i) consume more energy than they would require to maintain their weight at the start of their participation spell, and (ii) over-consume in this sense to a greater extent than if they had not participated. This is the pathway that most of the previous research on the effects of the FSP on obesity have attempted to investigate indirectly, by modeling obesity as a function of FSP participation.

$$EC = h\left(FSP, Z\right) \tag{7}$$

where the vector *Z* includes the relevant individual characteristics and other determinants of energy consumption.

The amount and quality of food eaten in a day is influenced by several internal and external signals. External cues that affect the intake of food in the short-term include how the meal looks (portion size and presentation), smells, tastes (palatability), and with whom and where one eats (Breifel et al. 1997; McCrory et al. 2000; Spiegelman and Flier 2001, p. 150; Rolls 2007; Wardle 2007). Dietary habits (e.g., set meal times), preferences, and beliefs also play an important role in initiating meals and, thus, total energy intake (Rolls 2007). Those who suffer from chronic stress (as opposed to acute stress) increase their energy intake, and more often this increase comes from dietary fats and sweets (Torres and Nowson 2007).

The internal cues that regulate the types and amount of food all act on the brain to signal hunger and trigger eating or, once eating has begun, to signal satiety and end eating. The volume, fat content, food variety, and energy density of a meal may all influence how quickly satiety registers in the brain, and therefore, energy intake (Jebb 2007; Rolls 2007; Wardle 2007).

Figure 3 illustrates the energy balance mechanism, and factors that influence the components of energy balance.

[Figure 3. Energy Balance Mechanism and Influences]

Human physiology and the energy balance equation imply that, if participation in the FSP contributes to obesity and weight gain, it must do so by increasing energy consumption, reducing energy expenditure, or both. Above and beyond basic energy requirements (i.e., RMR), total energy expenditure depends largely the duration, intensity, and frequency of physical activity (A). In theory, participation in the FSP could lower the amount of energy an individual expends in physical activity by reducing the amount of time available for exercise. That is,

$$A = g\left(FSP, Z\right) \qquad (8)$$

where the vector Z includes the relevant individual characteristics and other determinants of energy expenditure, and FSP measures either the length of the FSP participation spell or whether the individual participated in the past year.

The medical literature suggests that attaining and maintaining a healthy weight over an extended period of time requires engaging in moderate to vigorous physical activity for 30 to 90 minutes per day (Saris et al. 2003; Slentz et al. 2004). Nearly one in four adults in the U.S. do not engage in any leisure-time physical activity (Crespo et al. 1996). Strong evidence has shown that sex, age, income, education and race affect participation in physical activity and exercise (Trost et al. 2002). Examples of characteristics of the physical environment that create barriers to physical activity include unsafe neighborhoods, terrain, poor aesthetics, and lack of bike paths and walking paths (Humpel, Owen and Leslie 2002; Trost et al. 2002). Weather conditions (e.g., extreme heat or cold, precipitation, and humidity), season, and hours of daylight also affect whether adults engage in physical activity (Tucker and Gilliland 2007; Sumukadas et al. 2009).

c. FSP Participation Model

Following Moffitt (1983) and Meyerhoefer and Pylypchuk (2008), we model the decision to participate in the FSP as the result of a household utility maximization process. Household decision-makers maximize utility with respect to food (which can be transformed into energy consumption) (*EC*), non-food (*NF*), and their current weight status (*ES*) net of (i) the disutility of unhealthiness or obesity and (ii) the stigma of welfare receipt, given the total household money income (*Y*) and time constraints (*H*). *NF* consists of other purchased (non-food) goods unrelated to the production of a healthy weight.

The household decision-maker maximizes the net-utility function given by Equation (9), subject to the monetary budget constraint given by Equation (10), and the time constraint given by Equation (11).

$$\max_{F,NF,H} U\left(L, EC, NF, H\right) - C\left(ES - ES^{Good}\right) - P \cdot C^{P}\left(S, T; Z\right) \tag{9}$$

$$Y = EI + P \cdot FSB \tag{10}$$

$$H = W + L + A \tag{11}$$

W, *L*, and *A* measure the amount of time spent at work, leisure (e.g., sleeping, cooking meals, or watching television), and doing physical activity, respectively. In this framework $P = 1$ if the household participates, 0 if not; household and individual characteristics affect $C^{P}\left(S, T; Z\right)$, which describes the (fixed) disutility of the stigma (*S*) and transaction costs (*T*) associated with participating in the FSP; $C\left(ES - ES^{Good}\right)$ represents the disutility associated with feeling overweight (e.g., social stigma or feeling like an outcast). For simplicity, total income (*Y*) is comprised of earned income (*EI*) and the FSP benefit (*FSB*).[9] The vector *Z* includes personal characteristics that influence health and the disutility of participation.

Utility maximization results in functions describing household demand for food, non-food, labor, and physical activity,

$$EC^* = EC^*\left(p_F, p_{NF}, EI, P; Z\right) \tag{12}$$

$$Q^* = \left\{NF^*, L^*, A^*\right\} \tag{13}$$

Therefore, when the household maximizes utility it jointly determines body weight, physical activity, and food demand. The decision to participate in the FSP hinges on whether the utility of the household, when it participates, is greater than its utility when it does not participate. That is, if P^* (Equation (14)) signifies the net utility from participation,

$$\begin{aligned} P^* = {} & U\left(F^P, NF^P, ES^P, EI, FSB\right) - U\left(F^{NP}, NF^{NP}, ES^{NP}, EI\right) \\ & - C^P\left(S, T; Z\right) + C\left(ES^{NP}\right) - C\left(ES^P\right) \end{aligned} \tag{14}$$

then the household participates if $P^* > 0$ and does not participate otherwise. The superscript $j = P, NP$ indicates whether the household participates in the FSP.

From Equation (14), changes in earned income (*EI*), welfare stigma (*S*), transaction costs (*T*), information, and body image will influence the likelihood of participating in the FSP. That is, reducing *EI*, *S*, or *T* would increase the probability that the household participates. The existing literature suggests the transaction costs tend to be greater for single-parent families, seniors, those who do not speak English, residents of rural areas, those who work non-traditional hours, households with two full-time working adults, and those who do not participate in other

[9] Some evidence suggests that being obese carries a significant stigma and that this stigma has a lasting effect on education and earnings, especially for women (Gortmaker et al., 1993; Puhl and Brownell, 2001; Baum and Ford, 2004).

social welfare programs (Food and Nutrition Service 1999; Currie and Grogger 2001; Gabor et al. 2002; McKernan and Ratcliffe 2003; Yen 2010). Those with more education, smaller families, lower unemployment, and more uncertainty about the amount of FSP benefits they would receive experience a greater disutility of welfare or stigma cost (Moffitt 1983). For female-headed households, a FSP participation spell decreases in length with increases in the household head's current income and with decreases in her uncertainty about future income (Blank and Ruggles 1996). Lastly, the probability that a household will choose to participate increases with increases in its expected FSP benefit (Food and Nutrition Service 1999; Currie 2004). Applying for benefits, recertifying FSP eligibility, and possibly increased food preparation and cooking time constitute some of the time costs associated with participation in the FSP, but the same factors may also have an effect on body weight by changing consumption and meal preparation choices.

