Does More Money Make You Fat? The Effect of Household Income Transfers on Adolescent and Young Adult Health

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Abstract

We investigate the effect of household cash transfers during childhood on young adult body mass indexes (BMI). The effects of extra income differ depending on the household's initial socio-economic status (SES). Children from the initially poorest households have a larger increase in BMI relative to children from initially wealthier households. Several alternative mechanisms are examined. Initial SES holds up as the most likely channel behind the heterogeneous effects of extra income on young adult BMI. Poverty generates long-term health vulnerabilities that cannot be fully mediated by public policy such as direct cash disbursements.

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I. Introduction

The global obesity epidemic is anticipated to become one of the most significant non-communicable disease threats to global public health in the near future (The Lancet, 2011). Leading public health experts around the world have called for coordinated government action to help turn the tide of obesity and the twin threats of cardiovascular disease and diabetes (Wang et al, 2011; The Lancet, 2011). There is significant concern that the rise in obesity world-wide will slow or even reverse the significant mortality reductions experienced by high income countries in the past several decades (Swinburn et al, 2011) and that obesity has become a bigger threat to public health than smoking.

Current trends are particularly alarming among children and adolescents. Globally in 2004, there were 170 million overweight (inclusive of obese) children (Lobstein et al, 2004). The US has experienced a drastic increase in the prevalence of childhood and adolescent obesity since the 1980s. According to the most recent National Health and Nutrition Examination Survey (2008) 11.9 percent of children aged 2-19 were at or above the 97th percentile of the Body Mass Index (BMI)-for-age growth charts and 17 percent were at or above the 95^{th} percentile (Ogden et al, 2010). Being overweight in young adulthood is a predictor of later-life obesity and chronic conditions such as diabetes and heart disease. The recent rise in poverty in the US makes the robust connection between household socio-economic status and children's BMI and later-life health particularly alarming. We know relatively little about the mechanisms behind these strong correlations. A good understanding of the link between poverty and obesity is particularly pressing today, when the poverty rate in the US stands at its highest since 1993.[1]

Theory predicts an inverted U-shape relationship between unearned income and weight (Lakdawalla and Philipson, 2009). As income increases, households and individuals increase their consumption of food and consequently we see an increase in weight. Beyond a certain threshold, the wealthiest households are either able to

[1] The Census Bureau, announcement from September 13, 2011

purchase higher quality foods that are more nutritious or pursue health-related activities, so the income-weight curve starts sloping downwards. Without exogenous variation in either body mass or income, the direction of causality between the two is unclear. To our knowledge, there is no experimental evidence testing this prediction. This study uses exogenous cash transfers to determine the direction of causality clearly.

Our research shows that exogenous unearned income transfers have heterogeneous effects on adolescent and young adult health depending on pre-intervention socio-economic background. Consistent with theory, we find evidence that extra unearned income increases BMI among youths from poorer households relative to their wealthier peers.

We study the effect of exogenous income transfers for American Indian households on and off of the Eastern Cherokee Reservation in North Carolina. These transfers are provided to all enrolled tribal members regardless of their economic characteristics.[2] An equal proportion of profits from the tribal casino operations is provided to the entire distribution of tribal member household types; both wealthy and poor households received the same-sized transfers. Our findings suggest that the income transfers generated by the casino operations increased BMI among adolescents from families with average incomes below $30,000, but not among their better off peers. Further investigation reveals that this is due to differential changes in weight and height among youths from different economic backgrounds. Adolescents from initially poorer households are more likely to maintain or increase their weight but less likely to experience increases in height as compared to adolescents from initially wealthier households. Consequently, children from the initially poorer households tend to increase their relative BMI over time. These results imply that growing up in a poor

[2] Memership in the Eastern Cherokee tribe is determined by genealogical ties to existing tribal membership rolls from 1924. Additionally, the minimum blood quantum required is 1/16 for tribal membership; therefore, ethnically individual tribal members may be mixed race but they may still be politically tribally enrolled members. The enrollment requirements are for tribal citizenship, not ethnicity or race. Only tribally enrolled citizens are eligible for the casino transfer payments. We use Native American, American Indian, and tribal member interchangeably through the rest of the text.

household has long-lasting effects on health. Policies intended to improve long-term health outcomes must account for differences in household characteristics.

In addition to initial household income, we examine several other channels that may contribute to heterogeneous effects of extra household income on later life health. For example, we study the effects of pre-intervention maternal labor force participation, mother's education, and the child's birth weight which is a proxy for the child's health endowment. We find that the differences in initial household income are the main contributor to the observed heterogeneous policy effects.

This research contributes to two major strands of the existing empirical literature. First, we offer the first assessment of the medium-term effects of quasi-experimental household income transfers on adolescent BMI. We add to the literature examining the health effects of public policy interventions in childhood. We show that interventions that start as late as adolescence could benefit children's long-term well-being. Further, it is demonstrated that the effect of these income interventions vary with family socio-economic status.

Second, we contribute to the growing economics literature on the impact of Native American-run casinos on the well-being of neighboring communities (Evans and Topoleski, 2006; Wolfe et al 2011). Native Americans are a population that has received relatively little attention in the economics literature, especially considering the dire socio-economic and health conditions on many Native American reservations. The Indian Gaming Regulatory Act (IGRA) of 1988 provided an avenue for Native American tribes to pursue potentially lucrative gaming ventures on their reservations in order to combat poor economic conditions. The express purpose of IGRA was to increase tribal incomes and to lift tribal members out of poverty and alleviate social problems related to poverty and deprivation, including poor health outcomes. We show that the effects of casino-generated cash transfers on children from tribal communities are not unambiguous. To our knowledge this is the first study of the effects of casino transfers on tribal members' health that uses individual panel data.

The next section puts the present study in the context of the current related literature. Section 3 describes the data and offers a basic analysis of the evidence. Next, we employ panel data estimation techniques in our main empirical analysis. Finally, Section 5 offers some concluding remarks.

II. Background

A consensus has emerged that early life conditions and shocks to health affect long-term economic and social outcomes (Currie et al, 2010) and that children from poor families experience worse health conditions (Currie, 2009). With particular reference to weight and obesity, Baum and Ruhm (2009) show that weight changes over the life-cycle are inversely related to SES and that differences in obesity across SES groups widen with age. They also show that family SES affects individuals' weight over their lifespans.

Public policy could work to counterbalance any such adverse initial conditions by providing extra resources to poor families. Some work has been done to identify the long-term effects of welfare programs such as Food Stamps (Almond at al, 2010, 2011) and Head Start (e.g. Currie and Thomas, 1995; Carneiro and Grinja, 2011; Frisvold, 2007). However, a recent review of the literature identifies few studies that have tested how pure income transfers to families affect the short- and long-term wellbeing of their children (Almond and Currie, 2009). The existing literature has focused on studying the short-term effects of income transfers (Dahl and Lochner, 2005; Milligan and Stabile, forthcoming) and on relatively young ages at intervention (infancy and early childhood). These studies do not investigate whether the effects persist into adulthood and whether and to what extent the age at intervention matters.

A separate literature has emerged studying the effects of Head Start on childhood obesity. Participation in Head Start has been found to reduce obesity (Frisvold 2007; Carneiro and Ginja 2008) and a recent contribution by Frisvold and Lumeng demonstrates that even the "dosage" of Head Start received (half-day or full-day) matters (Frisvold and Lumeng, 2011). The children participating in Head Start were affected by the program at very young ages, so we still do not know whether interventions at later stages of child development could be beneficial. Moreover, we have little evidence of the effects of interventions targeted at the household level, rather than at the pre-school class.

When studying the determinants of childhood obesity outside specific policy interventions, economists have concentrated primarily on the effects of the supply and quality of food consumed by children. For example, it has been shown that fast food restaurants close to school grounds increase the prevalence of obesity among 9th graders (Currie et al, 2009) and higher prices of fruit and vegetables in the neighborhood are associated with higher BMI, especially among economically disadvantaged children (Powell and Chaloupka, 2009). Increased supply of fast food or "bad" food potentially available to children contributes to higher incidence of childhood obesity.

Studies investigating the effects of changing access to different types of food assume that the demand-side effects are negligible. This paper asks the opposite question: holding access and availability of foods constant, would higher household incomes result in changes in obesity rates among youth? Due to the panel nature of our data, we can control for unobserved area characteristics, such as the kinds of restaurants and supermarkets in a particular area that affect all children residing there in the same way.

