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The Effects of Female Labor Force Participation on Obesity

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Abstract

This paper assesses whether a causal relationship exists between recent increases in female labor force participation and the increased prevalence of obesity amongst women. The expansions of the Earned Income Tax Credit (EITC) in the 1980s and 1990s have been established by prior literature as having generated variation in female labor supply, particularly amongst single mothers. Here, we use this plausibly exogenous variation in female labor supply to identify the effect of labor force participation on obesity status. We use data from the National Health Interview Survey (NHIS) and replicate labor supply effects of the EITC expansions found in previous literature. This validates employing a difference-in-differences estimation strategy in the NHIS data, as has been done in several other data sets. Depending on the specification, we find that increased labor force participation can account for at most 19 percent of the observed change in obesity prevalence over our sample period. Our preferred specification, however, suggests that there is no causal link between increased female labor force participation and increased obesity.

JEL Classification: H31, I12, J22

Keywords: Female Labor Force Participation, Obesity, Earned Income Tax Credit

1 Introduction

Obesity is a critical issue in the United States and increasingly around the world.[1] According to the World Health Organization, since 1980 obesity has more than doubled worldwide, and in 2008 1.5 billion adults were overweight of which around a third were obese (WHO, 2011). Coincident with these obesity trends, a consensus has emerged regarding their negative health consequences as well as the associated individual and social costs.[2] Understanding the causes behind recent increases in obesity rates is fundamental for devising policies aimed at controlling and eventually lowering obesity rates.

It is universally accepted in the medical literature that people gain weight when calories consumed are greater than calories expended. Individual behaviors, environmental factors and genetics all contribute to the complexity of the obesity epidemic.[3] In this paper we explore labor supply, one particular channel through which individual choices can affect obesity. More precisely, we examine the relationship between increased labor force participation and weight gain among women. In the U.S., female labor force participation has been increasing for decades. Based on data from the Bureau of Labor Statistics (BLS), employment rates among all women age sixteen or older has increased from around 42% in the early 1970s to 54% in the early 1990s and 56% in the early 2000s. During the same period the overweight and obesity rates have also increased steadily. According to data from the National Center for Health Statistics (NCHS), the overweight rate among women increased from around 41% in 1970, to around 51% in the early 1990s, and 61% in the early 2000s, while the obesity rate increased in the same years from around 14% to 26% and 34% respectively.[4] The question we seek to answer in this paper is whether there is a causal relationship between the

[1] Obesity is defined as a Body Mass Index (BMI) ≥ 30. Overweight is a BMI ≥ 25. BMI is calculated as weight in kilograms divided by height in meters squared.

[2] Obese adults have a higher risk of developing chronic disease, such as diabetes, hypertension, heart disease and colon cancer; see CDC (2006) for more on this issue. For an overview of the numerous social and economic costs of obesity see Cawley (2011).

[3] See Binkley, Eales, and Jekanowski (2000), and Foreyt, and Poston (2002) for more on this topic.

[4] The employment figures are based on the authors' calculations from Current Population Survey (CPS) data available at the BLS website (http://www.bls.gov/cps/cpsaat2.pdf), while the obesity figures are based on the 2008 Health Report for the United States, see NCHS (2008).

observed upward trend in female labor force participation and the prevalence of overweight and obese.[5]

While there exists a relatively strong positive correlation between female labor force participation and obesity rates, the theoretical effect of labor force participation on obesity is ambiguous. In general, increased labor force participation should increase income, which in turn should increase expenditures on food since it is a normal good. However, Drewnowski and Specter (2004) report that "low quality" foods tend to be cheaper than "high quality" foods and thus an increase in one's food budget may actually reduce calories consumed as the basket of foods purchased shifts towards relatively more expensive but less calorically dense fruits, vegetables and lean meets (Darmon, Ferguson, and Briend 2002, 2003). Conversely, increased labor supply may increase the opportunity cost of time, giving people incentives to consume more convenience foods such as fast food, frozen food, or restaurant meals, which may worsen the quality of their diets and tend to result in a greater number of calories consumed per meal (Paeratakul et al., 2003). Increased labor supply could also affect the expenditure side of the net calorie equation if the caloric expenditure during hours of employment differs from caloric expenditure during hours of leisure. Depending on the nature and intensity of one's occupation, increased labor supply may result in an increase (decrease) in caloric expenditure and thus a decrease (increase) in one's weight, holding calories consumed constant (Lakdawalla, Philipson, and Bhattacharya 2005; Lakdawalla and Philipson 2007). Thus, the overall effect of increased labor force participation on obesity is, a priori, ambiguous.

In this paper we concentrate in estimating the *overall* or *net* effect of increased female labor force participation on obesity for single mothers. First, focusing on single mothers is useful because increased labor force participation has an unambiguously positive effect on

[5]Throughout this paper we refer to labor force participation as measured by employment. This approach ignores unemployed women, who normally would be included among the labor force participants. This approach has the advantage of being more robust, given that the nature of who is unemployed will change with the business cycle. For example, individuals are more likely to be discouraged and stop searching for jobs during recessions.

family income. The net effect on family income in a two earner household is more ambiguous, as the woman's labor force participation decision may be driven by the labor supply of her spouse. Second, since single mothers may face relatively tighter budget and time constraints, and are by definition the primary decision-maker in the household, there are fewer opportunities for intra-household dynamics to affect our estimates. Finally, and perhaps most importantly, focusing on single mothers allows us to exploit the "natural experiments" generated by the 1987 and 1994 expansions of the Earned Income Tax Credit (EITC). These policy changes provide a credible empirical strategy to study the causal effects of changes in labor force participation on obesity, because their effect on the labor supply of single women has been extensively documented in previous literature (discussed in detail below). As this effect on female labor supply is driven by policy decisions, it provides a source of plausibly exogenous variation in the employment of single women. Because the EITC expansions generated differential incentives for all women with children (1987) and even bigger incentives for women with two or more children (1994), we follow the EITC literature and base our empirical strategy on a difference-in-differences (diff-in-diff) approach, by which we compare either all women with children to women with no children, or alternatively we compare women with two or more children to women with only one child, before and after the EITC expansions. By making comparisons between similar groups across time, it is possible to control for the confounding factors that might be affecting the trends of both labor force participation and obesity. For example, some of the explanations advanced for the increasing prevalence of obesity are relative food price changes over time, technological change, availability of fast food restaurants, and other social factors. Unless our control group and treatments group are differentially exposed to these trends, conditional on all our explanatory variables, the use of the diff-in-diff strategy should eliminate any bias in our estimates.

Given that none of the previous EITC and labor supply literature has used data from the National Health Interview Survey (NHIS), we first verify that we obtain similar estimates of the labor supply response to the EITC expansions by the single women in our sample. Our resulting estimates are very similar to previous findings, and thus validates our identification strategy in this dataset. When we analyze the effects of increased labor force participation on being overweight or obese we find that, using single women with no children as the control group, labor force participation changes can account for at most 19% of the observed change in obesity prevalence for single mothers with children. However, we do not find any effect of labor supply on overweight or obesity when we compare single mothers with one child versus single mothers with two or more children. The latter is our preferred specification, since women without children and women with children may face very different constraints and other confounding factors that could affect both labor supply and weight.