4. Empirical Work

We specified regression models based on this theoretical development to quantify the empirical links and test for the effects FSP participation on obesity. The model specification, data details, and estimation results are presented next.

(a) Model Specification

Equation (15) represents the physiological processes and energy balance relationship described in Equations (2) and (6), and relates the change in weight in the past year to an individual's calorie surplus and length of FSP participation (or an indicator for participation in the previous 12 months), while controlling for physical activity, determinants of the amount of energy expended in physical activity, and other variables that influence energy expenditure, such as age and sedentary behaviors like watching television.[10]

$$ES = \alpha_0 + \alpha_1 PA + \alpha_2 CS + \alpha_3 FSP + \alpha_4 Z + \varepsilon_{ES} \quad (15)$$

Equations (16) and (17) are empirical counterparts of the conceptual models of energy consumption and expenditure described by Equations (7) and (8). Equation (18) is an empirical counterpart of the theoretical model of the decision to participate in the FSP, from Equation (14).

$$EC = \delta_0 + \delta_1 BW^t + \delta_2 FSP + \delta_3 Z + \varepsilon_{EC} \quad (16)$$

$$EE = \beta_0 + \beta_1 BW^t + \beta_2 FSP + \beta_3 Z + \varepsilon_{EE} \quad (17)$$

$$FSP = \phi_0 + \phi_1 BW^t + \phi_2 EE + \phi_3 Z + \varepsilon_{FSP} \quad (18)$$

In all four empirical models the vector *Z* includes information on genetic variation (age and race), socio-economic status (marital status, income-to-poverty ratio, and educational attainment), health behaviors and conditions (smoking, alcohol, thyroid conditions, depression, serum C-reactive protein, television and computer viewing time, and the number of meals at restaurants), and employment characteristics (indicators for being employed, ever-worked, and working full-time). In Equation (18) the vector *Z* also includes an indicator for U.S. citizenship, the number of months at their current job, and homeownership status. In contrast to previous research, contemporaneous weight BW^t in our model is measured, not self reported.

(b) Data

In our main analysis we used data from the National Health and Nutrition Examination Survey (NHANES) 2003-2004. The National Center for Health Statistics (NCHS) and the Centers for Disease Control and Prevention (CDC) conduct NHANES. Starting in 1999

[10] Dietary recall data are notorious for underreporting in total energy intake, and some RMR prediction equations overstate energy requirements, implying that the calculated calorie surplus could be biased down (Breifel et al. 1997; Henry 2005).

NHANES became a continuous annual survey with publicly available data released in two-year increments. NHANES has a complex survey design and is intended to represent civilian non-institutionalized individuals of all ages living in the United States. NHANES contains details on household and individual characteristics, dietary recall information, lab test results, and physical exam measurements. Of the 12,761 individuals selected for NHANES 2003-2004, 10,122 completed interviews, and 9,643 underwent a physical exam in the mobile examination center (MEC).

We used the sampling weights, masked variance units, and strata provided in the publicly available NHANES 2003-2004 data, and performed all analysis in STATA-MP 10.0 for Windows. We restricted the data to non-pregnant women at least age 18 and no older than 70 with non-missing values for the variables used in our analysis and household income no more than 185 percent of the federal poverty threshold.

Table 1 includes summary statistics for the sample data. Figure 4 illustrates the difference in body weight for FSP participants relative to non-participants and ineligible women. Note that Figure 4 gives a "snapshot" of the difference in weight in 2003-2004. Women aged approximately 25 to 40 years who participated in the FSP over the past year had significantly higher body weight than both eligible women who did not participate and ineligible women. Consistent with the previous literature, participants were less educated, less likely to be married or employed, and had worked fewer hours in the previous week. Participants were also more likely to be black, watch more than three hours of television per day, have a thyroid condition, smoke cigarettes, and had more days they felt depressed in the previous month.

[Table 1. Summary Statistics]

[Figure 4. Weight and Age for Women by FSP Status]

(c) Results and Interpretation

Table 2 displays the results from estimation of the model described by Equation (15) for low-income women 25 to 40 years old. Column 1 illustrates the significant and positive association between FSP participation and weight often described and cited in the literature. As can be seen in columns 3 and 4, without controlling for any individual characteristics, a significant positive association also exists between FSP participation (and FSP spell length) and weight gain over the previous year. Our results suggest that women between the ages of 25 and 40 who participated in the FSP gained about 10 more pounds (or 1 more pound per month of their participation spell) in the past year compared with low-income women who did not participate. For women 18 to 70 years old the coefficient on FSP participation implies an additional one pound of weight gain for participants (results not shown). Columns 5-10 display the results of the model, adding progressively more individual characteristics. Note that the FSP participation effect loses significance as additional regressors are added to the model, but that the magnitude remains steady at about 1 pound per month of participation in the FSP. Interestingly, women who reported that they had never worked or that they watched more than three hours of television per day gained significantly more weight, while women who spent more than three hours per day on a computer, or needed more emotional support than they received in the previous year, gained significantly less compared with the default category. Figure 5 demonstrates the difference in weight gain between participants and non-participants.

[Table 2. OLS Regression of Weight on FSP Spell Length among Low-Income Women Aged 25-40]

Tables 3 and 4 contain the results from estimation of the models described by Equations (16) and (17). Our results imply that the length of the FSP spell does not significantly affect calorie surplus or physical activity of low-income women. The medical literature suggests that the magnitude of the coefficient on FSP implies a 0.5 to 2.5 pound increase in weight per year (Hall et al. 2009).[11] Similarly, we do not find conclusive evidence that participation in the FSP significantly decreases the likelihood that a woman engages in physical activity. However, the signs of the coefficients on FSP spell length and participation are consistent with weight gain: that is, FSP participation has a positive association with caloric intake and a negative association with the likelihood of engaging in physical activity.