One way to assess the contribution of increased incomes on adolescents' BMI is to consider exogenous changes in the affordability of different types of food. Affordability can increase in two ways: by providing extra funds that can be spent on food only (such as food stamps and other coupons) and by changes in expendable income. Previous studies have found mixed results on the effect of receiving food stamps on adult obesity rates (Townsend et al, 2001, Chen et al, 2005; Kaushal, 2007). Two recent studies examine the causal effects of extra expendable income on BMI. Schmeiser (2008) considers low income women while Cawley et al (forthcoming) study Social Security recipients. Both utilize instrumental variable (IV) strategies to estimate changes in BMI and obesity rates attributable to changes in income. Our study differs from previous studies by focusing on children and using a quasi-experimental framework. We are not aware of any previous economics research on the effects of exogenously increased household income on adolescents' BMI in the United States.[3]

Empirically, the relationship between income and obesity is hard to identify. Among studies using data on adult populations, the main problem is identifying the direction of causation – higher incomes make food more accessible, but obesity and the associated health problems make it harder to earn high incomes. People with higher incomes can afford better food, and they are also less likely to be obese.[4] There is a separate literature estimating the effect of BMI on earnings (Kline and Tobias, 2008; Cawley, 2004; Mocan and Tekin, 2009) and at least one study shows that overweight and obese adults are likely to suffer from low self-esteem which may be underlying their lower earnings (Mocan and Tekin, 2009). To plausibly capture the empirical relationship between income and weight, one has to exogenously increase the amount of dispensable income available to the household without affecting the extent of physical activity or physical attractiveness needed to earn that income.

Assessing the effect of exogenous income transfers on the BMI of children and adolescents is attractive for two reasons. First, the transfers we consider come from an exogenous source and their size is not affected by the initial financial situation of the household. Second, the transfer affects children while they are teenagers - a time when most children earn little on their own.[5] The children in our study are subjected to the income effect, but unlikely to be affected by a substitution effect away from labor.[6]

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[3] In a study examining obesity rates for adults over thirty years, Chang et al (2005) find that there has been an increase at all levels. Their study differs from ours in that they are looking at an association between income and obesity (they do not have an exogenous change to income) and they are looking at adults only.

[4] Behrman and Deolalikar (1987) have shown that changes in income in a developing country are not necessarily associated with changes in food consumption – they find that it depends on the income elasticity of food.

[5] Child labor laws and mandatory schooling requirements in the U.S. prevent children from working full time until age 18.

[6] In developing countries, the case would be quite different in that the additional household income would allow children to work less and enter school which may have separate effects on the child's BMI. See, for instance, the literature on child labor in developing countries. Edmonds (2008) provides a useful overview of the findings.

III. Data and basic analysis

The Great Smoky Mountains Study of Youth (GSMS) is a longitudinal survey of 1420 children aged 9, 11 and 13 years at the survey intake that were recruited from 11 counties in western North Carolina. The children were selected from a population of approximately 20,000 school-aged children using an accelerated cohort design.[7] Children from the Eastern Band of Cherokee Indians were over sampled for this data collection effort. Survey weights are used in the child outcome regressions that follow. The federal reservation is situated in two of the 11 counties within the study. The initial survey contained 350 Indian children and 1070 non-Indian children. Proportional weights were assigned according to the probability of selection into the study; therefore, the data is representative of the school-aged population of children in this region. Attrition and non-response rates were found to be equal across ethnic and income groups.

The survey began in 1993 and has followed these three cohorts of children annually up to the age of 16 and then re-interviewed them at ages 19 and 21.[8] Both parents and children were interviewed separately up until the child was 16 years old; interviews after that were only conducted with the child alone.

After the fourth wave of the study, a casino was opened on the Eastern Cherokee reservation; the survey children were approximately 13, 15 and 17 years of age at that time. The casino is owned and operated by the tribal government. A portion of the profits are distributed on a per capita basis to all adult tribal members.[9] Disbursements

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[7] See Costello E. Jane, Adrian Angold, and Barbara Burns, and Dalene Stangl, and Dan L. Tweed, and Alaatin Erkanli, and Carol M. Worthman (1996) for a thorough description of the original survey methodology.

[8] Individuals are interviewed regardless of where they are living (whether on their own, in college, or still living with their parents). No child is dropped from the survey because they moved out of their parent's home. We find no statistically significant difference in attrition between the treatment and control groups or selective attrition on health outcomes. American Indians comprise 24% of the sample in the very first survey wave and comprise approximately 27% of the sample at age 21.

[9] All adult tribal members received these per capita disbursements. If there were any non-compliers (parents that either did not receive or refused the additional income) then any estimates found here would be an under estimate of the true effects of additional income. Children listed as tribal members were

are made every six months and have occurred since 1996. The average annual amount per person has been approximately $4000. This income is subject to the federal income tax requirements. However, as the transfers are not part of earned income, they do not directly affect EITC for eligible individuals.

The outcome variables of interest are Body Mass Index (BMI), height, weight and obesity. The first three measures are recorded at each survey wave. Interviewers measured survey respondents using rulers and scales. Medically recommended levels of BMI are between 20 and 25 for adults. Individuals with BMI levels of 25-30 are considered overweight in adults; those with BMI greater than 30 are considered obese.[10] We have constructed a simple obesity index variable for our survey subjects (ages 19 and 21) which takes on the value of 1 when BMI is greater than 30 and is 0 otherwise. We utilize the Centers for Disease Control BMI-for-age chart for boys and girls. These measures account for differential growth rates between the genders at different ages. Adolescents are classified by age, gender, weight and height and assigned a percentile. Individuals that exceed the 95th percentile for their age and gender group are considered obese while individuals who are above the 85th percentile are classified as overweight (inclusive of the obese). We employ these designations in the tables that follow.

Table 1 provides descriptive statistics. The sample is balanced on conditions at intake such as age, sex, and maternal labor force participation between tribal members and the rest. American Indian mothers are significantly less likely to have been to college, and more likely to have completed only high school. The incidence of obesity and being overweight is substantially higher among American Indian youth. A large

eligible for the casino disbursements themselves at age 18 if they completed high school; even if they did not complete high school they would receive the casino transfers at age 21. While they initially did not know exactly how much the transfers will amount to, tribal members had every reason to believe that this was a permanent positive change in their incomes. Casino operations are authorized under the Indian Gaming Regulatory Act of 1988 which allowed the development of economic activities related to gaming on US Federally recognized American Indian reservations. By the time the Eastern Cherokee tribal casino began operation, other tribal casinos had been operating in places such as Florida and the mid-west for almost a decade.

[10] In the analysis we drop several extreme outliers (which we attribute to either recording error or measurement error) for recorded BMI levels that exceed 100 or are below 10.

proportion of these adolescents are obese (36%) as compared to 19% of the rest of the sample. The difference comes from an eight kilogram difference in weight, while average height is very similar between the two groups.

Tribal members come from poorer families – their households received, on average, ten thousand dollars less in annual income in the three survey waves before the casino opened. In the original data, the variable for household income is provided in categories which are $5,000 in size each. A value of 6, for instance, corresponds to approximately $30,000 (the average for non-Indians); while a value of 4 corresponds to an annual income of approximately $20,000 (the average for American Indian households). These amounts correspond closely to data for the region from the 1990 US Census. The casino disbursements (approximately $4,000) represent more than a twenty percent increase in the average household income of parent couples of mixed heritage, and more than 40 percent increase in households of two tribal members. The casino transfers alone would be enough to close the income gap between an average family with two non-member parents and families composed of two tribal members.

In Figure 1 we plot correlation coefficients between household income in the last survey wave before the initiation of the income transfers and children's body mass. The graph indicates that children who come from households with an initial income of between $10-20,000 will have on average a BMI that is 2 points higher than a child from a household with income of $60,000 or more (the omitted income category). A clear negative correlation between household income and children's BMI is apparent, at least up to annual income levels of around $40,000.

In Figure 2 we provide a simple graph of the distribution of BMI for American Indians at age 19 by age cohort on the left and for Non-Indians on the right. The graph shows that the youngest age cohort of American Indians, who also spend the longest time in households with income transfers, tends to have a distribution of BMI that is to the right of the other two cohorts. The middle age cohort distribution is to the right of the oldest age cohort. We interpret these plots as suggestive evidence that longer exposure to casino transfers may have increased adolescent BMI.

We take an individual-level approach in Figure 3. We plot the distribution of changes in BMI *for the same individual* between the ages of 13 and 19 among tribal members and non-members of the three cohorts.[11] Regardless of initial body weight, on average Native American children in the youngest cohort tend to gain more weight relative to non-Indians. But we also observe higher variance in the relative gains among this group – a non-trivial proportion of tribal members gain less than the comparable group of whites.

A. Cohort-level analysis: Obesity and BMI at ages 19 & 21

As a first cut of the data we use a difference-in-differences regression strategy to examine the effects of varying duration of treatment using differences among cohorts measured at ages 19 and 21. The duration of treatment differ across the age cohorts as they were affected by the casino transfer payments at different points in their childhood; the youngest group was first treated at age 13, the middle group at age 15 and the oldest group at age 17. We include several other variables which have the potential to explain changes in child obesity and BMI such as maternal labor force participation and education, distance between the household's residential location and the casino, as well as the child's own personal income and education at age 19.

We compare young adult outcomes for adolescents who resided for a total of six (four years for the middle age cohort) years as minors in households with extra income to adolescents who resided for two years as minors in households with exogenously increased incomes. The two youngest age cohorts (Age 9 and Age 11 at survey intake; ages 13 and 15 at first treatment) function as the "after-treatment" cases and the oldest age cohort (Age 13 at survey intake; age 17 at first treatment) is the "before-treatment" case. We focus explicitly on the effect of the income transfer on BMI and the incidence of obesity at ages 19 and 21. Non-tribal members serve as the pure control group.

