The Effect of Business Cycles and Parental Indebtedness on Childhood Obesity

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Abstract

In this paper we examine how business cycles affect obesity among children, and whether the effect is different for a subsample of households with consumer debt. We use data from three waves of the Child Development Supplement of the Panel Study of Income Dynamics spanning from 1997 to 2007, along with monthly state-level unemployment data. These data have measures of household debt and child obesity, as well as food expenditures and time use data. We find that a higher unemployment rate is associated with a lower weight for children in households with debt. While we find that the children in households with debt appear to exercise more during recessions, this relationship does not explain the relationship between recessions and childhood obesity. We speculate that households may be using debt to smooth consumption and protect health during recessions.

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1 Introduction

The effect of macroeconomic downturns on health has been well documented. In the US and other developed countries, transitory economic conditions, as measured by higher unemployment rates, are associated with lower mortality rates and better health behaviors (Ruhm, 2000; Dehejia & Lleras-Muney, 2004; Ruhm, 2005; Aguiar, Hurst, & Karabarbounis, 2011). Health benefits have been recorded for both adults (Stevens, Miller, Page, & Filipski, 2011) and infants (Dehejia & Lleras-Muney, 2004). However, there is evidence that health benefits from recessions may not be universally shared.[1] Coile, Levine, and McKnight (2012) find that recessions serve to worsen the long-term health outcomes among workers who are approaching retirement age and become unemployed during a recession. Minority groups and the less-educated in the US have been found to suffer worsening health with economic downturns (Charles & DeCicca, 2008). In low-income countries, population health declines with recessions (Ferreira & Schady, 2008; Lobstein & Frelut, 2003). These findings suggest that some, usually more vulnerable populations, suffer negative health effects due to the stress of economic insecurity and job loss while other individuals may be able to invest more time into health improving activities when the economy slows.

There are also reasons to believe that the obesity response to recessions might be different from other health outcomes. On the one hand, the opportunity cost of exercise and home production goes down during recessions and so individuals may be losing weight. But on the other hand, the income decline associated with recessions may cause households to consume cheaper, less nutritious foods and the stress, depression, and economic insecurity associated with recessions may induce weight gain. The empirical evidence on the relationship between recessions and obesity is mixed. For instance, Ruhm (2005) finds that excess weight declines during recessions in the US while Bockerman et al. (2007) find that weight increases during recessions in Finland.

In this paper, we examine how economic conditions affect childhood obesity and then con-

[1] We use the term 'recessions' and 'economic downturn' loosely to indicate months in which the economy is contracting and unemployment is rising as opposed to formal definition in which there are two consecutive quarters of falling GDP or the 1.5% rise in unemployment within 12 months.

sider whether the effect is different for children who live in households with debt. In so doing we make several contributions to the existing literature. First, most of the research connecting recessions with health focus on adults (exceptions include Dehejia and Lleras-Muney (2004), Arkes (2009), Courtemanche (2009), and Stevens, Miller, Page, and Filipski (2011)). Focusing on children is important because poor health during childhood has been shown to have permanent effects on health, earnings and social status into adulthood (Case, Fertig, & Paxson, 2005; Anderson & Butcher, 2006). Weight gain, in particular, is difficult to reverse (Daniels, 2006; Stettler, Zemel, Kimanyika, & Stallings, 2002; Ogden, Carroll, Curtin, Lamb, & Flegal, 2012) and childhood overweight increases the probability of adult obesity and all of its associated health problems and costs (Finkelstein et al., 2012). Children are also a theoretically interesting sample because they do not work in the US so their body weight cannot be affected directly by job-related stress or the physical exertion of employment, as might be true of adults.

Second, we explore whether the effect of recessions on child obesity varies by household debt status. Consumer debt has grown enormously in the US over recent decades. Average balances on credit cards tripled between 1983 and 1995 (Sullivan, 2008). This trend is accompanied by both positive and negative consequences. Households are less credit-constrained but they have also consumed beyond their means resulting in the financial burden of debt. Thus, families with debt may be financially constrained due to their debt making them particularly hard hit by recessions. Or households with access to credit may be increasing debt during recessions to smooth consumption (Carroll, Slacalek, & Sommer, 2012; Sullivan, 2008) and in so doing may be able to invest in health capital. Thus, we hypothesize that debt may play an important role in the relationship between recessions and health.