[Table 3. OLS Regression of Calorie Surplus on FSP Spell Length among Low-Income Women Ages 25-40]

[Table 4. OLS Regression of Physical Activity on FSP Spell Length among Low-Income Women Ages 25-40]

We conducted several robustness checks of our results. Following Shapiro (2005) and using data from the NHANES 2007-2008 survey we also investigated whether the timing of the disbursement of FSP benefits had any effect on caloric intake, and found no effect.[12] In addition, the qualitative results were unchanged when we conducted the analysis without survey weights, or dropped observations with unrealistic values for calorie intake.

To better understand the positive association between weight gain and participation, we need to identify the factors that influence participation. Table 5 contains the results for the model described by Equation (18). Consistent with the previous literature, we found that more-educated women and women with greater job security (as measured by time in current job) were

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[11] The formula from Hall et al. (2009) used to estimate the expected weight gain from a change in energy intake is: $\Delta EI_{\text{kcal/day}} \approx 9{,}100_{\text{kcal/kg}}\left(\frac{\Delta BW}{365}\right) + 22_{\text{kcal/kg/day}}\Delta BW_{\text{kg}}$, which is equivalent to $\Delta BW_{\text{lbs}} = \left[\Delta EI_{\text{kcal/day}} / 103.466\right]$.

[12] These results are omitted for brevity, but are available from the authors upon request.

less likely to participate in the FSP. We also found that women who ate more meals at restaurants were significantly less likely to participate in the FSP, perhaps because they had strong preferences for food-away-from-home, which cannot be purchased with food stamps. Black women, women who smoked, and women who did not rent or own their place of residence had a higher probability of participation. However, the inclusion of additional determinants of FSP participation did not make the relationship between weight and participation insignificant.

[Table 5. Linear Probability Model of FSP Participation and Body Weight for Low-Income Women]

5. Conclusion

We found a positive relationship between FSP participation and weight gain for a subset of women. However, we do not interpret this result as evidence that FSP participation causes weight gain or obesity. We do not find convincing evidence that participation in the FSP significantly increases energy consumption or significantly decreases energy expenditure. Our findings suggest that a positive association between FSP and weight exists, but we find no evidence of a direct causal link from one to the other. The association between weight and FSP likely results from confounding factors that make individuals more likely to both gain weight and participate in the FSP. It is conceivable that other characteristics that vary geographically could affect whether households participate, along with their dietary patterns, physical activity levels, and social norms with respect to welfare participation and body image. Future research should investigate and control for geographic variation that may affect both program participation decisions and health outcomes.

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7. Tables and Figures

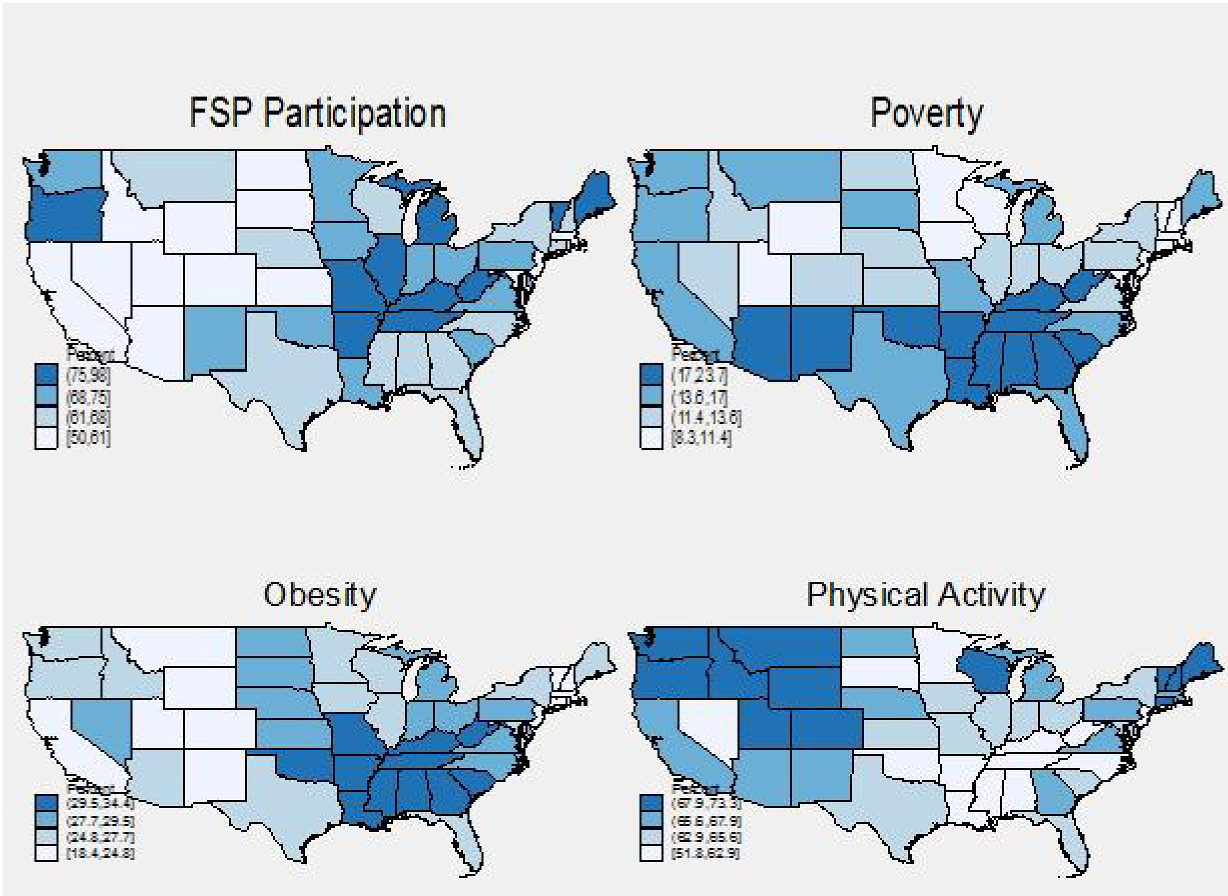

Figure #.#. Rates of Food Stamp Program and adult physical activity, poverty, and obesity by state.
Data source: USDA-ERS Food Environment Atlas.