[11] For the youngest age cohort, we restrict analysis to age 12 as there were no observations at age 13 for this cohort. It is important to note that none of the three cohorts were treated with the increase in household income at these ages.

The size of the exogenous increase in household incomes can take on two different values depending upon the number of American Indian parents in each household.[12] It is possible for there to be 0, 1 or 2 American Indian parents in each household. Clearly households with two tribal member parents will have double the amount of exogenous income than households with only a single American Indian parent. The equation below details the specification:

$$Y_i = \alpha + \beta_1 \times Age9_i + \beta_2 \times Age11_i + \delta_1 \times NumParents + \gamma_1 \times Age9 \times NumParents_i + \gamma_2 \times Age11_i \times NumParents_i + X_i'\theta + \varepsilon_i$$

(1)

In the equation above, Y is BMI or obesity status for the survey children measured at ages 19 or 21, Age9 and Age11 variables indicate whether or not the child is drawn from the youngest or middle age cohorts - the age 13 cohort (oldest) is the omitted category in this regression. The variable NumParents indicates the number of parents who are tribal members in that child's household. The two coefficients of interest are γ_1 and γ_2, which measure the effect of receiving the casino disbursements and being in either the age 9 or age 11 cohorts relative to the 13 year old cohort. The vector X controls household conditions prior to the opening of the casino and includes average household income over the four pre-treatment years, the sex of the child, the race of the child, the mother's pre-intervention labor force participation and education level .

Identification of equation 1 relies on the fact that the different age cohorts of children were randomly sampled within American Indian and non-Indian groupings.[13] Additionally, it is important that the pre-intervention trends between the treatment and

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[12] We find that the effect of the treatment (household eligibility for the casino per capita transfer) results in approximately $3900 additional household income at each survey wave. The average amount distributed per person has been about $4000 per year. This suggests that households do not alter their labor participation in response to this additional household income.

[13] See Akee et al (2010) for evidence of the comparability of respondents across age cohorts.

control groups move in a similar direction; these graphs are provided in Appendix Figures 1-3 for pre-treatment BMI, weight and height.

B. Difference-in-Difference Regression Results for BMI and Obesity at Ages 19 &21

We present several specifications of the difference-in-difference regression in Table 2. In all of these regressions, the omitted category of children is the oldest age cohort (age 13 at survey intake; age 17 at beginning of treatment). Thus all coefficients are interpretable as differences with the oldest cohort.

The first 4 columns in Table 2 report coefficients obtained from an OLS regression of BMI on a number of controls specified in equation (1) above. Columns 5-8 report marginal effects after probit regression coefficients of obesity at ages 19 and 21.[14] Columns 1, 3, 5 and 7 show the difference-in-difference regressions based on the model in equation 1. The coefficients of interest, while not statistically significant, indicate that adolescents who reside in households with at least one tribal member parent and are in the youngest age cohort have lower BMI and are less likely to be obese by ages 19 and 21.[15] Based on the pure correlations plotted in Figure 1, we expect that the effects of exogenous income transfers on BMI will vary depending on initial household income. In columns 2 and 4, we test this hypothesis. In these regressions we interact initial household income (prior to the casino payments) with the original difference in difference term from columns 1 and 3. Our results confirm the

[14] We report marginal effects for ease of exposition. Linear probability regressions yield the same results. The tables are available from the authors. In a series of papers Norton and co-authors (2003, 2004) have shown that interaction terms in binary regressions are not properly calculated by standard statistical analysis software output (e.g. STATA). We have used their suggested estimator (inteff) and report interaction coefficients evaluated at the mean.

[15] Even though the coefficient of the youngest Native American cohort is not significant, it is negative, which appears at odds with the raw data evidence we presented in Figure 2. However, in addition to showing a higher prevalence of BMI in the 30-40 range and a larger variance in BMI in the youngest cohort, Figure 2 shows lower prevalence of extreme obesity (over 40 BMI) in the youngest group. When we exclude these observations from the sample, the coefficient becomes positive, even though still not statistically significant. The interaction coefficients with income are not affected by restricting the sample in this way.

theoretical prediction that the marginal effect of extra income varies across the initial income distribution.[16] The results demonstrate that relative to the oldest cohort, the exogenous income transfers reduced BMI by 0.6 index points and also decreased the probability of obesity by 3% at age 19 with each $5,000 increase in *initial* household income for the youngest cohort of adolescents. We find similar effects at age 21; there is a reduction of between 2 and 4 percentage points in the probability of being obese with each $5,000 increase in the initial household income at ages 19 and 21.

We show graphically that poverty matters for BMI using a simple poverty/non-poverty distinction. In Figure 4 we separate the tribal and non-tribal populations along poverty lines and plot the distributions of BMI at ages 13 and 21 aggregating across all cohorts; the younger age is effectively pre-treatment for all age cohorts and age 21 is after treatment for all cohorts. Figure 4 indicates that American Indians tend to have higher BMI than non-Indians even at a relatively young age. By age 21, this difference becomes more pronounced with a proportionately higher increase in BMI for American Indians. Figure 4 is illustrative of the results reported in Table 2, that poor American Indians are relatively heavier at age 21 compared to their relatively wealthier counterparts. This figure also shows that the average gain between ages 13 and 21 is largest for poor tribal members than any other group. We revisit this finding using an individual panel approach in section IV below.

The other covariates reported in Table 2 are also informative. We find that American Indian adolescents are 4-6 body mass index points heavier and between 33 and 42 percentage points more likely to be obese than non-Indians. We also find that the average of childhood household income (in the three years prior to the government transfer program) negatively affects BMI and obesity at age 19.

We conduct several placebo and robustness tests for this difference-in-difference analysis in Appendix I. We test whether differences in parental labor force participation, the gender of the parent receiving the transfer, the distance from the household to the

[16] Behrman and Hoddinott (2005) find for Mexican children enrolled in the PROGRESSA program that the effects on growth are more pronounced for individuals from poorer households.

casino or own education can explain the results reported in Table 2. The analysis is presented in Appendix Tables 1-5 and indicates that our initial results are robust to alternative hypotheses about the cause of the heterogenous effects of extra household income on adolescent BMI.

IV. Individual panel data estimates

A potential concern about the results from our basic analysis is that children of Native American ancestry might grow at differential rates than non-Indian children. In order to account for this possibility, we take advantage of the panel nature of our data and examine the effect of the casino transfer payments on health outcomes at each survey wave. Because the panel data contain information on the same individuals at multiple points in time, we are able to include age-by-race fixed effects and a Native American-specific time trend.

A. Empirical Strategy

We examine changes in the body mass index, as well as weight and height. We use all available data for each individual from ages 9 (11 and 13 respectively) onwards, interviewed every year until age 16 and then again at ages 19 and 21. The empirical specification is:

$$Y_{it} = \alpha_i + X_{it}'\beta + \varepsilon_{it} \quad (2)$$

Where, α_i is the individual fixed effect and X is the vector of control variables, including whether the individual child, i, belongs to a household that is eligible for casino payments. This indicator variable is always zero for households that are not receiving the casino transfers; for households that are receiving the casino transfers, the variable is zero for the first four survey waves and then takes the value of one thereafter. Identification of the casino effect is driven by differences between Native American treated and untreated children of the same age; this is possible because the Native American children in our panel data are treated to casino payments at different ages. For instance, we can compare 16 year olds who were treated (the two youngest age cohorts) to 16 year olds who were not treated (the oldest age cohort).We emphasize that vector X also includes a set of age by race fixed effects, to control for potentially different growth paths between tribal members and others. We also include a Native American-specific time trend. Taken together these two different types of race-cohort controls (time invariant and time variant) should account for any meaningful differences across the two groups.[17]

It is important to note that there were no health or educational programs created immediately after the advent of casino disbursements by the tribal government. In later years new programs have been developed, but for the crucial period in which these children were minors in their parents' households, there is little evidence of new programs. Anecdotal evidence suggests that the revenues from the casino operations were, at least in the short run, spent only on per capita disbursements to the tribally-enrolled membership. Spending on large-scale construction was not completed until well after the youngest age cohort were over 18 years old. Therefore, the children in this study were not minors when new tribal programs and facilities became operational.

B. Panel level BMI regression analysis

The basic difference-in-difference analysis implied differential effect on BMI and obesity rates at ages 19 and 21 depending upon initial household income. Figure 3 shows that children residing in treated households for the longest periods increased their BMI relative to others, but it also shows that they have higher variance in the gains. In this section, we investigate whether the data support similar heterogeneity in the effect of extra income once we account for fixed individual characteristics and race-specific trends and exploit only variation coming from different survey waves within individuals. We also test for heterogeneous effects across maternal characteristics and children's initial health endowments.

[17] In results not reported here, we include a squared Native American-specific time trend and find no differences in our results.