The remainder of the paper is organized as follows: Section 2 provides a review of the literature on labor supply and obesity; Section 3 discuses the EITC expansion; Section 4 describes the data; Section 5 describes the empirical strategy; Section 6 presents the results; and Section 7 concludes.

2 Labor Supply and Obesity

Technological improvements such as time saving household appliances have changed how households allocate their time. Lakdawalla and Philipson (2009) develop the hypothesis that technological change has generated the observed weight gains in American society by making home- and market-production more sedentary and by lowering food prices through agricultural innovation.

Lakdawalla, Philipson, and Bhattacharya (2005) argue that over time jobs have changed from physically intensive manual labor that expends many calories to more sedentary activities, such as sitting and typing on a computer, that expend far fewer calories. Holding constant calories consumed this shift to more sedentary work would increase weight and thus obesity. This hypothesis is supported by Lakdawalla and Philipson (2007) who find that men who spend 18 years working in the most physically demanding occupation are 14 percent lighter than their peers who spend 18 years working in the least physically intensive occupation.

In addition to the effect of labor supply on caloric expenditure, there is the likelihood that increased labor supply, particularly by women, may alter caloric consumption. Cutler, Glaeser, and Shapiro (2003) suggest that the lower time cost of prepared foods can explain the decline in cooking times, home meals and the increased consumption of prepared food observed in the data. The authors find that as women devote more time to work they devote less to food preparation, increasing their reliance on convenience food and fast food that is higher in caloric content. Prochaska and Schrimper (1973) establish a high positive correlation between different measures of opportunity cost of the household manager and the expenditure and frequency of consumption of meals prepared away from home.[6] More recently, Jensen and Yen (1996) find that the effects of a wife's employment are significant and positive on both the consumption frequency and level of expenditures on lunch and dinner consumed away from home. Similarly, Mutlu and Gracia (2006) find that income and the opportunity cost of women's time have a positive effect on the consumption of food prepared away from home.

Within an aggregate framework, Gomis-Porqueras and Peralta-Alva (2008) study the implications of the decline in both the monetary and the (relative) time cost of prepared foods on adult calorie intake in the Unites States. The time channel operates through declines in income taxes and the gender wage gap. These changes increase female labor supply and the opportunity cost of cooking at home, thus decreasing the time spent preparing home cooked meals.[7] Similarly, Cutler, Glaeser and Shapiro (2003) document that increased consumption

[6]See Byrne, Capps, and Saha (1996), and Dong et al. (2000) for a more recent analysis.

[7]These findings are consistent with analyses where further disaggregation of household members, food types and origin have been considered. For instance, Nielsen, Siega-Riz and Popkin (2002) employing data from the Continuing Survey of Food Intake 1977-1978 and 1994-1996 find that people of different age groups have increased their consumption of meals from restaurants/fast-food establishments. Furthermore, they find that individuals in the 19 to 39 age range, the stage of the life-cycle when labor participation and opportunity cost considerations are most important, display the largest increase in consumption of meals in restaurant/fast-food places.

of snacks, which are mostly prepared away from home, are key in understanding recent calorie consumption trends.

Related to our study, Schmeiser (2009), using NLSY79 data, studies the effects of *family income*, not labor force participation, on obesity, by exploiting the variation in EITC benefits as an instrument for family income. He finds that increased family income can explain around 20% of the increase in obesity prevalence amongst women over the 1990s and early 2000s, but had no effect on obesity prevalence amongst men. Similar to Schmeiser (2009), we exploit changes over time in the generosity of EITC benefits, but rely on a different empirical strategy that uses alternative control groups to assess the effects of labor force participation on obesity rather than income.

3 The EITC

The Earned Income Tax Credit (EITC) can be received only by eligible taxpayers with labor earnings. Moreover, the generosity of the credit is tied to the number of eligible dependent children in the tax unit, thus making low-income families with children the primary recipients. The structure of the EITC is such that first there is a range in which the credit increases with earned income ("phase-in" region), then the region of maximum credit is attained ("plateau" region) and finally there is a"phase-out" region over which the credit decreases to zero when the income eligibility cut-off is attained. As benefit accrual or decline varies with labor earnings, the benefit structure changes the incentives to work for low income individuals by altering their marginal tax rate. In particular, an increase in the EITC for single parents (mostly women) provides an unambiguous incentive for those not in the labor force to increase labor force participation, as it simply increases their effective wage rate in the labor force.[8] Because our data only contains information on whether a person is

[8]For individuals that are already in the labor force, the effect of the EITC on labor supply depends of the region of the credit in which the individual falls: for those in the "phase-in" region, the incentive is to increase hours worked as the EITC increases the wage rate (the substitution effect dominates the income effect). For those in the plateau range, there is only an income effect from increased benefits, which should decrease

employed or not, we will only study the effects of the EITC on the labor force participation decision, not on hours worked.

The variation in EITC benefits we exploit in this study is fairly large. The maximum EITC benefit increased in real dollars from 1986 to 1987 by 50%, from 1990 to 1991 by 25%, from 1993 to 1994 by 63%, and from 1994 to 1995 by 20%.[9] More importantly, these changes affected differentially the incentives of taxpayers with different numbers of children. Starting in 1991 the EITC credit has been different for one-child taxpayers versus two-or-more-children taxpayers. The difference was very small up to 1994, when it increased 25% in favor of taxpayers with more than one child. Starting in the same year, childless taxpayers became eligible for a small credit with a maximum value of $400, in 2005 real dollars.[10]

The study of the effects of the EITC on labor supply has a long tradition in applied economics. These studies have tended to rely on variation in the program over time (Eissa and Liebman, 1996; and Meyer and Rosenbaum, 2001), on variation within the program across families (Dickert, Houser and Scholz, 1995; Eissa and Hoynes, 2004; Hotz, Mullin and Scholz, 2006), or on variation across families and states (Cancian and Levinson, 2006). Hotz and Scholz (2003) summarize the findings from this vast literature and draw as one of their broad conclusions that the EITC positively affects the labor force participation of single-parent households and that these effects are substantial.[11] This is why in this paper

hours worked; and for those in the "phase-out" region, both the substitution and income effects encourage them to *reduce* hours worked with an increase in benefits. It is unclear whether taxpayers understand the EITC rules and parameters well enough to "fine-tune" hours worked to maximize the tax credit (see Chetty and Saez, 2009).

[9] In 2005 real dollars, the maximum EITC benefit was $980 in 1986, $1,463 in 1987, $1,424 in 1990, $1,771 in 1991, $2,042 in 1993, $3,332 in 1994 and $3,986 in 1995. The total increase from 1986 to 1996 was 450% (see Hotz and Scholz, 2003, Table 3).

[10] The maximum credit in 1994, in 2005 real dollars, was $2,672 for one-child taxpayers, versus $3,315 for more-than-one-child taxpayers. The credit phased out at an income level of $34,305 and $33,335 for each of the two groups respectively. In addition to the Federal EITC program, several states have "state-EITC" programs with benefits that are additional to the Federal EITC. In the period analyzed the number of states with an EITC program increased from one in 1984 to sixteen in 2004. Thus, for the vast majority of the states only the federal program is relevant.