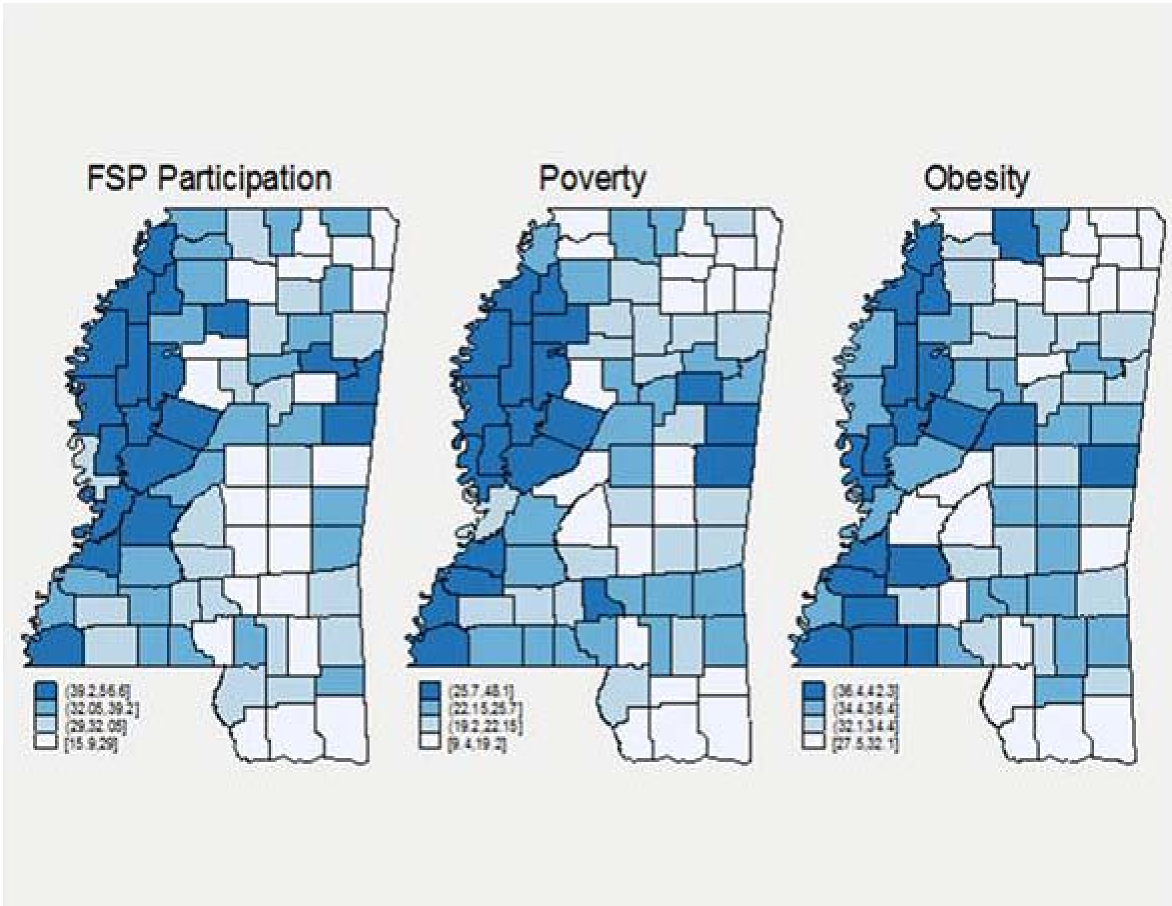

Figure 2. Rates of Food Stamp Program participation among households below 200% of poverty, poverty, and obesity in Mississippi by county.
Data source: USDA-ERS Food Environment Atlas.

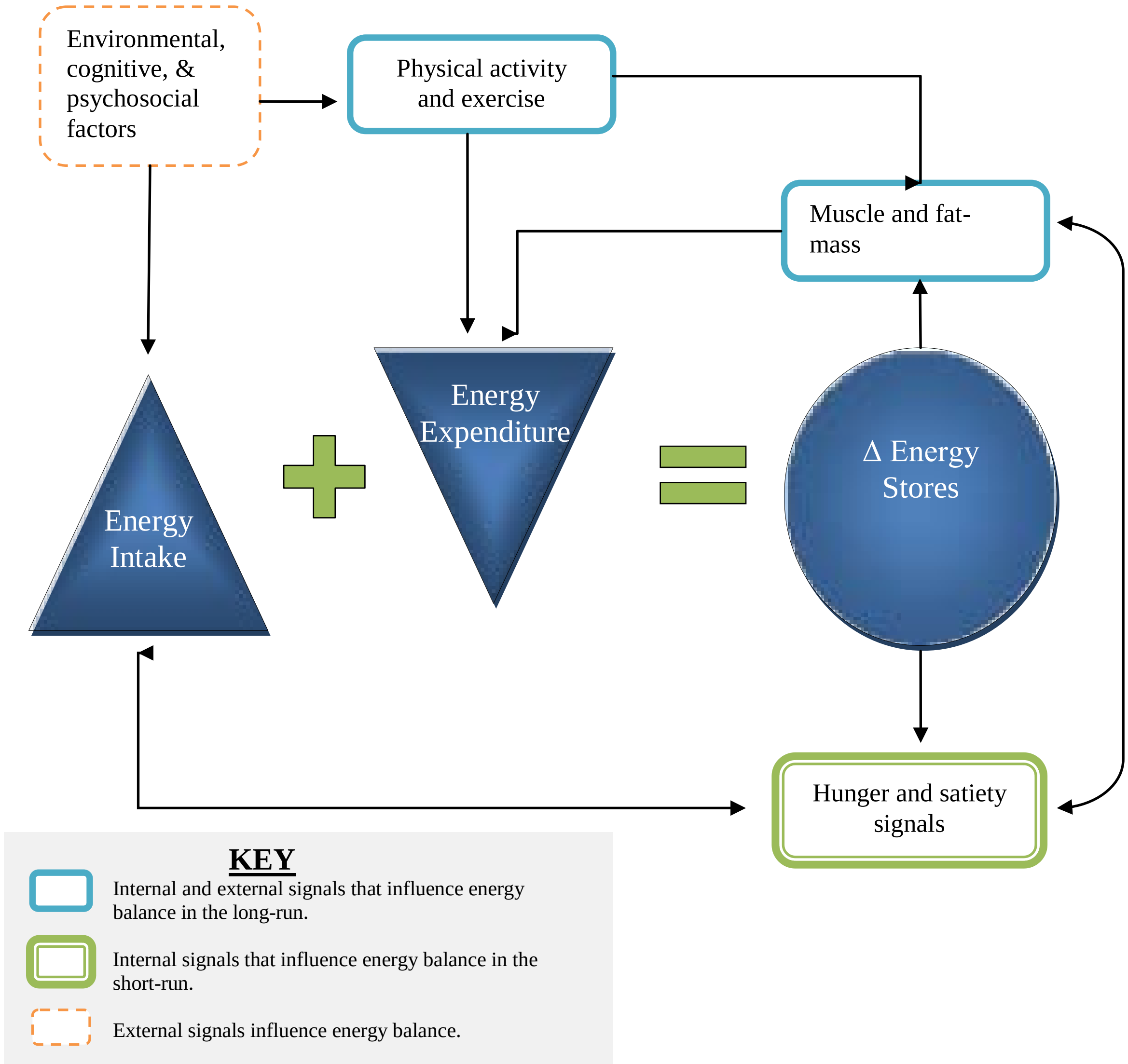

Figure 3. The Energy Balance Equation: Underlying Mechanisms and Influences
[Adapted from Schoeller (2009) and Sherwood (2007).