The panel estimations, based on the model in equation (2), are reported in Tables 3-5. In addition to individual specific fixed effects, all reported models include age-by-race dummies. We cluster standard errors at the individual level. We also include an indicator for the presence of children in the household who are less than 6 years old. Consistent with previous results in the development literature, the effect of young siblings in the household is negative and significant. These results are robust to controlling for the total number of siblings in the family

In column 1 of Table 3 we include a binary variable for casino payments that is equal to one in years when households are eligible to receive transfers and zero otherwise. The coefficient is small and not statistically different from zero.[18] In column 2 we add an interaction term with initial household income, testing the hypothesis that the effects of casino transfers differ across pre-treatment income groups. Adolescents residing in households eligible for casino transfer payments have on average two thirds of a unit increase in BMI which is equal to 10% of the standard deviation of BMI for adolescent tribal members, but the coefficient is not statistically significant at conventional levels. The interaction effect is negative and statistically significant. As a result of the transfers, an adolescent from a household with $5,000 more in initial household income will have a BMI that is 0.18 BMI units lower than a comparable individual from a poorer household.

C. Panel Level Weight and Height Regressions

BMI has two components – weight and height; these components could be affected differently by extra household income during adolescence.[19] We investigate whether the differences in BMI between adolescents residing in households from

[18] We find qualitatively similar results when using a continuous variable for duration of treatment. These results are presented in Appendix Table 6.

[19] There are several growth spurts in children's physical development, during which they gain significantly in height. For example boys in the US gain up to 10 cm/year at age 13, and up to 5 cm/year at ages 14-16 (see, e.g. Figure 1 in Case and Paxson, 2008). In our study, the youngest treated cohort were aged thirteen at the time that the income transfers were first received by the parents. On average, these children would have gained around 25 cm (girls) and 28 cm (boys) in height between their 13th and 20th year

different parts of the income distribution could be caused by the differential impact of extra income on these two components. Table 4 reports the effect on the government transfer on adolescent weight. We find in column 1 that there is a negative effect of receiving casino payments on gaining weight. However, this coefficient is not statistically significant and when we include an interaction variable with the initial level of household income, the main effect becomes positive in sign (but not statistically significant).[20] The interaction term is statistically significant implying that there is a non-linearity in the effect of additional household income on weight. In this case, it appears that a child coming from a household with an additional $5,000 in initial income would experience a 0.4kg reduction in weight as a result of the extra income compared to a child coming from a household that was $5,000 poorer before the intervention.

We repeat this analysis for the adolescents' height at each survey wave. These results are presented in Table 5. In column 1 the casino disbursement dummy is positive, but not significant. We find that the coefficient on the interaction term with income in column 2 is positive and marginally statistically significant at the 10% level, implying that an adolescent from a household with $5,000 more in initial income will experience a 0.23 cm increase in height if they also receive the casino payments. We conclude that extra income transfers are more likely to result in height increases for children coming from better off families.[21] This result should however be interpreted with caution as it is only marginally statistically significant.

Taken together these results show evidence for non-linearity in the effects of extra unearned income on height and weight. Overall, it appears that the joint contribution of differential effects by income on the two components affects our findings on BMI.

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[20] In unreported analysis we tested whether the government transfers were significantly correlated with the probability that the respondent was on a diet or had any nutritional problems such as bulimia and anorexia. We found no evidence that the casino transfers resulted in differential eating behavior or eating disorders across treatment groups.

[21] In results not shown, after dividing the sample by males and females, we find that the effect is larger for males; the difference in coefficients by gender is not statistically significant.

D. Potential Mechanisms

Our findings thus far indicate that there is a heterogenous effect of additional household income on the BMI of household children. The effect differs according to where the household resided in the initial distribution of incomes. In this section, we investigate whether our observed results are diminished or otherwise changed by interacting the casino transfer payment variable with other initial household conditions. The empirical specification in Table 6 is the same as presented in Table 3 with the addition of other casino interaction variables.

In the first two columns, we include casino interaction variables with mother's initial labor force status and education levels. For simplicity of interpretation, we divide maternal education into two broad categories and construct a dummy equal to one if the mother has finished high school or more and zero otherwise. The coefficients on both variables are not statistically significant. Additionally, the main coefficient of interest, the interaction of casino payments and initial average household income, does not diminish greatly in magnitude or statistical significance.

The specifications in columns 3 and 4 include the casino transfer payment interactions with the child's birthweight and average weight in the first 3 survey waves. Birth weight is coded in three categories: 1 if birth weight <2500 grams, 2 if birth weight is >2500 and <4500 and 3 if birth weight is >4500 grams. Children who were born with low birth weight gain more relative to their peers. This may be due to two mechanisms. On the one hand, lower birth weight infants might maintain lower weight in adolescence, so they have more to gain. On the other hand, low birth weight may proxy for more fragile health or SES which in itself may be related to larger gains in BMI. We test which hypothesis is more likely by including an interaction term with the individual's average pre-casino weight (in the first three survey waves). Initially heavier children gain less. Once both interactions are included in the specification in column 5, the marginal effect of birth weight is still significant at the 10% level and pre-casino weight is significant at the 5% level. We conclude that low birth weight proxies for more than simply genetic body mass differences.

In the specification reported in column 6, we include all of these additional interactions with our variable of interest, casino payment interaction with average initial household income. In this specification and in all of the previous ones, the negative interaction between initial household income and casino-generated cash remains economically and statistically significant. Changes in household income have a non-linear effect on BMI for adolescents depending upon the level of the household's initial income and initial income appears to matter more than any other channel that we consider in the analysis.

As a final piece of evidence of this heterogeneity, we report the effects of extra income by initial income category in Table 7. The omitted income category is the highest category, and therefore the coefficients on all other income categories are interpreted as reflecting differences from the highest income group. Again, the results indicate individuals who come from households that were initially poorest tend to gain the most in BMI due to the extra cash transfers.

V. Concluding remarks

Due to the quasi-experimental nature of our data, we are able to identify the effect of a permanent increase in unearned household income on weight gain and eventual obesity in adolescents and young adults. We trace out differential effects of extra income depending on the initial financial conditions in the household.

We find that individuals who come from the initially poorest households tend to gain more weight after the introduction of the transfer payments than their richer neighbors. These effects are not due to initial health conditions as proxied by birth weight or due to increases in own educational attainment. We also show that the heterogeneity remains even after we include interactions with maternal characteristics and the child's initial health endowment. Our results are robust to the inclusion of these additional potential mechanisms.

Taken as a whole, our findings support the notion that unearned extra household income has heterogeneous effects on adolescent body mass depending upon the child's household type. This has significant implications for the design of policies intended to address the continuing adolescent and young adult obesity epidemic in the US and the ensuing future threat of chronic weight-related disease.

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For Online Publication Only along with Appendix Tables

Appendix I. Alternative Hypotheses, Controls and Placebo Tests

Previous research in both developed and developing countries has shown that exogenous changes to household income controlled by an adult female can have beneficial effects on spending for children and household consumption goods (Duflo, 2003; Duflo and Udry, 2003; Duncan 1990 and 1994; Lundberg et al, 1997).[22] Appendix Table 1 presents results implying that differences in the gender of the transfer recipient were not significant for this intervention. It is important to note, however, that the extra income recipients were not randomly assigned across parents' genders and there may be systematic differences between families where the mother or the father is Native American (and the other parent is not).

In Appendix Table 2, we present additional difference-in-difference regression results. Extra income transfers might directly affect the child's characteristics which in turn could affect their BMI and obesity levels. In column 1 we report results from a specification controlling for high school completion at 21. For instance, if casino transfers helped maintain the tribal children in school for longer, and own education affects BMI independently from income (e.g. see Baum and Ruhm, 2009), the cohort differences at age 19 may be driven by own education, rather than heterogeneous effects by initial household income. The results are very similar to the baseline specification reported in Table 2. In column 2 of Appendix Table 2 we report a specification

[22] See Lundberg and Pollak (1996) for a discussion of this literature or Behrman (1997). Additionally, in a previous paper (Akee et al, 2010) we report that household structure appears to be unaffected by the casino income payments; we find no evidence for increased divorce or marriage rates over time.

controlling for birth weight. This is the best proxy for initial capital that we have in the data. We split birth weight into three categories – low birth weight (below 2500 grams), normal weight (>2500 and <4500 grams) and high birth weight (>4500 grams). The omitted category in the estimation is normal birth weight. We find that the main interaction coefficients do not change.

The differences we find between youths coming from different income backgrounds could be due to differences in food supply. For example, if low-income households reside in areas where high quality food is sparse, children would receive worse nutrition even if parents have the financial means to provide better quality food. To test for such effects we include county-level fixed effects in our main regression. The results are reported in column 3 of Appendix Table 2. There are no significant changes in the main coefficients. Finally, in column 4 of Appendix Table 2 we include a measure of the individual's own income at age 21. Even though the coefficient is negative, it is not statistically significant. The main coefficient on the triple interaction term with income is not significantly changed.