[11] An exception to this conclusion is the article by Cancian and Levinson (2006), which compared a state (Wisconsin) that provides higher EITC benefits to families with three or more children than families with two children, with other states that provide the same supplemental EITC benefit to families with two or more children. Using a diff-in-diff analysis they did not find an effect of the EITC on the labor force participation of families with three or more children. All prior studies, summarized in Hotz and Scholz (2003), and the

we concentrate our analysis on single women with children, the group for which we expect to find labor force participation effects of the EITC expansions.

4 Data

We use the National Health Interview Survey (NHIS), a nationally representative annual sample of households in the United States.[12] The repeated-cross-section nature of the NHIS has the advantage of reflecting more accurately trends that affect the overall U.S. population and permits relatively narrow subgroup comparisons. The NHIS contains information on family structure, labor force participation, self-reported height and self-reported weight of the surveyed adults. We use annual waves from 1982 to 2004, which implied having to harmonize variable definitions across different sampling designs. We provide details on the data construction in the Appendix.

The NHIS has *self-reported* height and weight data, which is known to be less reliable than direct measures of these variables. The vast majority of studies on obesity rely on the person's body mass index (BMI), or on measures derived from the BMI based on self-reported weight and height given their widespread availability in social science data sets. Based on BMI, adults are considered overweight if their BMI is greater than or equal to 25, and obese if it is greater than or equal to 30. However, as shown by Burkhauser and Cawley (2008), individuals systematically mis-report their weight and height.[13] They propose a method to adjust BMI to correct for these systematic differences derived from the relationship between self-reported and measured weight and height in the National Health and Nutrition Examination Survey (NHANES) III. Following much of the social science literature on obesity, we adjust the self-reported weight and height information in our data using the Burkhauser and Cawley

study by Hotz, Mullin and Scholz (2006) do find a positive effect of the EITC on single mothers' labor force participation.

[12] We use a restricted-use version of the NHIS data, which contains county-level identifiers not present in the public-use version. This data was processed on-site at the Research Data Center (RDC) of the National Center for Health Statistics (NCHS) in Hyattsville, MD.

[13] For example, women under-report their true weight and men over-report their true height. The magnitude of the self-report bias also varies by race.

(2008) parameters to yield an adjusted BMI value.We further calculate overweight and obese status from the adjusted BMI. One of the constraints imposed by using this adjusted BMI is that the adjustment is available only for three racial groups: whites, blacks and Hispanics. Thus, only those three groups are included in our analyses. Virtually all the results we present in the paper, are unchanged if instead of using adjusted BMI we use the unadjusted BMI. The results based on the unadjusted BMI are available upon request. Moreover, given that functions of height and weight are *dependent variables* in our analyses, the econometric implications of any measurement error are not too problematic.[14]

We concentrate our analysis on single women 20 to 64 years old, the group most likely to be eligible for EITC benefits. Being "single" here is not determined by marital status, but by the absence of a live-in partner or spouse. We divide individuals into two educational categories: high school degree or less and some college (which includes any attendance to a two-year of four-year college). This classification guarantees the consistency of the education categories reported in the NHIS from 1982 to 2004. We apply further sample selection rules as specified in the Appendix.

Table 1 provides the summary statistics of the 111,301 women included in our sample, both overall and by education group. The average labor force participation of our sample is 81%, the percentage of overweight (BMI≥25) women is 47% while 21% of them are obese (BMI $\geq$ 30) and the average age is almost 40. The majority of the women are white (70%) and have at least a high school degree (85%). When comparing the two subsamples by education group, it is clear that the women with a high school degree or less are more likely to be non-whites, have more children, have higher BMI on average, have higher overweight and obesity rates, and have a lower average labor force participation rate.

[14]In a linear regression model, if the dependent variable is subject to a measurement error which is uncorrelated with the covariates in the model, it is well known that the estimators will be consistent, although their standard errors will increase (Wooldridge, 2001, p. 71). In this case, we do not have any reason to believe that any errors that may arise from self-reporting of height and weight are correlated with the covariates. In particular, we are not aware of any evidence for the NHIS that there are systematic differences in self-reporting error across time or by individuals in households with different numbers of children, our covariates of primary interest.

5 Empirical Strategy

Our empirical strategy is based on comparing the trends over time in our outcomes of interest (employment, obesity measures) for two groups that can be interpreted as "treatment" and "control", in the sense that we expect one of the groups to be more affected by changes in the EITC. The expansion of the EITC generates a "natural experiment", because it creates a treatment group (e.g. families with two or more children) and a control group (e.g. families with one child). We assume that there are no unobserved factors that differentially affect the labor supply or obesity of single women with different number of children over our sample period, within our geographic unit of analysis (counties). Provided this assumption holds, these groups can be compared before and after the EITC expansion to quantify the causal effects on our outcomes of interest.

In this paper we follow two strategies. First, as in Meyer and Rosenbaum (2001), we compare single women with children versus single women without children, before and after the 1987 EITC expansion. Second, we follow Meyer and Rosenbaum (2001) and Hotz, Mullin and Scholz (2006), and compare single mothers with one child, versus single mothers with two or more children, before and after the 1994 EITC expansion (which benefited mostly mothers with two or more children). We perform this additional analysis because the groups are (potentially) more heterogeneous when comparing women with children to those with no children, and therefore are (potentially) more likely to be affected differentially by any unobserved factors. The heterogeneity across households might be especially relevant when it comes to the allocation of time in home production. This potential problem with unobserved factors is reduced when comparing single mothers of one child versus mothers of two or more children.

An important advantage of our approach is that by comparing women with different numbers of children at the same point in time (and within a county), we are able to hold constant confounding factors (like price changes and technological changes) that have been proposed as explanations for the increase in obesity. In that sense, unless these factors differentially affect families with different numbers of children, our strategy presents a clean way of understanding the effects of female labor force participation on obesity.[15]

Both empirical strategies considered in this paper (women with no children *versus* women with children and women with one child *versus* women with two or more children) generate a series of difference-in-differences regressions of the form:

$$Y_{ict} = \beta_0 + \beta_1 X_{ict} + \beta_2 S_{ct} + \beta_3 D_n + \sum_t \gamma_t D_t + \sum_\tau \delta_\tau (D_\tau * D_n) + \eta_c + u_{ict}, \qquad (1)$$

where i refers to an individual, c denotes the county, and t represents the year. The variable Y_{ict} is alternately an indicator variable for whether the woman is employed, the $log(BMI)$, an indicator for whether the woman is overweight, or an indicator for whether the woman is obese. The vector X_{ict} includes individual covariates, and the vector S_{ct} includes county and state-level characteristics. D_n denotes an indicator for whether the woman i has two-or-more children (for the specifications where the comparison group are one-child women), or an indicator for whether the woman i has any children (for the cases where the comparison group are women with no children). D_t represent indicator variables for the year in which observation i is observed and D_τ represent indicator variables for the year being part of period τ.