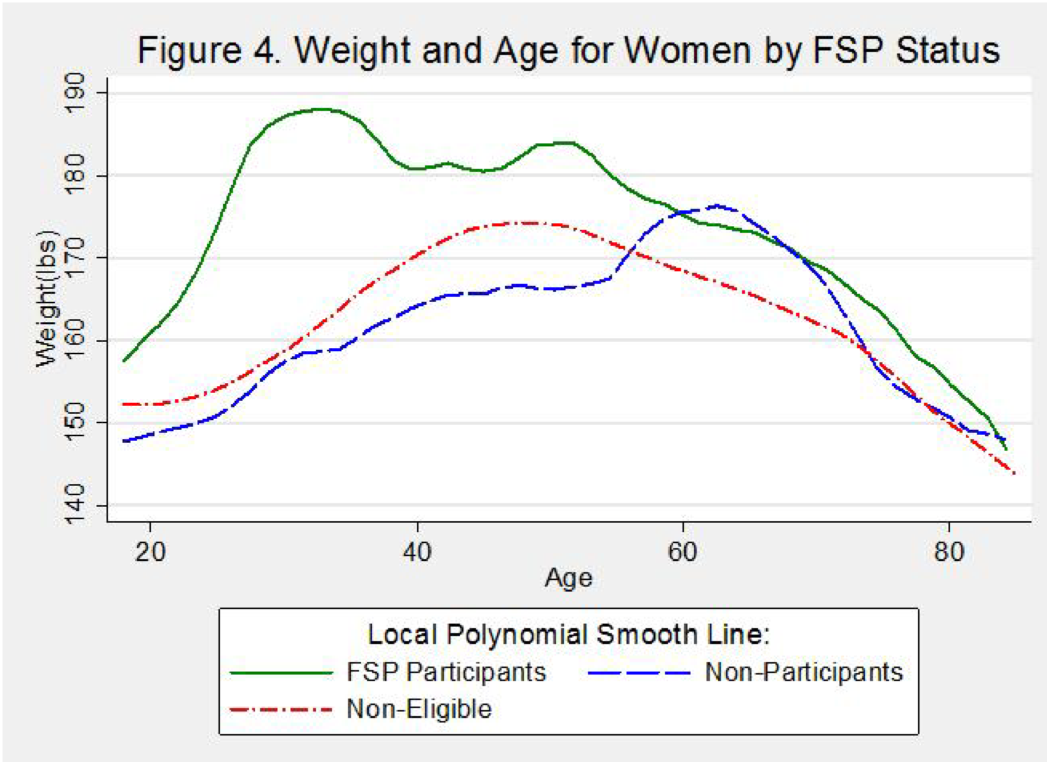
Figure 4. Weight and Age for Women by FSP Status
Weight(lbs)
140
150
160
170
180
190
20
40
60
80
Age
Local Polynomial Smooth Line:
FSP Participants
Non-Participants
Non-Eligible

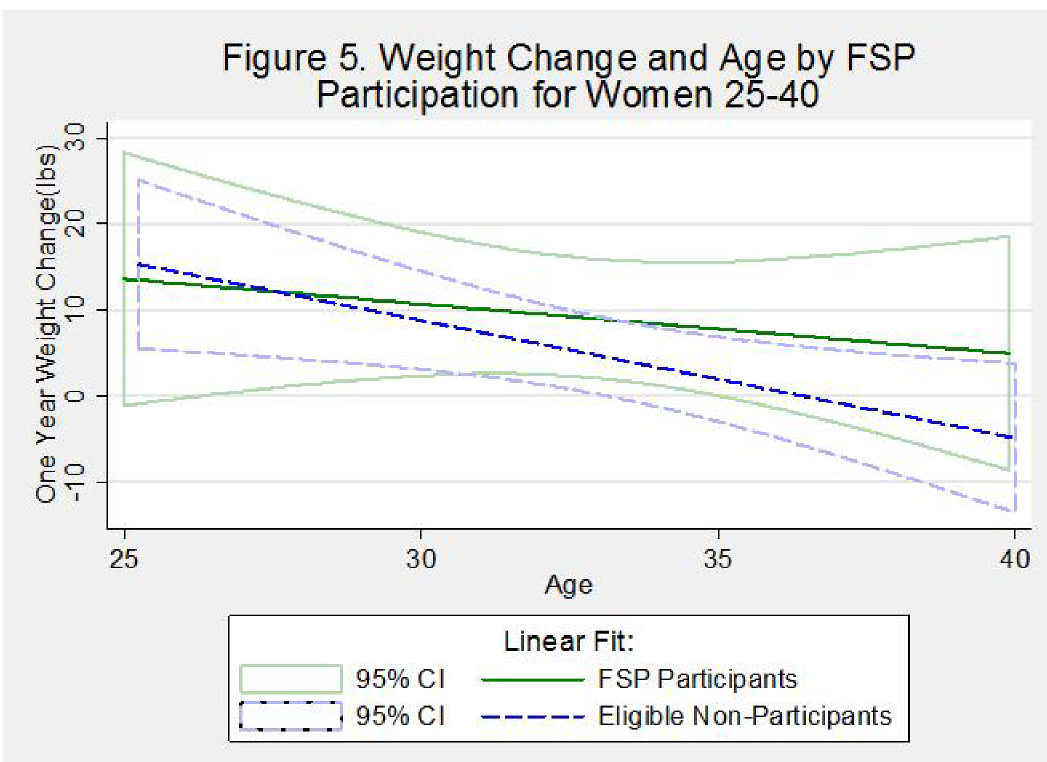
Figure 5. Weight Change and Age by FSP Participation for Women 25-40
One Year Weight Change(lbs)
-10
0
10
20
30
25
30
35
40
Age
Linear Fit:
95% CI
FSP Participants
95% CI
Eligible Non-Participants