For this study we use the Child Development Supplement (CDS) of the Panel Study of Income Dynamics (PSID). This dataset covers childhood obesity over a ten year period observed at three points in time (1997-1998, 2002-2003, and 2007). These data include detailed information on children and can be linked to parent data in the main PSID dataset. Following the literature, we use the monthly state unemployment rate to measure macroeconomic downturns and we account

for state-specific time trends in our analysis. In addition, because we have multiple observations on children, we can account for unobservable characteristics with child-level fixed effects. We find that higher unemployment is associated with a lower percentile body mass index (BMI) for children in households with debt. While we find that the children in households with debt appear to exercise more during recessions, physical activity does not explain the relationship between recessions and weight loss among these children.

2 Background and Theory

The theoretical connections between business cycles and obesity lead to an ambiguous prediction. On the one hand, economic theory suggests that individuals invest in their health in economic downturns because as wages fall, the cost of time-intensive health-related activities (like exercise and preparing healthy meals at home) falls. This is a classic substitution effect. If individuals are unemployed or underemployed, they may have more time available than during economic booms. Consistent with these theories, Ruhm (2000) finds that people increase their physical exercise and Edwards (2011) finds that people increase their time spent preparing foods at home during recessions.

Related to this argument, childhood health, in particular, may improve during recessions if mothers are less likely to be working during recessions (Edwards, 2011). Mother's time is an important input in a child's health production function. Supporting this theory, there is substantial empirical evidence indicating that mother's employment is associated with a higher BMI for their children, especially among mothers with higher levels of education, as their time investment may be more productive (Anderson, Butcher, & Levine, 2003; Courtemanche, 2009; Fertig, Glomm, & Tchernis, 2009; Ruhm, 2008). If instead women's work hours are counter-cyclical because married women are more likely to work during recessions when husbands are unemployed or underemployed (Maloney, 1987), then we would expect a rise in children's weight during recessions.

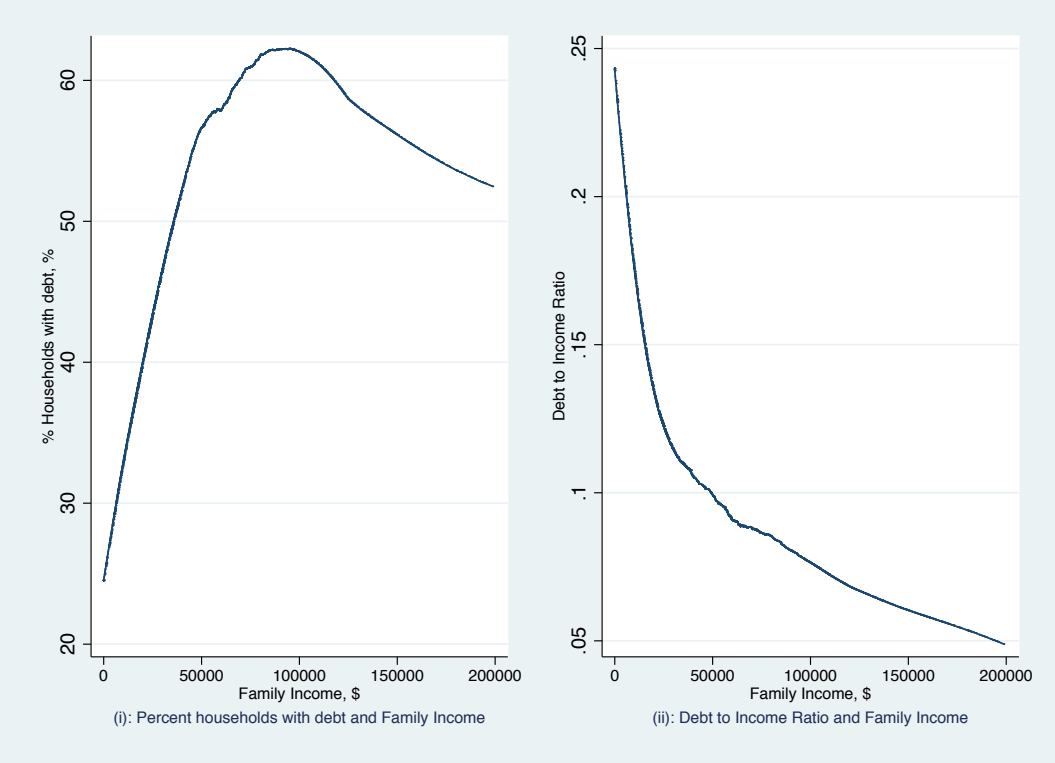
Recessions are not only associated with more time, but also less income. The decline in income associated with a recession reduces consumption of all normal goods, which includes health-related goods like expensive, nutritious foods and sports lessons, but also unhealthy goods like rich restaurant meals. Miller and Branscum (2012) find that eating out falls during recessions, which would suggest weight loss. In contrast, Dave and Kelly (2012) find that consumption of fruit and vegetables falls but consumption of snacks and fast foods rise during recessions, suggesting weight gain.