Differential exposure to extra income could alter maternal labor force participation among tribal members who would then, in turn, affect the child's obesity levels into adolescence and young adulthood.[23] Our data contain information on parental labor force participation for all survey years. We do not find any evidence, reported in Appendix Table 3, for changes in parental labor force participation. We

[23] Cawley (2010) offers a nice summary of the current state of the economics literature on children's obesity and in particular the role of maternal labor force participation. Skoufias and di Maro (2006) find no evidence for changes in parental labor force participation for households receiving payments from the PROGRESSA program in Mexico.

consider both maternal and paternal labor force participation. One possible explanation is that the extra $4000-$8000 a year was not enough to compensate for the loss of either the mother's or father's earnings. [24]

Finally, we use global positioning system data (GPS) to compute a distance measure which serves as proxy for other non-cash transfer related effects of the casino operations on households in Appendix Table 4. We do not expect to find much here; the Eastern Cherokee reservation is relatively small at a little over 100 square miles. Additionally, there are other relatively large economic hubs of activity in the vicinity -- Asheville, NC is less than an hour away and Knoxville, TN is just about two hours away. The average household is 32 miles (median is 36 miles) away from the casino, with a minimum distance of 5 miles and a maximum distance of 75 miles. We find that inclusion of this distance measure and an interaction variable with treatment households is not statistically significant; while the sample size diminishes somewhat do to missing information for some households, this does not change our main observed findings which are repeated in columns 2 and 4 of Appendix Table 4. .

Native American children may differ from their white counterparts differently in different cohorts for reasons unrelated to the extra income transfers. To test for

[24] There is little evidence that the casino itself generated differential employment for tribal members relative to the non-Indian parents. Overall employment does not appear to change after the casino opens for either group of parents. This is not surprising as the reservation and its residents are integrated into the regional labor market; similarly, many non-Indians work, and even reside, on the Eastern Cherokee reservation. Previous researchers have found that casino job growth on American Indian reservations was due primarily to non-Indian employment (Evans and Topoleski, 2002). Using data from the universe of tribes that opened a casino, Wolfe et al (2011) find that casino openings did not increase labor force participation among the affected tribes.

systematic differences we use the available information on health from the pre-casino period. Appendix Table 5 shows the results from models estimating the effects of extra income on birth weight, children's weight, height, and BMI at age 13. There are no significant differences between the three cohorts and across income categories when we examine the effects of casino payments on pre-intervention health outcomes.

Figures

Figure1: Simple correlations between BMI and income

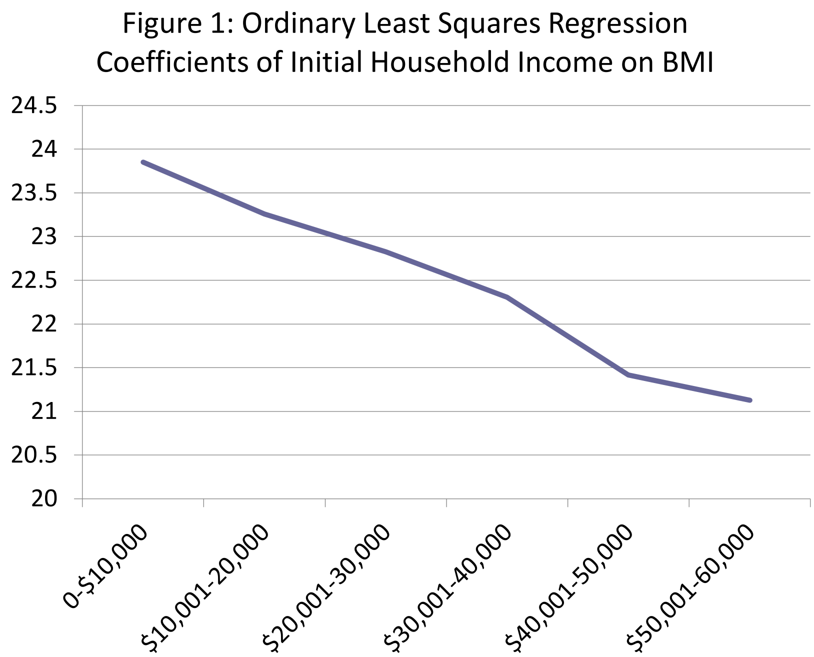


Figure 2: Distribution of BMI by Age Cohorts and Tribal Status at Age 19.

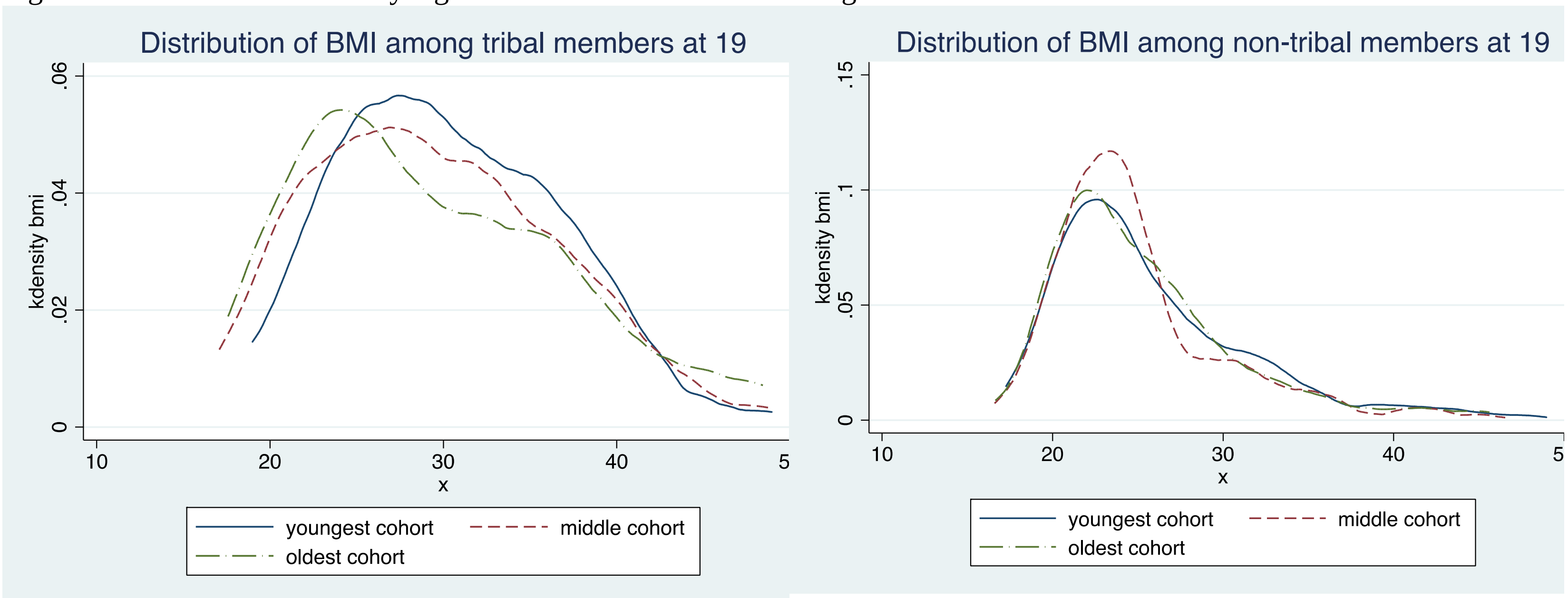
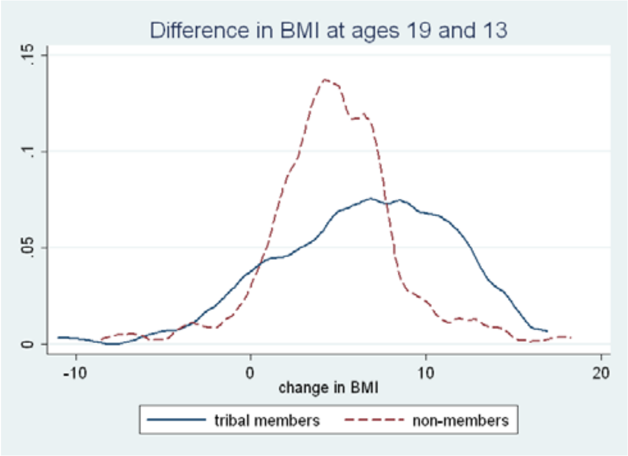
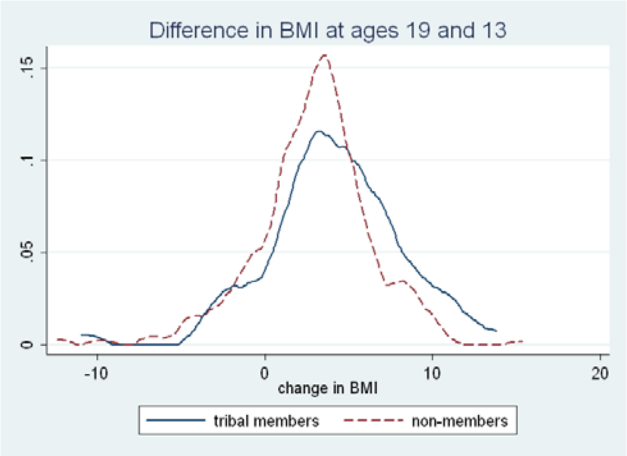