Table 1. Selected Summary Statistics For Low-income Women in NHANES 2003-2004

	18-70 Year Olds		25-40 Year Olds	
	Non-Participants	Participants	Non-Participants	Participants
Weight change	3.957	7.071	4.759	13.333
	(19.066)	(27.541)	(17.836)	(25.453)
Calorie surplus	213.127	197.169	435.536	467.681
	(874.088)	(934.372)	(746.729)	(966.559)
Physical activity	0.163	0.187	0.250	0.211
	(0.021)	(0.029)	(0.051)	(0.054)
Age	45.793	39.517	33.034	32.428
	(15.314)	(14.618)	(4.080)	(4.176)
$[\text{Age - mean(Age)}]^2$	245.496	220.662	103.608	115.997
	(231.506)	(200.346)	(81.810)	(84.718)
Non-Hispanic black	0.235	0.456	0.194	0.561
	(0.024)	(0.037)	(0.047)	(0.066)
Mexican American	0.323	0.165	0.361	0.140
	(0.026)	(0.028)	(0.057)	(0.046)
Other race	0.069	0.044	0.083	0.018
	(0.014)	(0.015)	(0.033)	(0.017)
Income to Poverty Ratio	1.070	0.756	1.079	0.744
	(0.470)	(0.394)	(0.481)	(0.415)
HS Grad or more	0.608	0.538	0.694	0.596
	(0.027)	(0.037)	(0.054)	(0.065)
Married	0.542	0.346	0.736	0.316
	(0.028)	(0.035)	(0.052)	(0.062)

Table 1 (continued). Selected Summary Statistics For Low-income Women in NHANES 2003-2004

	18-70 Year Olds		25-40 Year Olds	
	Non-Participants	Participants	Non-Participants	Participants
Current smoker	0.229	0.374	0.222	0.421
	(0.024)	(0.036)	(0.049)	(0.065)
Alcoholic drinks per day	1.166	1.615	1.542	1.702
	(1.708)	(4.075)	(1.784)	(1.822)
# Restaurant meals/week	1.621	1.341	1.986	1.789
	(2.010)	(1.722)	(1.674)	(2.007)
> 3 hours TV/day	0.448	0.538	0.361	0.474
	(0.028)	(0.037)	(0.057)	(0.066)
> 3 hours computer/day	0.643	0.654	0.625	0.456
	(0.027)	(0.035)	(0.057)	(0.066)
Births	2.953	2.841	2.556	2.649
	(1.770)	(1.763)	(1.137)	(1.157)
Years since last birth	18.195	13.792	5.756	6.183
	(13.615)	(13.169)	(4.188)	(4.594)
Employed last week	0.476	0.335	0.639	0.509
	(0.028)	(0.035)	(0.057)	(0.066)
Hours worked last week	16.743	11.555	23.903	17.421
	(22.219)	(20.557)	(22.201)	(20.182)
Never Worked	0.072	0.049	0.069	0.000
	(0.014)	(0.016)	(0.030)	0.000
Needed more emotional support in past year	0.176	0.132	0.014	0.000
	(0.021)	(0.025)	(0.014)	0.000
C-Reactive Protein (biomarker for inflammation)	0.548	0.727	0.446	0.666
	(0.802)	(0.978)	(0.706)	(0.763)
Thyroid condition	0.085	0.082	0.028	0.070
	(0.016)	(0.020)	(0.019)	(0.034)
Days in the last month felt depressed	5.724	7.797	4.750	8.088
	(9.304)	(10.738)	(8.096)	(10.673)
Observations	319	182	72	57

Table 2. OLS Regression of Weight on FSP Spell Length among Low-Income Women Ages 25-40

	Weight (lbs)		Change in Weight in Past Year (lbs)							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
FSP Last Year (0/1)	31.21**		9.899*		8.854*		9.918		10.25	
	(8.744)		(4.376)		(4.097)		(5.393)		(5.585)	
FSP spell length		2.664**		1.066*		1.029		1.134		1.283
		(0.705)		(0.486)		(0.513)		(0.634)		(0.658)
Physical activity					1.070	1.313	-0.810	-0.159	-0.413	0.491
					(3.984)	(3.884)	(4.670)	(4.553)	(4.655)	(4.480)
Calorie surplus					-0.000382	-0.000901	0.000174	-0.000410	0.000826	3.52e-05
					(0.00329)	(0.00342)	(0.00281)	(0.00285)	(0.00256)	(0.00260)
Age					-1.861	-2.183	-1.856	-2.348	-3.107	-3.637
					(3.700)	(3.713)	(3.464)	(3.521)	(3.323)	(3.108)
$[\text{Age - mean(Age)}]^2$					-0.0288	-0.0393	-0.0121	-0.0278	-0.0572	-0.0730
					(0.116)	(0.115)	(0.113)	(0.114)	(0.114)	(0.105)
Non-Hispanic black					6.936	6.773	4.803	4.371	0.659	-0.407
					(4.259)	(4.309)	(4.081)	(4.174)	(4.602)	(4.512)
Mexican American					7.769*	8.655*	9.193*	10.71*	7.890	9.769*
					(3.621)	(3.473)	(3.826)	(3.737)	(4.360)	(4.446)
Other race					9.251	10.55	13.99	15.73	16.42	18.95
					(8.403)	(8.065)	(8.215)	(8.199)	(8.932)	(9.141)
Births					1.154	1.045	1.638	1.523	2.543	2.558
					(1.486)	(1.568)	(1.352)	(1.376)	(1.305)	(1.356)
Years since last birth					0.0838	0.0802	0.291	0.308	0.480	0.500
					(0.762)	(0.753)	(0.776)	(0.775)	(0.681)	(0.680)
Income to Poverty Ratio							-0.0119	0.301	-0.654	-0.211
							(3.436)	(3.115)	(3.261)	(3.062)
HS Grad or more							-0.229	-0.103	-0.282	0.0280
							(4.289)	(4.340)	(4.193)	(4.092)
Married							1.772	0.916	1.095	0.129
							(3.356)	(3.192)	(3.134)	(2.997)
Current smoker							-1.879	-1.540	-3.942	-3.634
							(5.227)	(4.992)	(5.178)	(4.840)

Table 2 (continued). OLS Regression of Weight on FSP Spell Length among Low-Income Women Ages 25-40