Of primary interest in our analysis are the δ_τ coefficients associated with the interaction between the D_n dummy and the D_τ period dummies. These coefficients are the diff-in-diff estimates and identify the relative difference in the average of the dependent variable between the two groups identified by the variable D_n following an EITC expansion. We consider two periods: the period 1987 to 1993, and the period 1994 to 2004. If there are positive effects of the EITC expansions on labor force participation and obesity, the δ_τ coefficients should be positive and statistically significant for all the dependent variables in the years after the corresponding EITC expansion, but not before it. The intuition behind the expected

[15] Technological changes in home food production have the potential of affecting differentially families of different size. However, we believe that these (potential) effects would have minimal impact on our estimates.

positive signs is that the EITC differentially increases the labor force participation of the women in the "treatment" group, which translate into increases in their BMI, probability of being overweight and probability of being obese.

To control for sources of unobserved heterogeneity that are fixed over time at the county level, we estimate the regressions with county fixed effects, represented by η_c. In our preferred specification we estimate models in which we include county-year fixed effects. In those cases we control for any unobserved heterogeneity that affects all individuals *within* a county at the same time.

Our empirical strategy can be interpreted as capturing the *overall* effects of labor force participation, including both the income effect on caloric intake, and the effect of labor force participation on caloric expenditure.[16] As previously discussed, an increase in income resulting from increased labor supply should increase all food consumption, if food is a normal good. Given that consuming foods prepared at home requires time, increases in wages caused by the EITC (and thus on the opportunity cost of time) may also have a substitution effect on the type of food individuals consume. In particular, individuals will tend to consume more foods away from home which have more calories than home-made meals prepared from scratch. Thus, there would be an increase in total calorie consumption if there is no change in the composition of food consumed by single mothers. On the other hand, as income increases there can also be an increase in the quality of the food consumed, which could potentially decrease total calorie consumption. For instance, substituting high calorie cheap foods for low calorie expensive foods like fruits and vegetables. If the substitution towards "quality" foods as income increases is sufficient, the total income effect on calories consumed

[16]An alternative to our diff-in-diff strategy, would have been to consider an instrumental variables (IV) approach, where employment appears explicitly as a covariate in the equations for obesity, and it is instrumented with the EITC expansions. However, for this strategy to be valid it is necessary that the exclusion restriction that the EITC expansions affect obesity only through labor force participation holds. As we cannot control for hours worked in our data, we are not confident that this assumption would be necessarily valid in our case. Schmeiser (2009) in his study of the effects of family income on obesity for men and women, uses NLSY79 data and exploits differences over time and by state in EITC benefits, as an instrument for income, not labor force participation. In his specifications he is able to control for hours worked. Because he keeps families with children and no children in his sample, the variation he exploits is similar to that in our diff-in-diff strategy when we compare single women with children with single women with no children.

can be indeterminate or even negative. Finally, increased labor force participation may have important effects for calorie expenditure. As more time is devoted to work, less time is available for leisure activities, in particular exercise, potentially reducing the amount of calories expended. However, if the strenuousness of one's employment is greater than the strenuousness of one's leisure activities then increased labor supply may increased calories expended and thus decrease weight. In summary, our empirical strategy captures the effects of changes in labor supply on obesity taking into account the net effect of calorie consumption and expenditure.

6 Results

Our analysis is based on the estimation of the diff-in-diff specifications given by equation (1), using two comparisons: (i) women with one or more children relative to women with no children, and (ii) women with two or more children relative to women with one child. Before we present the regression results, however, it is useful to analyze the unconditional means, to make clear the changes in our outcomes that we are attempting to explain. Thus, in Table 2 we present average employment rates and obesity measures by education level, family size, and time period. Panel A shows the comparison between women with children and women with no children, while Panel B shows the comparison between women with two or more children and women with one child. At the top of each panel we present the results for women with a high school education or less, and at the bottom those for women with some college education. Given that the first expansion of the EITC occurred in 1987 (equally benefiting eligible taxpayers with any number of children), and the second expansion occurred in 1994 (more greatly benefiting taxpayers with two or more children), we divide the analysis into the periods 1982 to 1986, 1987 to 1993, and 1994 to 2004. We present, for each panel, the average values of the variables of interest for the two comparison groups in columns (1)-(2), (4)-(5), and (7)-(8), for the three periods respectively, while columns (3), (6), and (9) present the differences between those averages for the two family size groups. Columns (10) and (11), finally, present the diff-in-diff in the averages, using 1982 to 1986 as the base period.

It is clear from Panel A of Table 2 that employment increases significantly for women with children (for all education levels) between 1982/86 and 1994/04 (more than 12 percentage points, from a base of around 60%, for the lower education group, and more than 7 percentage points, from a base of around 80% for the higher education group). At the same time, the employment level of women with no children remained fairly constant. The diff-in-diff in average employment between the beginning and final periods in column (11) confirms the significance of this difference in employment rates. Even after subtracting the changes in average employment rates for the "control" group (i.e. women with no children), there is a 9 percentage points increase in employment for the low education group and 7 percentage points for the higher education group. This implies that the EITC expansions (if properly captured by the diff-in-diff estimation) explains a very large percentage of the overall increase in employment levels of the women with children (9 points out of 12 for low education women, and 7.1 points out of 7.3 for high education women). The proportion of employment changes explained in Panel B, comparing women with one child to women with two or more children, is smaller (around 3 percentage points out of a change of 14 percentage points for low education women, and of 9 percentage points for higher education women), but still the differences in means appear statistically significant.

For the obesity measures, the results in Table 2 present a different story. For example, for low education women in Panel A, average BMI increases from 25.12 to 27.49 (this 2.37 points increase is equivalent to an increase of around 14 pounds, out of an initial weight of around 149 pounds, for a woman with a height of 5 feet 4.5 inches, the average in the sample). Because BMI increases for both groups of women, the differences in averages in column (11) is only 0.161, which implies that at most 1 pound of the 14 pound change can be explained by EITC expansions. A similar pattern emerges for the higher education group, and the comparison in Panel B, although there the diff-in-diff effect is negative (and still relatively small compared to the overall change in BMI). For the percentage of women that are overweight and that are obese, the results are similar, with large increases in both measures, of which a small proportion could be explained by the diff-in-diff comparison of unconditional means.

In the next subsection we perform a similar analysis in a regression framework. Interestingly enough, even though we include a variety of controls and fixed effects, the basic conclusions from Table 2 are not fundamentally changed with the regression analysis.

6.1 Labor Force Participation

In order to validate our identification strategy and the use of the EITC expansions with the NHIS data, it is crucial that we are able to reproduce prior results in the EITC literature on the effects of the EITC expansions on labor force participation by single women.