Finally, a theory from behavioral biology conjectures that humans are programmed to gain weight in times of economic insecurity to protect against food shortages (Smith, Stoddard, & Barnes, 2009). Similarly, stress and depression from unemployment risk may induce people to consume more calories (Wurtman, 1993). Studies show that psychological stress in the household can increase the probability of obesity among children (Koch, Sepa, & Ludvigsson, 2008). If these theories hold, economic downturns may result in a rise in obesity.

We are also interested in whether household consumer debt increases or decreases the effect of business cycles on child weight. Households with debt may be more financially constrained and as a result may be more likely to respond to the income effect (compared to the substitution effect) because they do not have the financial cushion to reduce hours worked. A reduction in wages or an increase in the risk of unemployment may induce workers in these households to work more hours, not fewer. While we do not know of any evidence about own-wage elasticities for those with debt specifically, there is evidence that poor households and women in particular have negative wage elasticities, consistent with a strong income effect (Kalachek & Raines, 1970; Tella, Tella, & Green, 1971). Debt can also contribute to the sense of economic insecurity which may affect weight gain. Consistent with this, there is evidence that debt increases stress and reduces an individual's ability to make healthy consumption choices (Keese & Schmidt, 2010). Debt in itself can have negative health consequences as well. Drentea and Lavrakas (2000) find that rising debt-to-income ratios are associated with worsening physical health and self-reported health measures.

In contrast to these arguments, the ability to borrow allows households to smooth consumption. Sullivan (2008) finds that households, especially poor households, use credit cards to smooth consumption during recessions. Those households without debt may have borrowing constraints. In Figure 1(i), we use data from the PSID to show that the percentage of households that carry any consumer debt rises with total family income (falling slightly for incomes higher than about $100,000/year), suggesting that the very poor may be credit-constrained. However, we show in Figure 1(ii) that the ratio of debt to income in our sample is highest for the poorest households, suggesting that low-income families with access to credit may be using debt to smooth consumption. Thus, households may accumulate debt in recessions to protect themselves from contracting their consumption to uncomfortable levels, or to invest in health capital.

Figure 1: Debt and Income



Source: Authors' calculations using data from the PSID-CDS.