	Weight (lbs)		Change in Weight in Past Year (lbs)							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Alcoholic drinks per day							-1.223	-1.481	-1.033	-1.361
							(0.721)	(0.727)	(0.790)	(0.777)
# Restaurant meals/week							0.245	0.181	0.380	0.426
							(1.150)	(1.144)	(1.034)	(1.029)
> 3 hours TV/day							5.005	5.602	7.110*	8.097*
							(3.112)	(3.307)	(3.217)	(3.418)
> 3 hours computer/day							-13.19**	-13.34**	-13.73**	-14.02**
							(3.399)	(3.115)	(3.438)	(3.115)
Employed last week							-3.737	-2.384	-4.561	-3.303
							(4.420)	(4.491)	(4.255)	(4.280)
Hours worked last week							0.0861	0.0694	0.0976	0.0840
							(0.0722)	(0.0760)	(0.0607)	(0.0640)
Never Worked							21.08*	21.36*	17.88*	18.47*
							(7.369)	(7.968)	(7.167)	(7.989)
Needed more emotional support in past year									-33.91**	-36.56**
									(10.29)	(10.09)
C-Reactive Protein (biomarker for inflammation)									4.480	4.088
									(3.661)	(3.568)
Thyroid condition									8.180	8.048
									(4.545)	(4.979)
Days in the last month felt depressed									-0.362	-0.432
									(0.243)	(0.237)
Constant	155.3**	158.9**	3.324	3.694	64.63	78.12	63.47	83.57	113.9	134.9
	(4.754)	(4.763)	(2.267)	(2.009)	(150.2)	(150.7)	(143.0)	(145.3)	(140.7)	(131.4)
Observations	129	129	129	129	129	129	129	129	129	129
R-squared	0.120	0.089	0.055	0.065	0.116	0.129	0.234	0.248	0.304	0.325

Standard errors in parentheses, ** p<0.01, * p<0.05.

Table 3. OLS Regression of Calorie Consumption and FSP Participation Among Low-Income Women

	Average Daily Calorie Consumption						Daily Calorie Surplus					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
FSP Last Year (0/1)	257.8		157.5		147.5		49.01		197.8		200.2	
	(126.2)		(153.1)		(200.0)		(146.5)		(154.8)		(207.5)	
FSP spell length		34.08*		25.07		24.42		18.43		31.25		33.83
		(13.08)		(17.89)		(21.78)		(12.53)		(17.06)		(20.24)
Weight			0.477	0.335	2.096	2.007			-7.414**	-7.586**	-6.037**	-6.172**
			(1.853)	(1.827)	(1.797)	(1.677)			(1.674)	(1.634)	(1.613)	(1.486)
Age			108.0	97.23	70.46	56.59			94.02	80.64	43.72	24.20
			(180.1)	(184.0)	(126.6)	(131.2)			(178.2)	(182.1)	(126.8)	(127.9)
$[\text{Age - mean(Age)}]^2$			5.369	4.993	3.456	3.031			5.208	4.742	3.067	2.471
			(5.666)	(5.837)	(4.029)	(4.169)			(5.551)	(5.728)	(4.088)	(4.108)
Non-Hispanic black			277.6	254.7	219.9	182.3			298.3	270.0	192.3	139.2
			(210.6)	(215.2)	(179.6)	(207.6)			(194.8)	(195.4)	(178.1)	(198.4)
Mexican American			209.9	233.0	308.1	337.7			264.7	293.3	384.3*	425.8*
			(132.4)	(139.8)	(162.9)	(164.4)			(135.4)	(140.4)	(152.3)	(150.5)
Other race			-32.00	11.08	259.0	298.6			43.15	96.53	420.0	475.2
			(212.3)	(222.2)	(195.4)	(205.4)			(255.5)	(265.2)	(247.4)	(258.3)
Income to Poverty Ratio					53.57	76.07					35.20	67.45
					(150.0)	(156.0)					(152.5)	(158.2)
HS Grad or more					-22.89	-8.690					-49.45	-29.03
					(156.3)	(149.8)					(161.9)	(152.8)
Married					-210.8	-211.9					-212.5	-213.1
					(153.4)	(158.1)					(166.3)	(168.3)
Current smoker					79.20	69.98					66.96	53.36
					(205.8)	(201.1)					(197.8)	(190.6)
Alcoholic drinks per day					97.76	91.29					84.18	75.20
					(47.52)	(49.16)					(46.68)	(48.35)
# Restaurant meals/week					110.1*	111.8*					122.4**	124.9**
					(39.78)	(39.15)					(40.62)	(39.57)

Table 3 (continued). OLS Regression of Calorie Consumption and FSP Participation Among Low-Income Women

	Average Daily Calorie Consumption						Daily Calorie Surplus					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
> 3 hours TV/day					84.55	102.6					143.6	168.7
					(154.7)	(157.8)					(155.7)	(159.6)
> 3 hours computer/day					-0.279	-4.676					-134.0	-139.9
					(115.8)	(115.7)					(124.6)	(122.0)
Births					41.88	43.09					63.95	65.72
					(47.90)	(47.04)					(46.40)	(46.25)
Years since last birth					-44.54*	-42.09*					-43.70*	-40.20
					(17.21)	(17.67)					(19.73)	(20.23)
Employed last week					-154.5	-137.4					-151.9	-128.8
					(234.8)	(222.1)					(221.1)	(204.4)
Hours worked last week					1.446	1.299					1.841	1.648
					(6.720)	(6.444)					(6.327)	(6.036)
Never Worked					120.3	141.1					274.2	304.5
					(380.9)	(371.0)					(393.0)	(379.4)
Needed more emotional support in past year					-32.20	-60.61					-343.9	-383.0
					(302.1)	(301.0)					(365.2)	(359.3)
C-Reactive Protein (biomarker for inflammation)					-118.0*	-123.7*					-104.8	-112.7
					(47.35)	(51.75)					(50.65)	(52.93)
Thyroid condition					-143.0	-139.7					-73.42	-68.95
					(145.8)	(149.6)					(142.8)	(153.3)
Days in the last month felt depressed					-6.996	-8.615					-10.01	-12.29
					(6.726)	(7.063)					(6.474)	(6.482)
Constant	1,875**	1,863**	-3,154	-2,706	-1,759	-1,241	386.4**	342.9**	-2,941	-2,385	-1,009	-282.1
	(85.28)	(77.37)	(7,192)	(7,353)	(5,320)	(5,480)	(94.88)	(96.44)	(7,128)	(7,287)	(5,403)	(5,428)
Observations	129	129	129	129	129	129	129	129	129	129	129	129
R-squared	0.026	0.047	0.163	0.176	0.333	0.342	0.001	0.012	0.269	0.286	0.421	0.435

Standard errors in parentheses, ** $p<0.01$, * $p<0.05$.