Table 3 presents the regression results for employment, by education groups. Columns (1) through (4) present four different models. Model (1) represents a regression with just the dummy for family size, year fixed effects and the interaction terms of the family size dummy with the two periods of interest (1987-1993 and 1994-2004). Model (2) adds county fixed effects to Model (1), while Model (3) adds individual level controls and county/state level controls to Model (2).[17] Finally, in Model (4) we exploit the fact that we have multiple individuals within a county for each survey year and estimate models with county times year fixed effects. For these models the variation we exploit is the difference between the two family sizes within a given county and year. Of course for Model (4) county/state controls, which are constant within such cells, are not included. We consider Model (4) to be the preferred specification because it controls for any county times year level unobserved

[17]The individual level controls are age, age squared, a dummy for foreign born (only available for 1987 and after), race/ethnicity dummies for White and Hispanic (Black is the omitted category), a dummy for being married, and variables indicating the number of children in the family of ages <1, 1, 2, 3, 4, 5 and 6 to 18 years old. The county/state controls are county-level unemployment rate, employment to population ratio, and real average earnings per job, state-level average AFDC/TANF and food stamps benefits paid per person in the state, state minimum wage, real cigarette prices, and groceries and fast food price indexes.

heterogeneity. In every table we include the p-value of the Wald test of the hypothesis that both interaction coefficients of interest are jointly zero. The column numbers identifying different models remain constant across all the tables that follow.[18]

Regardless of the particular specification, all the coefficients of interest are positive and most are statistically significant in panel A. The results in panel A show that for the High School or Less education group in the period 1994-2004, after the 1994 expansion of the EITC, employment rates of single women with children increased between 9 and 10 percentage points with respect to that of single women with no children, regardless of the model used. The effects for the Some College group are smaller, in the order of 4 percentage points for Model (4). In both cases the EITC expansion after 1994 explains a large proportion of the change in employment since 1982-1986 by the women with children, around 83% for the lower education group and around 58% for the higher education group. In addition, for both education groups, the 1987 EITC expansion appears to modestly increase employment (around 2 percentage points). Since the 1987 expansion benefited all taxpayers with children equally, these results are as expected.

The results in panel B, where the comparison is done between women with one child and women with two or more children, are still positive for the 1994-2004 period, but smaller than in Panel A. For Model (4), the employment effect is 3.9 percentage points for the lower education group, and 3.3 percentage points for the higher education group; although only statistically significant at the 10% level. For the period 1987-1993 the employment effects appear as essentially zero in Panel B for all models in both education groups. This finding is consistent with the fact that EITC benefits only started to differ by number of eligible children with the 1994 expansion. Thus, we should not expect any differences in behavior for the two groups of mothers with children prior to 1994.

The results in Table 3 are mostly in line with prior results in the EITC literature, as

[18] We also run similar regressions to those in Table 3 by race/ethnicity groups. The results are similar to those presented in Table 3, although for some groups the coefficients are more variable, and less precisely estimated, in particular for the comparison between women with one child versus women with more than one child, where cells can become relatively small. These additional results are available upon request.

surveyed by Hotz and Scholz (2003). It is very difficult to compare exactly with the prior literature given that our sample is for a different time period and based on a different dataset. Nevertheless, we obtain the expected sign, and the size of the coefficients is consistent with prior estimates in the literature.[19] The results in panel A after 1994 clearly pick up the EITC expansion that differentially benefited families with a higher number of eligible children. As we argue below, it is reasonable to question whether the "no children" group is the best choice as a control group in those regressions. We, nevertheless, report both sets of specifications, but limit our emphasis on the results from regressions like those in panel A.

6.2 Obesity

Having established that with the NHIS data we find similar employment effects to those found in previous EITC literature, which we consider a validation of our identification strategy, we turn to analyzing the effects of the the EITC expansions (and increased force participation) on obesity measures. Table 4 presents results from regressions like Model (1), i.e. with no covariates other than year fixed effects, and Model (4), our preferred specification. We present results for three different measures of obesity: log(BMI), an indicator for overweight (BMI≥25) and an indicator for obese (BMI≥30).

Panel A of Table 4 presents the results for the comparison between women with children and women with no children. For log(BMI) the coefficients from Model (4) imply an increase around 1% for the low education group for both periods of interest, and close to 2% for the post 1994 period for the higher education women. These coefficients imply that the EITC expansions can explain only between 13% and 15% of the overall change in BMI observed for each education group. We find similar results when using the overweight and obese indicators as our outcomes. The change in the proportion of overweight women is around 3 percentage

[19] For example, Hotz and Scholz (2003) report that Eissa and Liebman (1996) using repeated cross sections of the Current Population Survey before and after the 1987 expansion find a 2.8 percentage point increase in labor force participation when making a comparison like that in panel A, from a base of 74.2 percent. And Hotz, Mullin and Scholz (2006) when making comparisons like those in panel B find effects in the order of 3 percentage points from an employment base of around 40 percent.

points for both EITC expansions for the lower education group, explaining around 15% of the overall change in overweight in the whole analysis period. For the higher education group, only the coefficient associated with the 1994-2004 period is statistically significant, with a change of 3.8 percentage points, or around 17% of the overall change in overweight. We find slightly higher results for the obesity rate, where the expansion of the EITC can explain around 19% of the total increase in obesity rates for either education group.[20]

Panel B of Table 4 presents the results for the comparison between women with one child and women with two or more children. Here, almost none of the coefficients are statistically significant (and all are negative), regardless of the adiposity measure used or education group. We believe that this diff-in-diff specification, where we compare women with different numbers of children is a more robust strategy than the diff-in-diff specification that compares women with children versus women with no children. The "control" group is (potentially) more heterogeneous in the latter specification and therefore (potentially) more likely to be differentially affected by unobserved factors. In contrast, a "control" group composed of women with only one child is less likely to be affected by unobserved heterogeneity. For example, single women with different numbers of children are probably more comparable in terms of time constraints and the characteristics of home production, including time devoted to child rearing, cooking, groceries shopping, etc. For this reason, we believe this comparison should be the preferred specification, which implies that no causal relationship exists between changes in labor force participation of single women and changes in their obesity levels.

6.3 Placebo test

To further validate our identification strategy we conduct a "placebo test" in which we use an outcome variable that should have not been affected by the EITC expansions, but is related to obesity. A good candidate is the height of individuals.[21] This variable enters in

[20]To capture potential nonlinearities we also explored the effects on several other BMI cutoffs, both lower and higher than 25 and 30, the overweight and obesity cutoffs. Results are very similar to those presented in Table 4. These additional results are available upon request.

[21]We thank Kristin Butcher for suggesting this test.

the denominator of the formula for BMI, and thus is related to obesity, but we would not expect it to be affected by any policy variable. That is, we expect the effects of the EITC expansions to be zero for this variable. Unfortunately in the NHIS data, starting in the year 1997, this variable is truncated for women. In order to have comparable results for the whole 1982-2004 period we applied the same truncation to the pre-1997 NHIS data. We believe this truncation should not fundamentally affect our results.[22]

We present in Table 5 the results from conducting the placebo test. We use as dependent variable $log(height)$, to facilitate the interpretation of the results. As before, we concentrate our analysis on Model (4). Panel A presents the regressions comparing women with children to women with no children, and Panel B those comparing women with two or more children to women with one child. As we can see in Panel A, there is only one coefficient which is statistically significant, in the lower education group, for the period 1994-2004. The coefficient is very small, just 0.2% increase in height, or close to 0.15 inches. This makes it very unlikely that it can explain any of our prior BMI results. This height effect could bias downward the obesity measures, but by a very small amount. For example, at the average weight and height, an increase in 0.15 inches reduces the BMI by 0.12, or 0.5%. For Table B we do not observe any statistically significant difference in height. From these results we conclude that our empirical strategy seems to be working as expected.[23]

[22]The data is truncated for heights below 60 inches and above 70 inches starting in 1997. This truncation does not affect our BMI variable which is calculated prior to truncation by NHIS. According to NHIS staff, the cutoff points affect a very small fraction of the observations in each tail. We cannot check that claim for the 1997 and after data, but we checked the percentage of women below and above the cutoff points for the 1982 to 1996 non-truncated height data. Our analyses show that on average only 1.6% of women are below the 60 inches cutoff, and only 2% are above the 70 inches cutoff. Moreover, we do not find any evidence that those percentages change systematically either over time, or by education level or family size.