3 Data and Methods

3.1 Data

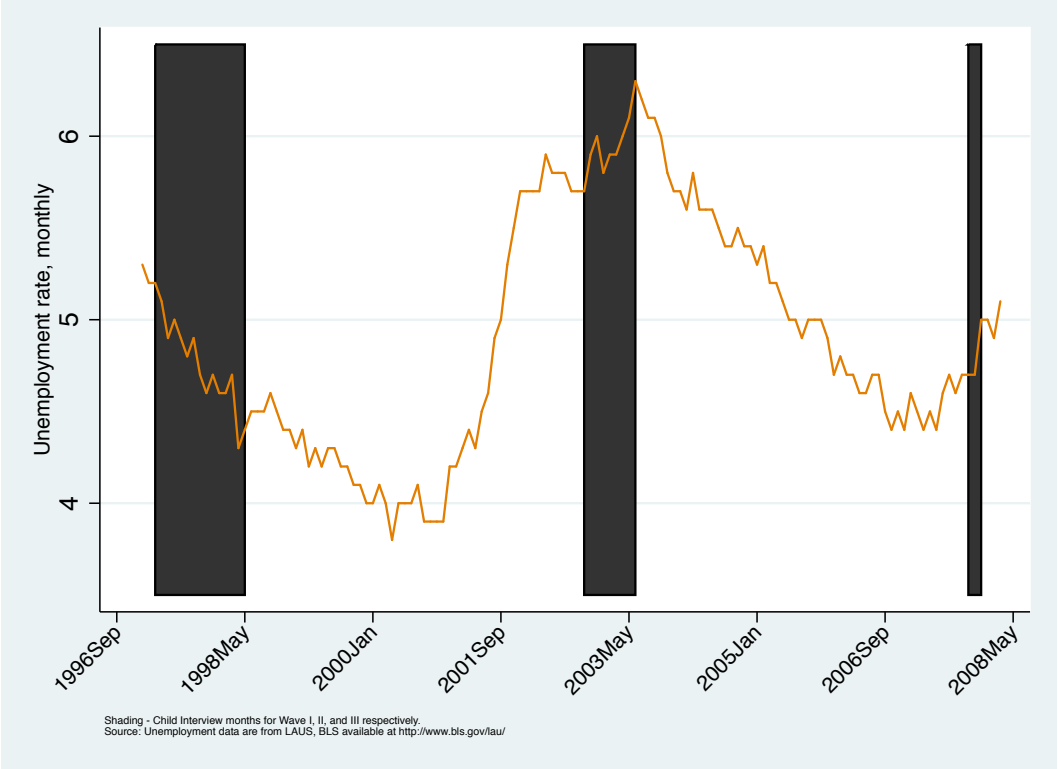
The data used in this study are from the the Child Development Supplement of the Panel Study of Income Dynamics and the Bureau of Labor Statistics. The PSID has followed a nationally representative sample of households and a low-income oversample since 1968. Over time, the study has added the 'split-off' households as children and other members of the original PSID households start their own households. The CDS began in 1997 collecting additional information on approximately 3,500 children under the age of 13 in PSID households in 1997 and 1998. The children were followed-up in 2002-2003 and then again in 2007. Only CDS children under the age of 19 were re-interviewed at follow-up waves. We link the children in the CDS to their parent and household characteristics in the main PSID interview from the closest corresponding year (1997, 2003, and 2007).

We omit about 600 person-year cases because we must drop children under the age of 2 (percentile BMI charts are only available for those above age 1) and because of missing information on the child's BMI or household debt. Our analysis sample contains 6,525 observations of 3,372 children between the ages of 2 and 18 at the time of interview. Of these children, 1,831 are observed twice and 661 are observed three times. Some of the children are siblings as the CDS included at most two children per family and many are cousins because all households are derived from the 1968 household sample. For this reason, we cluster the standard errors in all regressions to account for intra-cluster correlations at the 1968 family level.