Figure 3: Distribution of changes in BMI between ages 13 and 19

Youngest cohort



Middle cohort



Oldest cohort

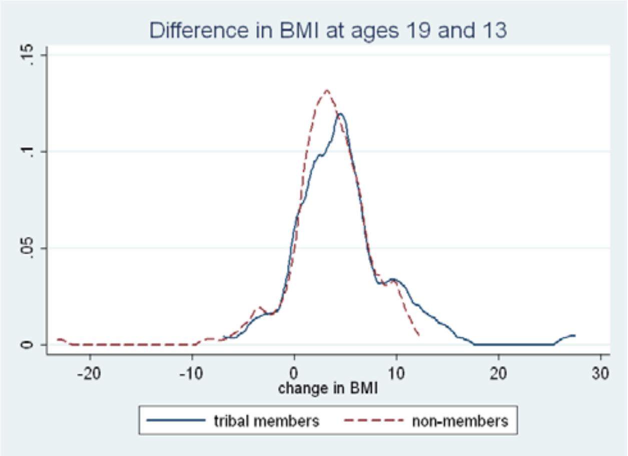
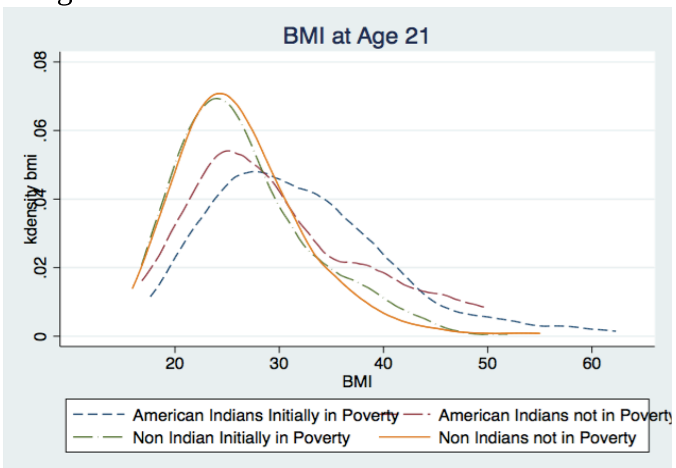


Figure 4: Distribution of BMI at ages 13 and 21 by tribal membership and income category

At age 13



At age 21

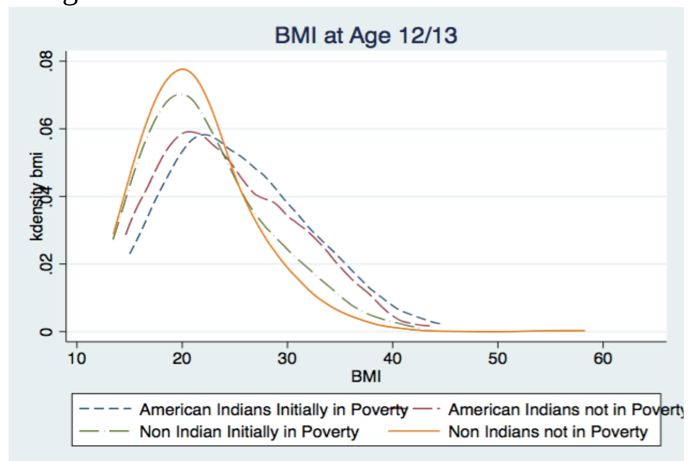


Table 1: Means and Standard Deviations of Main Outcomes and Control Variables at First Survey Wave

	Non-Indians			American Indian		
	Obs.	Mean	St. Dev.	Obs.	Mean	St. Dev.
Obese	909	0.190	0.393	304	0.362	0.481
Body Mass Index (BMI)	909	20.048	4.703	304	22.990	6.069
Weight in kgs	909	43.951	14.790	304	51.876	18.141
Height in cm	909	146.531	12.390	304	148.735	11.951
Age	909	10.870	1.625	304	10.895	1.605
Sex (1=male)	909	0.567	0.496	304	0.536	0.500
Number of American Indian Parents	909	0.017	0.127	304	1.217	0.634
Mother with high school education	909	0.290	0.454	304	0.342	0.475
Mother with college education	909	0.498	0.500	304	0.352	0.478
Mother participates in the labor force	791	0.861	0.346	255	0.863	0.345
Average pre-casino household income	899	29,104.56	17111.64	299	18,754.18	14231.39
Birthweight	822	7.485	1.333	281	7.516	1.274

Note: Average pre-casino household income categories taken at midpoints

Table 2: Marginal Effect of Casino Transfers on Obesity and Overweight Status at Ages 19 and 21; Ordinary Least Squares and Probit Regressions

VARIABLES	(1) BMI at Age 19	(2) BMI at Age 19	(3) BMI at Age 21	(4) BMI at Age 21	(5) Obese at Age 19?	(6) Obese at Age 19?	(7) Obese at Age 21?	(8) Obese at Age 21?
Age Cohort 1 x Number of AI Parents x Average HH Income		-0.637**		-0.635*		-0.0284**		-0.0444***
		(0.269)		(0.327)		(0.0125)		(0.0167)
Age Cohort 2 x Number of AI Parents x Average HH Income		-0.0254		0.0446		0.00513		0.00295
		(0.233)		(0.277)		(0.0117)		(0.0169)
Age Cohort 1 x Number of American Indian Parents	-0.624	3.033*	-1.105	2.813	-0.0244	0.119	-0.0525	0.175*
	(1.000)	(1.777)	(1.196)	(2.092)	(0.0411)	(0.0755)	(0.0513)	(0.102)
Age Cohort 2 x Number of American Indian Parents	0.168	0.248	1.042	0.888	0.0100	-0.0225	0.0157	-0.0126
	(0.981)	(1.797)	(1.144)	(2.078)	(0.0426)	(0.0753)	(0.0543)	(0.104)
Age Cohort 1 x Average HH Income		0.219		0.520***		0.0125		0.0258*
		(0.172)		(0.184)		(0.0103)		(0.0138)
Age Cohort 2 x Average HH Income		-0.0401		0.178		-0.0121		-0.00725
		(0.153)		(0.178)		(0.0102)		(0.0142)
AI Parents and Average HH Income		-0.0694		-0.132		0.00450		0.00147
		(0.181)		(0.232)		(0.00865)		(0.0123)
Average HH Income	-0.157**	-0.179	-0.0543	-0.276**	-0.0120***	-0.0118	-0.00818	-0.0166
	(0.0682)	(0.113)	(0.0786)	(0.128)	(0.00437)	(0.00775)	(0.00564)	(0.0111)
Age Cohort 1 (13 yo)	1.461**	0.0300	1.239*	-2.287	0.0380	-0.0422	0.0596	-0.102
	(0.705)	(1.488)	(0.744)	(1.571)	(0.0470)	(0.0708)	(0.0540)	(0.0926)
Age Cohort 2 (15 yo)	0.278	0.569	0.687	-0.583	-0.0102	0.0657	0.0189	0.0743
	(0.649)	(1.524)	(0.728)	(1.708)	(0.0428)	(0.0890)	(0.0570)	(0.120)
Number of AI Parents	-0.748	0.547	-1.228	0.562	-0.0379	-0.0488	-0.0952*	-0.0673
	(0.825)	(1.415)	(1.106)	(1.666)	(0.0379)	(0.0614)	(0.0498)	(0.0824)
American Indian race	5.729***	3.906***	6.050***	3.754***	0.331***	0.283***	0.424***	0.311***
	(0.983)	(0.863)	(1.190)	(1.035)	(0.0803)	(0.0795)	(0.0842)	(0.0797)
Sex	0.630	0.566	0.571	0.493	0.0145	0.0130	0.0508	0.0492
	(0.554)	(0.560)	(0.610)	(0.614)	(0.0329)	(0.0317)	(0.0399)	(0.0395)
Mother has a High School Diploma	0.374	0.261	0.505	0.297	0.00266	-0.00236	-0.00105	-0.00869
	(1.453)	(1.442)	(1.550)	(1.552)	(0.0574)	(0.0553)	(0.0692)	(0.0676)
Mother has Some College or More	-0.661	-0.848	-1.785	-2.019	-0.0346	-0.0451	-0.135*	-0.140*
	(1.420)	(1.414)	(1.519)	(1.534)	(0.0596)	(0.0590)	(0.0770)	(0.0777)
Average Labor Force Participation of Mother	-0.358	-0.338	0.655	0.566	-0.0285	-0.0315	0.0693	0.0643
	(0.882)	(0.879)	(0.934)	(0.885)	(0.0544)	(0.0521)	(0.0697)	(0.0660)
Constant	25.65***	25.99***	25.48***	27.42***				
	(1.602)	(1.829)	(1.685)	(2.001)				
	921	921	913	913	920	920	912	912

Robust standard errors in parentheses. Household income is a categorical variable where each bin is $5,000 in size. The lowest category, for instance, goes from 0 to $5,000. The second bin goes from $5,001 to $10,000, etc.
*** p<0.01, ** p<0.05, * p<0.1

Table 3: Effect of Casino Transfers on BMI; Individual Fixed-Effects Panel Regression

	(1)	(2)
VARIABLES	BMI	BMI
Household Eligible for Casino Disbursement	-0.211	0.673
	(0.379)	(0.467)
Interaction of Casino x Average Household Income		-0.184***
		(0.0513)
Number of Children in Household Less than 6 Years Old	-0.231	-0.221
	(0.145)	(0.145)
Constant	22.44***	22.45***
	(1.120)	(1.118)
Observations	4,585	4,585
R-squared	0.319	0.321
Number of gsms	1,268	1,268

Clustered standard errors at the individual level in parentheses.