[23]It is not easy to find other variables related to obesity for which we would expect a placebo test to have a zero expected effect. Age, for example, is not a good candidate, because the average age at which women have children has increased during the period, and also the age differential between the women with children and no children has increased over time. For example, the average age of women with no children has increased in the period 3 years (from a base of around 41 years), while for women with children it has only increased 2 years (from a base of around 35 years), with the difference statistically significant (differences are even starker for the higher education group). At the same time, the evolution of age for women with different numbers of children has been more similar, with no statistical significant difference for the lower education group, and small statistically significant difference for the higher education group. This is another reason why the comparison between women with children and women with no children seems less than ideal.

7 Conclusion

This study assesses whether a causal relationship exists between the labor force participation of single mothers and their obesity. We exploit the expansions of the Earned Income Tax Credit (EITC) that took place in 1987 and 1994 as natural experiments that exogenously increased female labor force participation.

We use data from the National Health Interview Survey (NHIS) and replicate the findings of the prior literature regarding positive employment effects for single mothers of the EITC expansions. This validates employing the difference-in-differences approach, proposed by such literature, for our NHIS data. Comparing women with children to women with no children we find that increased labor force participation can account for, at most, 19% of the observed changes in obesity prevalence in our sample. However, when we use our preferred specification, which compares single women with one child to single women with two or more children, our results suggest that there is no causal link between increased female labor force participation and increased adult obesity.

Our results apply to a particular population, single women with children and with relatively poor labor prospects for them to be potentially affected by the EITC policy changes. Thus, our conclusions may or may not apply to other single women, or to married women. Future research should address whether our conclusions can be generalized. The challenge, of course, is to find a credible source of exogenous variation in labor force participation, as we have in the EITC, but which affects all women.

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Appendix: Data Construction

We use data from the National Health Interview Survey from 1982 to 2004. Constructing a consistent series over time for many of the variables of interest for such a long period, considering that the NHIS suffered relatively big changes in 1985 and 1997, and many small changes in other years, was a challenging task. The variable employment, was one of the most difficult to harmonize across this period because prior to 1997 the survey inquired about the employment status in the *two* weeks prior to the survey date, while in 1997 the question was changed to the employment status only *one* week prior to the survey. This generates a small jump in the employment rates starting in 1997. Because our analysis is based on the differences between two groups (by number of children) across time, we believe that this does not fundamentally affect our results.[24] Regarding the Body Mass Index (BMI), we calculated it for years prior to 1997, but used the already calculated (by NHIS) BMI variable for 1997 and after. To avoid dealing with (a small number of) outliers in this variable, all the individuals who were kept in our analysis sample have BMIs between 15 and 50. The overweight and obese indicators were created based on the standard definitions of BMI$\geq$25 and BMI$\geq$30, respectively, based on the adjusted BMI following the methodology of Burkhauser and Cawley (2008). We created an indicator variable to determine whether the individual is foreign born, which is only defined for 1987 and after.[25] We were also very careful in harmonizing definitions for the variables measuring educational attainment, and for the variables identifying full time students and disabled individuals (based on which we selected our analysis sample). To calculate the number of children, we define children based on the eligibility rules for the EITC, which implies that anybody who is 18 years as of December 31 of the survey year is considered a child. (We ignore EITC rules allowing dependents older than 18 to be considered an "EITC qualifying child" when they are full-time students or disabled.) Finally, note that the NHIS has a complex survey design which has to be taken into consideration in estimation. Thus, all the results presented in the paper have been calculated using the NHIS sampling weights.

When we pooled all the NHIS surveys from 1982 to 2004, we identified 714,167 women of ages 20-64 years old. For all these women we established whether they have a live-in partner or not, and classified them as "single" or "non-single", respectively. This classification is independent of the civil status declared in the survey. The sample is reduced to 166,670 women when selecting only single women. Of those, we dropped 21,761 observations because the women were disabled or full time students, 14,002 observations because they had missing information on the dependent variables and 12,447 observations because they had missing information on the individual or county level covariates needed for the regression analyses. The rule we follow was to drop all observations for which information was missing or invalid for the following variables: gender, age, race, civil status, indicator for foreign born

[24] There were many other small changes in the definition of the variables that determine the employment status, before 1997, but fundamentally after 1997. We have tried to make the definitions comparable across time as much as possible. Details on the rules followed to determine employment (and also for all other variables) are available from the authors upon request.

[25] For years prior to 1987 we make the indicator equal to zero for everybody. We cannot include a dummy variable accounting for this issue in our regressions, though, because it would be perfectly collinear with some of our year fixed effects.

(for survey years after 1987), employment status, height, weight, BMI, and county/state level variables (unemployment rate, employment/population ratio, average earnings, average AFDC/TANF and food stamps benefits paid per person in the state and state minimum wage). In summary, 111,301 women satisfy our sample selection rules and have valid information. This is the sample used for all the analyses and for which summary statistics are presented in Table 1.

We expressed all dollar amounts in 2005 real dollars, this affects the following county/state level variables: county average annual earnings, state minimum wage, the measures of social assistance at the state level (per per capita AFDC/TANF payments to individuals and per capita food stamps payments to individuals).

Our state level grocery price index and fast food price index were constructed from the Council for Community and Economic Research's ACCRA Cost of Living index following the procedure of Chou, Grossman and Saffer (2004). Using the MSA level prices of a consistent set of groceries and fast food meals collected over time and contained in the ACCRA data we construct a MSA level price index using the respective budget shares of each item in our index. We then aggregate all MSA level indices within a given state up to the state level using the respective population share of each MSA within the state. The average annual price of a pack of cigarettes for each state was obtained from Orzechowski and Walker (2010). The price of a pack of cigarettes was converted into real 2005 dollars and included in our model to control for any potential impact of cigarette price changes on weight.