Using current state identifiers and month and year of interview, we merge on state-level monthly unemployment rates from the Local Area Unemployment Statistics dataset available on the Bureau of Labor Statistics website. Figure 2 shows the trend in the monthly unemployment rate for the entire US. We have highlighted the months when interviews were conducted for the three waves of the CDS. The shaded regions depict months during which either the child or family interview

were conducted (Wave 1: March 1997 - May 1998, Wave 2: October 2002 - June 2003, and Wave 3: October 2007 - December 2007). The first wave coincides with falling unemployment rates, the second wave covers a period of relatively high unemployment, and the third wave covers a period of rising unemployment rates prior to the Great Recession of 2007. The figure demonstrates that the movements in the unemployment rate are strongly correlated with macroeconomic conditions.[2]

Figure 2: PSID-CDS and the US Monthly Unemployment Rate, 1995-2008



3.1.1 Outcome – Percentile BMI

The primary variable of interest in this analysis is the child's percentile body mass index. BMI is weight in kilograms divided by height in meters squared (kg/m^2). The height and weight data used to calculate the BMI are not self-reported but are collected by direct measurement either by

[2]We note that although the unemployment rate is affected by discouraged workers, it is still widely used in the literature as a key indicator of economic downturns (Bockerman et al., 2007). Some authors argue that better measures of economic conditions are real GNP (van Den Berg, Lindeboom, & Portrait, 2005) and the employment rate which captures the movements into and out of the labor market (Ruhm, 2005).

the interviewer or the parent at the time of the interview. Because children's growth is rapid, the BMI scale does not correlate well with obesity as it does for adults. Therefore, the Centers for Disease Control and Prevention (CDC) has produced a chart of percentiles describing the BMI distribution by the age in months (starting at 24 months) and sex of children based on early waves of the National Health and Nutrition Examination Survey. We use these charts to construct the percentile BMI for each child at each interview wave and use this as our continuous dependent variable.

Summary statistics for our variables are in Table 1. The average percentile BMI for our sample is 69.9 such that boys have a slightly higher percentile BMI on average than girls. The fact that the average is higher than 50 reflects the increase in overweight among children over time.

3.1.2 Key explanatory variables

Our proxy for macroeconomic conditions is the unemployment rate - the percent unemployed among non-institutionalized civilians who are aged 16 years and older. Following Ruhm (2008), we compute a three month average state unemployment rate - the average includes the two months prior to the child's interview month and the interview month. The average 3-month state unemployment rate for our sample is 5.3% and ranges between 2.4% and 8.5%.

As does most of the literature in this area, our analysis only captures the contemporaneous, and potentially temporary, effect of recessions on child weight. We may explore longer-term effects in the future using observations observed three times over the window between 1997 and 2007 as there is some recent evidence that finds longer-term effects of recessions (Coile et al., 2012). We hypothesize that weight gains, in particular, may result in permanent health changes as they tend to be hard to reverse.

Household debt is collected in the main PSID interview and includes credit card charges, student loans, medical or legal bills, or loans from relatives, but does not include any mortgage on a primary

Table 1: Descriptive Statistics

	Mean	Min	Max
Percentile BMI (full sample)	69.9	0	100
Percentile BMI (boys)	71.0	0	100
Percentile BMI (girls)	68.8	0	100
3-month average state unemployment rate	5.3%	2.4%	8.5%
Any debt	0.53	0	1
Debt value (2006$)	$5,756	$0	$727,679
Debt to income ratio	0.10	0	1
Child is girl	0.49	0	1
Age of child (months)	124.7	24	227
African-American	0.42	0	1
Other Race	0.12	0	1
Head is high school dropout	0.21	0	1
Head has some college	0.25	0	1
Head has college degree	0.19	0	1
Female-headed household	0.32	0	1
Number of children in family	2.2	0	9
Family income (2006$)	$65,975	$0	$2,335,760
Own home	0.61	0	1
Hours worked by head	39.3	0	108

N = 6525 child-year observations; 3372 unique child observations.
The sample includes 3310 male observations from 1717 unique males and 3215 female observations on 1655 unique females.

residence or vehicle loans. Unfortunately, debt is not collected in the 1997 family interview so debt from the 1999 family interview is matched to the 1997 CDS child observation. For children observed in 2002-2003, the debt variable is taken from the 2003 family interview. For children observed in 2007, the debt variable is taken from the 2007 family interview. We use two measures of household debt: whether the household has any debt, and the debt to income ratio (which is restricted to range between 0 and 1). More than half of the sample (53%) has consumer debt such that the average balance (including 0s) is $5,756. The average debt-to-income ratio is 10%. Female-headed households are less likely to have any debt than male-headed households (46.3% vs. 56.6%), but have a higher debt-to-income ratio than male-headed households (13% vs. 8%).