*** $p<0.01$, ** $p<0.05$, * $p<0.1$

Included in all specifications but not reported are: age-by-race fixed effects and a Native American-specific time trend. Household income is a categorical variable where each bin is $5,000 in size. The lowest category, for instance, goes from 0 to $5,000. The second bin goes from $5,001 to $10,000, etc.

Table 4: Effect of Casino Transfers on Weight in Kilograms; Individual Fixed-Effects Panel Regression

VARIABLES	(1) Weight in Kilograms	(2) Weight in Kilograms
Household Eligible for Casino Disbursement	-0.667	1.384
	(1.083)	(1.413)
Interaction of Casino x Average Household Income		-0.428**
		(0.187)
Number of Children in Household Less than 6 Years Old	-0.840*	-0.817*
	(0.458)	(0.458)
Constant	66.41***	66.43***
	(3.024)	(3.021)
Observations	4,585	4,585
R-squared	0.549	0.550
Number of gsms	1268	1268

Clustered standard errors at the individual level in parentheses.

*** p<0.01, ** p<0.05, * p<0.1

Included in all specifications but not reported are: age-by-race fixed effects and a Native American-specific time trend. Household income is a categorical variable where each bin is $5,000 in size. The lowest category, for instance, goes from 0 to $5,000. The second bin goes from $5,001 to $10,000, etc.

Table 5: Effect of Casino Transfers on Height in Centimeters; Individual Fixed-Effects Panel Regression

VARIABLES	(1) Height in Centimeters	(2) Height in Centimeters
Household Eligible for Casino Disbursement	0.191	-0.910
	(0.404)	(0.688)
Interaction of Casino x Average Household Income		0.230*
		(0.129)
Number of Children in Household Less than 6 Years Old	-0.123	-0.135
	(0.231)	(0.231)
Constant	170.6***	170.6***
	(1.413)	(1.409)
Observations	4,585	4,585
R-squared	0.568	0.568
Number of gsms	1268	1268

Clustered standard errors at the individual level in parentheses.

*** p<0.01, ** p<0.05, * p<0.1

Included in all specifications but not reported are: age-by-race fixed effects and a Native American-specific time trend. Household income is a categorical variable where each bin is $5,000 in size. The lowest category, for instance, goes from 0 to $5,000. The second bin goes from $5,001 to $10,000, etc.

Table 6: Potential Altennative Mechanisms of Casino Transfers on BMI; Individual Fixed-Effects Panel Regression

VARIABLES	(1) BMI	(2) BMI	(3) BMI	(4) BMI	(5) BMI	(6) BMI
Household Eligible for Casino Disbursement	0.133	0.963*	3.298**	2.804***	4.902***	4.082***
	(0.717)	(0.553)	(1.376)	(0.904)	(1.498)	(1.580)
Interaction of Casino x Average Household Income	-0.173***	-0.166***	-0.188***	-0.204***	-0.206***	-0.199***
	(0.0551)	(0.0543)	(0.0513)	(0.0499)	(0.0497)	(0.0545)
Number of Children in Household Less than 6 Years Old	-0.293*	-0.219	-0.218	-0.221	-0.218	-0.289*
	(0.152)	(0.144)	(0.145)	(0.145)	(0.145)	(0.152)
Interaction of Casino x Mother's Labor Force Participation	0.414					0.906
	(0.673)					(0.644)
Interaction of Casino x Mother's Educational Attainment		-0.484				-0.149
		(0.526)				(0.580)
Interaction of Casino x Child's Birthweight			-1.290**		-1.109*	-1.093
			(0.644)		(0.639)	(0.670)
Interaction of Casino x Child's Average Weight Prior to Casino Intervention				-0.0307**	-0.0284**	-0.0291**
				(0.0130)	(0.0130)	(0.0137)
Constant	20.95***	22.42***	22.41***	22.42***	22.39***	20.85***
	(1.558)	(1.124)	(1.113)	(1.115)	(1.112)	(1.557)
Observations	4,126	4,585	4,585	4,574	4,574	4,120
R-squared	0.319	0.321	0.322	0.322	0.323	0.322
Number of gsms	1,131	1,268	1,268	1,262	1,262	1,128

Clustered standard errors at the individual level in parentheses.

*** p<0.01, ** p<0.05, * p<0.1

Included in all specifications but not reported are: age-by-race fixed effects and a Native American-specific time trend. Household income is a categorical variable where each bin is $5,000 in size. The lowest category, for instance, goes from 0 to $5,000. The second bin goes from $5,001 to $10,000, etc. Birth weight is coded in 3 categories: 1 if birth weight is <2500 grams; 2 if birth weight is >2500 grams but less than 4500 grams; 3 if birth weight is >4500 grams.

Table 7: Effect of Casino Transfers on BMI; Individual Fixed-Effects Panel Regression

	(1)
VARIABLES	BMI
Household Eligible for Casino Disbursement	-1.401**
	(0.571)
Casino x Lowest 2 Average Household Income Categories in First 3 Survey Waves	1.631**
	(0.765)
Casino x 3rd and 4th Average Household Income Categories in First 3 Survey Waves	1.492**
	(0.590)
Casino x 5th and 6th Average Household Income Categories in First 3 Survey Waves	1.208*
	(0.723)
Casino x 7th and 8th Average Household Income Categories in First 3 Survey Waves	1.598**
	(0.678)
Casino x 9th and 10th Average Household Income Categories in First 3 Survey Waves	-0.798
	(0.731)
Casino x 11th and Higher Average Household Income Categories in First 3 Survey Waves	0.370
	(0.785)
Number of Children in Household Less than 6 Years Old	-0.234
	(0.145)
Constant	22.36***
	(1.130)
Observations	4,585
R-squared	0.321
Number of gsms	1268

Clustered standard errors at the individual level in parentheses.
*** $p<0.01$, ** $p<0.05$, * $p<0.1$
Included in all specifications but not reported are: age-by-race fixed effects and a Native American-specific time trend. Household income is a categorical variable where each bin is $5,000 in size. The lowest category, for instance, goes from 0 to $5,000. The second bin goes from $5,001 to $10,000, etc.

Appendix Table 1: Difference in Difference Regression for Obesity at Ages 19 and 21 by Gender of Parent Receiving Casino Transfer Payment

VARIABLES	(1) Obese at Age 19?	(2) Obese at Age 21?
Age Cohort 1 x American Indian Mother	0.0188	-0.0460
	(0.0854)	(0.0928)
Age Cohort 2 x American Indian Mother	-0.00428	-0.0354
	(0.0912)	(0.0948)
Age Cohort 1 x American Indian Father	-0.0522	-0.0614
	(0.0788)	(0.0776)
Age Cohort 2 x American Indian Father	0.0813	0.116
	(0.130)	(0.117)
Age Cohort 1 (13 yo)	0.0401	0.0500
	(0.0466)	(0.0494)
Age Cohort 2 (15 yo)	-0.0125	0.0185
	(0.0404)	(0.0494)
Child has an American Indian Mother?	-0.0825	-0.0557
	(0.0770)	(0.0805)
Child has an American Indian Father?	-0.00408	-0.112**
	(0.0622)	(0.0570)
Average HH Income	-0.00978**	-0.00311
	(0.00461)	(0.00528)
American Indian race	0.319***	0.350***
	(0.0547)	(0.0619)
Sex	0.0121	0.0456
	(0.0342)	(0.0401)
Mother has a High School Diploma	-0.0107	-0.00734
	(0.0721)	(0.0930)
Mother has Some College or More	-0.0471	-0.158*
	(0.0689)	(0.0859)
Mother's Age	-0.00343	-0.00263
	(0.00263)	(0.00316)
Average Labor Force Participation of Mother	-0.0382	0.0566
	(0.0652)	(0.0606)
Constant	0.402***	0.342*
	(0.145)	(0.179)
Observations	911	909
R-squared	0.061	0.076

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Appendix Table 2: Difference in Difference Regression with Additional Controls at age 21; Marginal effects from Probit estimation

	(1)	(2)	(3)	(4)
	Obese at Age 21?	Obese at Age 21?	Obese at Age 21?	Obese at Age 21?
Age Cohort 1 x Number of AI Parents x Average HH Income	-0.176***	-0.179***	-0.196***	-0.159**
	(0.0656)	(0.0650)	(0.0696)	(0.0670)
Age Cohort 1 x Number of AI Parents x Average HH Income	0.0110	0.0108	-0.0195	0.00151
	(0.0675)	(0.0671)	(0.0725)	(0.0695)
Age Cohort 1 x Number of American Indian Parents	0.675*	0.698*	0.807*	0.666
	(0.399)	(0.403)	(0.417)	(0.413)
Age Cohort 2 x Number of American Indian Parents	-0.0418	-0.0496	0.163	0.0830
	(0.413)	(0.415)	(0.430)	(0.424)
HS graduate	0.151			
	(0.180)			
Low birth weight		-0.0942		
		(0.345)		
High birth weight		0.274		
		(0.325)		
County Fixed Effects?			Yes	
Independent Household Income				-0.0393
				(0.0499)
Constant	-0.651	-0.597	-0.448	-0.312
	(0.497)	(0.511)	(0.580)	(0.545)
Observations	912	912	911	817

Note: Includes all of the control variables from regression in Table 2

Robust standard errors in parentheses. Household income is a categorical variable where each bin is $5,000 in size. The lowest category, for instance, goes from 0 to $5,000. The second bin goes from $5,001 to $10,000, etc.