Table 1. Summary statistics NHIS sample 1982-2004, single women 20-64 years old

	All		High School or less		Some College	
Variable	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**
Dependent variables						
Employed	0.81	0.39	0.72	0.45	0.90	0.30
BMI	25.9	5.7	26.5	5.9	25.3	5.5
Overweight (BMI≥25)	0.47	0.50	0.52	0.50	0.41	0.49
Obese (BMI≥30)	0.21	0.41	0.25	0.43	0.18	0.39
Demographic variables						
Age	39.7	12.5	41.0	12.9	38.4	11.9
White	0.70	0.46	0.64	0.48	0.77	0.42
Hispanic	0.09	0.28	0.11	0.32	0.06	0.24
Black	0.21	0.41	0.25	0.43	0.17	0.37
Married	0.03	0.17	0.03	0.16	0.03	0.17
Foreign born (only for 1987-2004)	0.06	0.24	0.07	0.26	0.05	0.23
Education variables						
High School dropout	0.15	0.36	0.29	0.46	0.00	0.00
High School degree	0.36	0.48	0.71	0.46	0.00	0.00
Some College	0.49	0.50	0.00	0.00	1.00	0.00
Family composition variables						
Has children	0.38	0.49	0.47	0.50	0.29	0.45
Has 1 child	0.18	0.39	0.21	0.41	0.15	0.36
Has 2 children	0.13	0.33	0.16	0.36	0.10	0.29
Has 3 or more children	0.08	0.26	0.11	0.31	0.04	0.20
Number of infants (age<1)	0.02	0.16	0.03	0.18	0.01	0.12
Number of 1-year old children	0.03	0.17	0.04	0.20	0.02	0.13
Number of 2-year old children	0.03	0.18	0.05	0.21	0.02	0.14
Number of 3-year old children	0.04	0.19	0.05	0.22	0.02	0.15
Number of 4-year old children	0.04	0.19	0.05	0.22	0.02	0.16
Number of 5 year old children	0.04	0.20	0.05	0.23	0.03	0.16
Number of 6 to 18-year old children	0.49	0.88	0.62	0.97	0.35	0.74
Number of 0-18-year old children	0.70	1.08	0.90	1.20	0.48	0.88
Number of observations	111,301		59,756		51,545	

Table 2. Average employment rates and obesity measures by education level and family size
Single women 20-64 years old

A. Women with 1+ children vs women with no children

	1982/1986			1987/1993			1994/2004			1987/93 - 1982/86	1994/04 - 1982/86
	No Children (1)	Children (2)	Diff = (2)-(1) (3)	No Children (4)	Children (5)	Diff = (5)-(4) (6)	No Children (7)	Children (8)	Diff = (8)-(7) (9)	Diff-in-Diff=(6)-(3) (10)	Diff-in-Diff=(9)-(3) (11)
High School or Less											
Employment	0.763	0.597	-0.171***	0.779	0.615	-0.161***	0.796	0.718	-0.081***	0.001	0.091***
BMI	25.24	25.12	-0.121	26.03	26.10	0.071	27.46	27.49	0.041	0.191	0.161
Overweight	0.428	0.402	-0.031***	0.488	0.488	0.001	0.600	0.595	0.001	0.031**	0.021**
Obesity	0.175	0.172	0.001	0.214	0.230	0.021***	0.293	0.308	0.011**	0.021**	0.021*
Some College											
Employment	0.909	0.804	-0.101***	0.923	0.843	-0.081***	0.915	0.877	-0.041***	0.031**	0.071***
BMI	23.38	23.90	0.521***	24.40	25.04	0.641***	25.92	26.75	0.831***	0.121	0.311**
Overweight	0.259	0.315	0.061***	0.338	0.390	0.051***	0.460	0.537	0.081***	0.001	0.021
Obesity	0.089	0.117	0.031***	0.133	0.171	0.041***	0.213	0.262	0.051***	0.011	0.021**

B. Women with 2+ children vs women with 1 child

	1982/1986			1987/1993			1994/2004			1987/93 - 1982/86	1994/04 - 1982/86
	1 Child (1)	2+ Children (2)	Diff = (2)-(1) (3)	1 Child (4)	2+ Children (5)	Diff = (5)-(4) (6)	1 Child (7)	2+ Children (8)	Diff = (8)-(7) (9)	Diff-in-Diff=(6)-(3) (10)	Diff-in-Diff=(9)-(3) (11)
High School or Less											
Employment	0.688	0.522	-0.171***	0.713	0.539	-0.171***	0.791	0.660	-0.131***	-0.011	0.031**
BMI	24.81	25.38	0.561***	25.91	26.25	0.341***	27.40	27.57	0.161	-0.231	-0.401**
Overweight	0.376	0.423	0.051***	0.479	0.495	0.021*	0.582	0.605	0.021**	-0.031**	-0.021
Obesity	0.158	0.184	0.031***	0.216	0.240	0.021***	0.305	0.310	0.011	0.001	-0.021
Some College											
Employment	0.840	0.766	-0.071***	0.884	0.798	-0.091***	0.897	0.854	-0.041***	-0.011	0.031*
BMI	23.88	23.93	0.051	25.15	24.92	-0.231	26.83	26.66	-0.171	-0.271	-0.221
Overweight	0.315	0.314	0.001	0.392	0.388	0.001	0.548	0.525	-0.021*	0.001	-0.021
Obesity	0.115	0.118	0.001	0.173	0.168	-0.011	0.265	0.258	-0.011	-0.011	-0.011

Note: ***, **, * denote statistically significance at the 1%, 5% and 10% level, respectively.

Table 3. Employment effects by education level
Single women 20-64 years old

A. Women with 1+ children vs women with no children

Dependent variable: Employment

	High School or Less				Some College			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
1+ children * (1987-1993)	0.002	0.002	0.018*	0.018*	0.026***	0.028***	0.023***	0.021**
	(0.012)	(0.012)	(0.010)	(0.010)	(0.009)	(0.009)	(0.009)	(0.009)
1+ children * (1994-2004)	0.090***	0.089***	0.103***	0.101***	0.067***	0.067***	0.044***	0.042***
	(0.014)	(0.013)	(0.012)	(0.012)	(0.011)	(0.012)	(0.011)	(0.012)
Number of observations	59,756	59,756	59,756	59,756	51,545	51,545	51,545	51,545
Adjusted R^2	0.030	0.040	0.161	0.163	0.011	0.015	0.098	0.107
P-val test 87/93=0 & 94/04=0	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.003
Individual controls	No	No	Yes	Yes	No	No	Yes	Yes
County controls	No	No	Yes	No	No	No	Yes	No
County fixed effects	No	Yes	Yes	No	No	Yes	Yes	No
County * Year fixed effects	No	No	No	Yes	No	No	No	Yes
Year fixed effects	Yes	Yes	Yes	No	Yes	Yes	Yes	No

B. Women with 2+ children vs women with 1 child

Dependent variable: Employment

	High School or Less				Some College			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
2+ children * (1987-1993)	-0.009	-0.013	0.001	-0.004	-0.011	-0.013	-0.014	-0.002
	(0.013)	(0.014)	(0.014)	(0.014)	(0.024)	(0.023)	(0.019)	(0.020)
2+ children * (1994-2004)	0.037*	0.036*	0.045***	0.039**	0.033	0.028	0.019	0.033*
	(0.019)	(0.019)	(0.017)	(0.016)	(0.022)	(0.020)	(0.015)	(0.017)
Number of observations	29,663	29,663	29,663	29,663	15,773	15,773	15,773	15,773
Adjusted R^2	0.046	0.066	0.180	0.184	0.014	0.021	0.103	0.116
P-val test 87/93=0 & 94/04=0	0.029	0.014	0.007	0.009	0.011	0.013	0.069	0.060
Individual controls	No	No	Yes	Yes	No	No	Yes	Yes
County/state controls	No	No	Yes	No	No	No	Yes	No
County fixed effects	No	Yes	Yes	No	No	Yes	Yes	No
County * Year fixed effects	No	No	No	Yes	No	No	No	Yes
Year fixed effects	Yes	Yes	Yes	No	Yes	Yes	Yes	No

Notes:
Roubst standard errors in parentheses, clustered by state.
*, ** and *** denote statistical significance at the 10%, 5% and 1% level, respectively.