The econometric models also include the child's gender, age in month (and its square), the child's race, the household head's education, whether the household is female-headed, the number of children in the family, family income, whether the household owns their home, and the head's average weekly hours worked.[3] These variables capture demographic and socioeconomic

[3]Approximately 5 percent of child-year observations were missing the household head's education and the child's race

characteristics known to affect body weight.[4]

Across all observations, children were on average a little over 10 years (124.7 months). The sample includes a large proportion of African-American children (42%) because of the oversample of low-income households. 21% of heads do not have a high school degree ($<$ 12 years), 25% have between 12 and 16 years of schooling, and 19% have a college degree ($\geqslant$16 years). 32% of the family observations have a female head and there are two children on average in each family. The average family income was $66,000 in 2006 dollars and 61% either own or are buying a home or a mobile home. On average, the head of the household works 39.3 hours per week, with single mothers working 30.2 hours per week.

3.1.3 Behaviors as Potential Mechanisms

In addition to estimating the relationship between recessions, parental debt and child weight, we also examine whether measures of maternal employment, food expenditure, and physical activity are behaviors that may help explain the relationship. From the main PSID interview, we obtain measures of maternal work hours and spending on food. Maternal average weekly work hours is calculated by dividing the total annual hours on all jobs including overtime by the total number of weeks worked the year prior to the interview year. The two questions on food expenditures we use from the family interview are the total weekly spending on food used in the home, and the total weekly spending on eating out by the head and everyone in the family.

A unique feature of the CDS data is time diaries are also collected at each interview wave. The primary caregiver or the child (if old enough) was instructed to write down what the child was doing at every point in time over 2 days – 1 week day and 1 weekend day. Since a child can be engaged in multiple activities simultaneously, the time diary permits two activities to be assigned to any given time – a primary and a secondary activity. In addition, the time diary asks that the

so we include dummy variables to indicate that education and race are missing.

[4]When child fixed effects are included, the time-invariant characteristics (gender and race) are omitted as control variables.

respondent indicate if the mother was participating in the activity with the child or whether the mother was 'around' during the activity.[5] From the time diaries, we have created three time-use variables measured in minutes: time spent participating in an activity with the mother or with the mother around, time spent playing sports, and time spent watching TV.

Table 2 provides means for these six behaviors representing potential mechanisms grouped by high and low average unemployment rates. While mother's work hours do not appear to differ by the unemployment rate category, the time spent with the mother is significantly lower when the unemployment rate is high. Spending on eating out is higher when the unemployment rate is high, but spending on food consumed at home is not significantly different across groups. Finally, when the unemployment rate is high, time spent playing sports is significantly lower while time spent watching TV is significantly higher. All of these unconditional differences suggest that behaviors change in a way to raise child weight during recessions. We use these as possible mechanisms through which recessions and debt may raise or lower child BMI.

Table 2: Statistics on behaviors as potential mechanisms

	Avg UR<5.3	Avg UR≥5.3
Mother's average weekly hours worked	27.6	27.9
Time with mother (minutes over 2 days)	731.9	677.3***
Weekly Home Food Expenditures (2006$)	$102.8	$100.8
Weekly Eating Out Expenditures (2006$)	$29.6	$32.3***
Time spent playing sports (minutes over 2 days)	153.0	118.7***
Time spent watching TV (minutes over 2 days)	299.7	328.2***

T-tests compare means across groups. *** p<0.01, ** p<0.05, * p<0.1
While mother's work hours are known for the entire sample (n=6525), the food expenditure variables are available for 6478 observations. The time diary variables are only available for 5260 observations.