*** p<0.01, ** p<0.05, * p<0.1

Appendix Table 3: Fixed-Effects Regression for Changes in Mothers' and Fathers' Labor Force Participation Rates

VARIABLES	(2) Full-Time Employment: Mother	(4) Full-Time Employment: Father
Household Eligible for Casino Disbursement	0.0440	-0.0225
	(0.0307)	(0.0192)
Household Income	0.00377	0.00251
	(0.00385)	(0.00215)
Number of Children in Household Less than 6 Years Old	-0.00786	-0.0326
	(0.0159)	(0.0221)
Mother's Age	0.00306	0.000244
	(0.00304)	(0.00196)
Constant	0.728***	0.922***
	(0.115)	(0.0750)
Observations	3,399	1,848
R-squared	0.004	0.005
Number of gsms	1136	619

Clustered standard errors in parentheses. Household income is a categorical variable where each bin is $5,000 in size. The lowest category, for instance, goes from 0 to $5,000. The second bin goes from $5,001 to $10,000, etc.

*** p<0.01, ** p<0.05, * p<0.1

Appendix Table 4: Effect of Cash Transfer on Child's Obesity at Ages 19 and 21 with Distance to Casino Interactions

VARIABLES	(1) Obese at Age 19?	(2) Obese at Age 19?	(3) Obese at Age 19?	(4) Obese at Age 21?	(5) Obese at Age 21?	(6) Obese at Age 21?
Interaction 1: Age Cohort 1 x Number of	-0.00636	0.138*	0.0241	-0.0389	0.167	-0.125
AI Parents	(0.0517)	(0.0807)	(0.0799)	(0.0560)	(0.105)	(0.0917)
Interaction 2: Age Cohort 2 x Number of	0.00200	-0.0123	0.0460	0.0307	0.00170	-0.0223
AI Parents	(0.0539)	(0.0800)	(0.0774)	(0.0583)	(0.107)	(0.0950)
Age Cohort 1 x Number of AI Parents x		-0.0300**			-0.0418**	
Average HH Income		(0.0131)			(0.0168)	
Age Cohort 2 x Number of AI Parents x		0.00238			-0.00101	
Average HH Income		(0.0125)			(0.0174)	
Interaction 1: Age Cohort 1 x Number of			-0.0829			0.0709
AI Parents x Distance to Casino			(0.160)			(0.225)
Interaction 2: Age Cohort 2 x Number of			-0.160			-0.180
AI Parents x Distance to Casino			(0.189)			(0.274)
Distance to Casino			0.0102			0.186
			(0.128)			(0.141)
Observations	856	856	856	853	853	853

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Note: Includes all other covariates used in the main regressions as well as the distance measure and the distance measure interacted with the age cohort variables and distance interacted with the number of AI parents. Sample size decreases from previous cross-section regressions due to missing observations and covariates. Household income is a categorical variable where each bin is $5,000 in size. The lowest category, for instance, goes from 0 to $5,000. The second bin goes from $5,001 to $10,000, etc.

Appendix Table 5 : Falsification tests: BMI, Weight, Height and Birthweight at Age 13 Pre-Treatment Regressions

VARIABLES	(1) BMI	(2) Weight	(3) Height	(4) Birthweight
Age Cohort 1 x Number of AI Parents x Average HH Income	-0.294	-0.918	-0.758	-0.118
	(0.833)	(2.982)	(1.381)	(0.246)
Age Cohort 2 x Number of AI Parents x Average HH Income	-0.125	0.105	0.596	0.061
	(0.213)	(0.645)	(0.431)	(0.067)
Age Cohort 1 x Number of American Indian Parents	0.835	5.832	7.638	0.241
	(3.553)	(12.602)	(6.764)	(0.939)
Age Cohort 2 x Number of American Indian Parents	1.273	0.814	-2.730	-0.325
	(1.494)	(4.603)	(3.190)	(0.450)
Age Cohort 1 x Average HH Income	0.622	2.029	0.845	0.122
	(0.543)	(1.872)	(0.735)	(0.100)
Age Cohort 2 x Average HH Income	-0.026	-0.428	-0.416	0.060
	(0.158)	(0.449)	(0.390)	(0.053)
AI Parents and Average HH Income	0.029	-0.149	-0.392	-0.122**
	(0.123)	(0.410)	(0.372)	(0.051)
Average HH Income	-0.213	-0.249	0.330	-0.005
	(0.138)	(0.294)	(0.366)	(0.031)
Age Cohort 1 (13 yo)	-2.614	-6.232	-1.747	-0.379
	(2.742)	(10.473)	(5.490)	(0.501)
Age Cohort 2 (15 yo)	0.726	5.747	4.231	-0.609
	(1.422)	(3.980)	(3.403)	(0.409)
Number of AI Parents	-1.027	-4.878	-3.272	1.106**
	(1.170)	(4.376)	(3.679)	(0.535)
Observations	773	773	773	731
R-squared	0.0909	0.0906	0.0319	0.0349

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Includes: gender variables, dummy variables for mother's education, labor force participation of the mother. Household income is a categorical variable where each bin is $5,000 in size. The lowest category, for instance, goes from 0 to $5,000. The second bin goes from $5,001 to $10,000, etc.

Appendix Table 6: Effect of Casino Transfers by Years of Treatment on BMI; Individual Fixed-Effects Panel Regression

VARIABLES	(1) BMI	(2) BMI	(3) BMI	(4) BMI	(5) BMI	(6) BMI	(7) BMI	(8) BMI
Years Receiving Casino Transfer	0.211	0.323	0.443	0.350	0.700	0.366	0.684	0.706
	(0.379)	(0.381)	(0.380)	(0.396)	(0.457)	(0.382)	(0.453)	(0.460)
Interaction of Years of Receiving Transfer x Average Household Income		-0.0286**	-0.0343**	-0.0270**	-0.0293**	-0.0340***	-0.0342***	-0.0446***
		(0.0129)	(0.0133)	(0.0135)	(0.0130)	(0.0128)	(0.0128)	(0.0137)
Number of Children in Household Less than 6 Years Old	-0.231	-0.225	-0.287*	-0.224	-0.226	-0.218	-0.220	-0.276*
	(0.145)	(0.146)	(0.152)	(0.146)	(0.146)	(0.147)	(0.146)	(0.152)
Interaction of Years of Receiving Transfer x Mother's Labor For			0.0794					0.157
			(0.160)					(0.156)
Interaction of Years of Receiving Transfer x Mother's Education				-0.0417				0.0843
				(0.129)				(0.152)
Interaction of Years of Receiving Transfer x Child's Birthweight					-0.216		-0.184	-0.184
					(0.149)		(0.148)	(0.162)
Interaction of Years of Receiving Transfer x Child's Average Weight Prior to Casino Intervention						-0.00529*	-0.00487	-0.00559*
						(0.00309)	(0.00311)	(0.00326)
Constant	23.16***	23.26***	22.26***	23.30***	23.00***	22.50***	22.34***	21.20***
	(1.614)	(1.594)	(1.920)	(1.591)	(1.616)	(1.633)	(1.648)	(1.938)
Observations	4,585	4,585	4,126	4,585	4,585	4,574	4,574	4,120
R-squared	0.319	0.320	0.320	0.320	0.321	0.322	0.323	0.323
Number of gsms	1,268	1,268	1,131	1,268	1,268	1,262	1,262	1,128

Clustered standard errors at the individual level in parentheses.

*** p<0.01, ** p<0.05, * p<0.1

Included in all specifications but not reported are: age-by-race fixed effects and a Native American-specific time trend. Household income is a categorical variable where each bin is $5,000 in size. The lowest category, for instance, goes from 0 to $5,000. The second bin goes from $5,001 to $10,000, etc.