The dependent variable is a dummy indicating if the person is employed. The regressions use NHIS data on single women ages 20 to 64 years old between the years 1982 and 2004. The regressions are run separately for each education group. All the regressions include year fixed effects (unless county*year fixed effects are included) and a family size dummy (1+ children or 2+ children), and its interactions with 1987-1993 and 1994-2004 dummies. Only those interaction coefficients are reported above. Individual controls are age, age-squared, a dummy for foreign-born (only for 1987-2004), race dummies for white and Hispanic (black is the omitted category), a dummy for married, and variables indicating the number of children in the family of ages <1, 1, 2, 3, 4, 5 and 6 to 18 years old. County/state controls are county-level unemployment rate, employment to population ratio, and real average earnings per job, state-level average AFDC/TANF and food stamps benefits paid per person in the state, state minimum wage, real cigarrette prices, and groceries and fast food price indexes.

Table 4. Obesity effects by education level
Single women 20-64 years old

A. Women with 1+ children vs women with no children

	Dependent variable: Log(BMI)				Dependent variable: Overweight (BMI≥25)				Dependent variable: Obese (BMI≥30)			
	High School or Less		Some College		High School or Less		Some College		High School or Less		Some College	
	(1)	(4)	(1)	(4)	(1)	(4)	(1)	(4)	(1)	(4)	(1)	(4)
1+ children * (1987-1993)	0.008*	0.011**	0.003	0.009	0.027**	0.031***	-0.003	0.010	0.018*	0.020*	0.011	0.019**
	(0.005)	(0.005)	(0.006)	(0.006)	(0.010)	(0.010)	(0.015)	(0.015)	(0.010)	(0.011)	(0.008)	(0.008)
1+ children * (1994-2004)	0.008	0.012**	0.010*	0.018***	0.024*	0.030**	0.021	0.038**	0.019	0.027**	0.022**	0.028**
	(0.006)	(0.005)	(0.005)	(0.005)	(0.014)	(0.013)	(0.016)	(0.015)	(0.012)	(0.012)	(0.011)	(0.011)
Number of observations	59,756	59,756	51,545	51,545	59,756	59,756	51,545	51,545	59,756	59,756	51,545	51,545
Adjusted R^2	0.032	0.121	0.049	0.134	0.027	0.107	0.038	0.115	0.018	0.074	0.025	0.078
P-val test 87/93=0 & 94/04=0	0.208	0.042	0.161	0.005	0.038	0.011	0.118	0.016	0.205	0.079	0.126	0.027
Individual controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
County controls	No	No	No	No	No	No	No	No	No	No	No	No
County fixed effects	No	No	No	No	No	No	No	No	No	No	No	No
County * Year fixed effects	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Year fixed effects	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No

B. Women with 2+ children vs women with 1 child

	Dependent variable: Log(BMI)				Dependent variable: Overweight (BMI≥25)				Dependent variable: Obese (BMI≥30)			
	High School or Less		Some College		High School or Less		Some College		High School or Less		Some College	
	(1)	(4)	(1)	(4)	(1)	(4)	(1)	(4)	(1)	(4)	(1)	(4)
2+ children * (1987-1993)	-0.011	-0.008	-0.010	-0.009	-0.033*	-0.031*	-0.003	0.003	-0.005	-0.002	-0.010	-0.007
	(0.007)	(0.007)	(0.008)	(0.007)	(0.018)	(0.016)	(0.017)	(0.018)	(0.016)	(0.016)	(0.016)	(0.018)
2+ children * (1994-2004)	-0.014	-0.009	-0.009	-0.012	-0.022	-0.019	-0.020	-0.026	-0.020	-0.015	-0.011	-0.013
	(0.009)	(0.008)	(0.007)	(0.008)	(0.019)	(0.017)	(0.017)	(0.018)	(0.018)	(0.018)	(0.015)	(0.019)
Number of observations	29,663	29,663	15,773	15,773	29,663	29,663	15,773	15,773	29,663	29,663	15,773	15,773
Adjusted R^2	0.034	0.141	0.049	0.141	0.030	0.121	0.040	0.122	0.019	0.090	0.025	0.082
P-val test 87/93=0 & 94/04=0	0.238	0.505	0.397	0.359	0.186	0.159	0.343	0.173	0.434	0.574	0.756	0.768
Individual controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
County/state controls	No	No	No	No	No	No	No	No	No	No	No	No
County fixed effects	No	No	No	No	No	No	No	No	No	No	No	No
County * Year fixed effects	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Year fixed effects	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No

Notes:
Roubst standard errors in parentheses, clustered by state. *, ** and *** denote statistical significance at the 10%, 5% and 1% level, respectively.
The regressions are identical to those presented in columns (1) and (4) of Table 3, the only change is in the dependent variables. See the explanation below Table 3 for details.

Table 5. Placebo Test - Effects on log(Height)
Single women 20-64 years old

A. Women with 1+ children vs women with no children

	Dependent variable: log(Height)			
	High School or Less		Some College	
	(1)	(4)	(1)	(4)
1+ children * (1987-1993)	-0.001	-0.001	-0.001	-0.002
	(0.001)	(0.001)	(0.001)	(0.001)
1+ children * (1994-2004)	0.002*	0.002**	0.000	-0.000
	(0.001)	(0.001)	(0.001)	(0.001)
Number of observations	59,756	59,756	51,545	51,545
Adjusted R^2	0.001	0.059	0.001	0.033
P-val test 87/93=0 & 94/04=0	0.019	0.011	0.445	0.187
Individual controls	No	Yes	No	Yes
County controls	No	No	No	No
County fixed effects	No	No	No	No
County * Year fixed effects	No	Yes	No	Yes
Year fixed effects	Yes	No	Yes	No

B. Women with 2+ children vs women with 1 child

	Dependent variable: log(Height)			
	High School or Less		Some College	
	(1)	(4)	(1)	(4)
2+ children * (1987-1993)	0.002	0.001	0.001	0.002
	(0.001)	(0.001)	(0.002)	(0.002)
2+ children * (1994-2004)	0.001	-0.000	0.001	0.002
	(0.001)	(0.001)	(0.002)	(0.002)
Number of observations	29,663	29,663	15,773	15,773
Adjusted R^2	0.002	0.080	0.001	0.040
P-val test 87/93=0 & 94/04=0	0.492	0.653	0.892	0.413
Individual controls	No	Yes	No	Yes
County/state controls	No	No	No	No
County fixed effects	No	No	No	No
County * Year fixed effects	No	Yes	No	Yes
Year fixed effects	Yes	No	Yes	No

Notes:
Roubst standard errors in parentheses, clustered by state. *, ** and *** denote statistical significance at the 10%, 5% and 1% level, respectively.
The regressions are identical to those presented in columns (1) and (4) of Table 3, using log(Height) as dependent variable. See the explanation below Table 3 for details.