Table 4. OLS Regression of Physical Activity and FSP Participation Among Low-Income Women Ages 25-40

	(1)	(2)	(3)	(4)	(5)	(6)
FSP Last Year (0/1)	-0.0638		-0.0903		-0.0720	
	(0.102)		(0.109)		(0.113)	
FSP spell length		-0.00522		-0.00915		-0.0119
		(0.00849)		(0.00948)		(0.00809)
Weight			0.000691	0.000645	0.000513	0.000557
			(0.00119)	(0.00117)	(0.00127)	(0.00123)
Age			0.103	0.106	0.0465	0.0533
			(0.127)	(0.129)	(0.106)	(0.107)
$[\text{Age - mean(Age)}]^2$			0.00335	0.00345	0.00190	0.00211
			(0.00396)	(0.00404)	(0.00328)	(0.00330)
Non-Hispanic black			-0.171	-0.171	-0.208*	-0.190*
			(0.101)	(0.0978)	(0.0892)	(0.0831)
Mexican American			-0.299*	-0.303*	-0.334**	-0.349**
			(0.103)	(0.104)	(0.0843)	(0.0829)
Other race			-0.321**	-0.330**	-0.361**	-0.380**
			(0.105)	(0.111)	(0.0633)	(0.0677)
Income to Poverty Ratio					0.0345	0.0235
					(0.0694)	(0.0649)
HS Grad or more					-0.144	-0.151
					(0.0969)	(0.0951)
Married					0.103	0.103
					(0.0901)	(0.0788)
Current smoker					-0.178	-0.174
					(0.101)	(0.100)
Alcoholic drinks per day					0.0610**	0.0642**
					(0.0190)	(0.0178)
# Restaurant meals/week					0.0204	0.0196
					(0.0224)	(0.0215)
> 3 hours TV/day					-0.0905	-0.0993
					(0.0931)	(0.0952)
> 3 hours computer/day					-0.156	-0.154
					(0.0766)	(0.0752)
Births					0.0390	0.0384
					(0.0367)	(0.0362)
Years since last birth					0.00452	0.00332
					(0.0111)	(0.0115)
Employed last week					-0.0694	-0.0778
					(0.145)	(0.141)
Hours worked last week					-0.000671	-0.000599
					(0.00396)	(0.00393)

Table 4 (continued). OLS Regression of Physical Activity and FSP Participation Among Low-Income Women Ages 25-40

	(1)	(2)	(3)	(4)	(5)	(6)
Never Worked					-0.318*	-0.328*
					(0.113)	(0.115)
Needed more emotional support in past year					0.834**	0.848**
					(0.217)	(0.215)
C-Reactive Protein (biomarker for inflammation)					0.00570	0.00848
					(0.0492)	(0.0498)
Thyroid condition					0.346	0.344
					(0.202)	(0.198)
Days in the last month felt depressed					0.00218	0.00297
					(0.00297)	(0.00314)
Constant	0.281**	0.273**	-3.931	-4.046	-1.706	-1.959
	(0.0814)	(0.0710)	(5.215)	(5.321)	(4.327)	(4.369)
Observations	129	129	129	129	129	129
R-squared	0.005	0.004	0.098	0.098	0.287	0.293

Standard errors in parentheses, ** $p<0.01$, * $p<0.05$.

Table 5. Linear Probability Model of FSP Participation Decision among Low-Income Women Ages 25-40

	(1)	(2)	(3)	(4)	(5)
Weight (lbs)	0.00385**	0.00297**	0.00613*	0.00700**	0.00776**
	(0.000953)	(0.000976)	(0.00224)	(0.00204)	(0.00179)
Weight 1 year ago			-0.00239	-0.00294	-0.00222
			(0.00197)	(0.00198)	(0.00208)
IPR*Weight			-0.00236	-0.00267	-0.00387*
			(0.00196)	(0.00191)	(0.00166)
Age		0.0320	0.0729	0.0887	0.0455
		(0.0622)	(0.0663)	(0.0644)	(0.0732)
$[\text{Age - mean(Age)}]^2$		0.00117	0.00216	0.00260	0.00112
		(0.00203)	(0.00207)	(0.00199)	(0.00226)
Non-Hispanic black		0.238*	0.186**	0.232**	0.254**
		(0.0918)	(0.0605)	(0.0632)	(0.0775)
Mexican American		-0.115	-0.0301	-0.0231	-0.0413
		(0.0859)	(0.124)	(0.125)	(0.104)
Other race		-0.222	-0.0471	-0.0751	-0.0683
		(0.150)	(0.128)	(0.127)	(0.147)
Income to Poverty Ratio			0.103	0.181	0.439
			(0.355)	(0.348)	(0.293)
HS Grad			-0.190*	-0.179*	-0.172*
			(0.0779)	(0.0670)	(0.0659)
Some college or more			-0.142	-0.119	-0.186**
			(0.0766)	(0.0811)	(0.0627)
Married/living as married			-0.215	-0.214	-0.126
			(0.117)	(0.113)	(0.113)
Divorced/widowed/separated			0.0881	0.0528	0.128
			(0.0831)	(0.0857)	(0.0881)
Full time work			0.243	0.261	0.284*
			(0.152)	(0.136)	(0.124)
Months at current job			-0.00222*	-0.00201*	-0.00142
			(0.000871)	(0.000882)	(0.000808)
Never worked			-0.406*	-0.374*	-0.358
			(0.164)	(0.170)	(0.172)
US Citizen			0.202*	0.199*	0.162
			(0.0927)	(0.0866)	(0.0802)
Current smoker			0.168*	0.165*	0.154*
			(0.0632)	(0.0628)	(0.0537)
Ex-Smoker			0.0117	-0.00649	0.0137
			(0.0878)	(0.0841)	(0.0668)
Alcoholic drinks per day			-0.0155	-0.0127	-0.0134
			(0.0159)	(0.0155)	(0.0125)

Table 5. Linear Probability Model of FSP Participation Decision among Low-Income (≤ 185% poverty) Women Ages 25-40

	(1)	(2)	(3)	(4)	(5)
# Restaurant meals/week			-0.0584*	-0.0646**	-0.0530*
			(0.0249)	(0.0195)	(0.0184)
> 3 hours TV/day			-0.0473	-0.0890	-0.119
			(0.0903)	(0.0803)	(0.0768)
> 3 hours computer/day			0.00535	0.0260	-0.0282
			(0.105)	(0.0925)	(0.0760)
Births			-0.00352	-0.0183	-0.0201
			(0.0281)	(0.0279)	(0.0286)
Needed more emotional support in past year			0.115	0.171	0.0735
			(0.223)	(0.226)	(0.203)
Days in the last month felt depressed				0.00942	0.00884
				(0.00565)	(0.00549)
Rent current home					0.118
					(0.0636)
Do not rent or own current home					0.818**
					(0.1000)
Constant	-0.239	-1.460	-2.730	-3.472	-2.072
	(0.185)	(2.630)	(2.813)	(2.764)	(2.950)
Observations	129	129	129	129	129
R-squared	0.120	0.199	0.519	0.544	0.589

Standard errors in parentheses, ** p<0.01, * p<0.05.