3.2 Methods

The basic empirical strategy builds on the foundation of Ruhm (2000, 2003, 2005) for understanding the effect of business cycles on health outcomes. We consider the following reduced-form

[5]The same is asked about the father. However, we focus on mothers and not fathers because father's work has been shown to not affect child obesity (Courtemanche, 2009; Cawley & Liu, 2012).

specification:

$$\begin{aligned} pBMI_{ism} &= \beta_1 UR_{sm} + \beta_2 DEBT_{it} + \beta_3 UR_{sm} DEBT_{it} \\ &+ \beta_4 X_{ism} + \mu_s + \gamma_t + \nu_{s*t} + \epsilon_{ismt} \end{aligned} \tag{1}$$

where $pBMI$ is the outcome variable of interest - the percentile BMI of the ith child living in state s interviewed in year-month m. UR_{sm} is the average unemployment rate over three months before and including year-month m in state s. $DEBT_{it}$ is one of two debt measures for child i's household measured for year t: whether the household has any debt or the debt to income ratio. X_{ism} includes the child and family characteristics listed in the bottom panel of Table 1 and ϵ_{ismt} is the disturbance term. In this specification, we include state fixed effects, year fixed effects, and state-specific linear time trends. The year effect accounts for factors that vary uniformly over time across states and the state effects account for differences across states. The main source of identification then is the within-state variation in the unemployment rate and debt that deviates from national trends and state-specific trends.

As it is not possible for children's weight to affect the state's unemployment rate, and unlikely that it affects parental debt, bias due to reverse causality is not our concern. However, because the factors that contribute to child weight are complicated, it is likely that this model suffers from omitted variable bias. For this reason, we modify the baseline model to include child fixed effects, shown in equation (2).

$$\begin{aligned} pBMI_{ism} &= \beta_1 UR_{sm} + \beta_2 DEBT_{it} + \beta_3 UR_{sm} DEBT_{it} \\ &+ \beta_4 X_{ism} + \gamma_t + \nu_{s*t} + \alpha_i + \epsilon_{ismt} \end{aligned} \tag{2}$$

This is our preferred model because it removes bias from time-invariant omitted variables, observable or otherwise. This model identifies the effects through changes in the unemployment rate and debt on changes in the child's percentile BMI. We argue that these data contain sufficient variation for our analysis. Among those children with multiple observations in the data, the percentile BMI changes on average by 29 points, the three-month average unemployment rate experienced differs

by an average of 1.2 points, and the average debt to income ratio changes by 0.146 points. Thirty five percent of households have debt in one wave, but do not in another.

The coefficients of interest are β_1 , β_2 , and β_3. β_1 measures the contemporaneous effect of the unemployment rate on the child's percentile BMI among those children without debt. β_2 indicates whether children in households with debt (or higher debt-to-income ratios) have a different percentile BMI on average than children in households without debt. β_3 indicates whether debt changes the effect of the unemployment rate on percentile BMI among children. Because the income and substitution effects of recessions work in opposite directions, and because food insecurity and stress may increase body weight, we are not able to predict the sign of β_1. Because debt may signal financial constraints or it may signal the ability to smooth consumption, we are not able to predict the signs of β_2 or β_3.

After examining whether recessions and parental debt affect child weight, we explore whether six behaviors may be mechanisms that explain the relationship. These behaviors are mother's work hours, time spent with mothers, home food expenditure, eating out expenditures, time spent playing sports and time spent watching TV. As discussed above, if the unemployment rate reduces the time available for mothers to care for and supervise their children, child weight may rise with the unemployment rate. If spending on eating out falls during recessions, assuming that restaurant food is higher calorie and less nutritious than home cooked food, child weight may fall. Likewise, a rise in spending on home cooked food could signal healthier diets. Finally, if time spent playing sports falls and time spent watching TV rises, child weight could increase.

We speculate that the relationship between the food expenditure variables and recessions may be especially affected by debt. If debt permits consumption smoothing, then spending may stay the same regardless of the unemployment rate, but if debt signals financial strain, then we would expect consumption (especially consumption of restaurant meals) to fall during recessions.

To examine whether these behaviors are potential mechanisms, we first estimate the effect

of the unemployment rate and parental debt on each of these behaviors. This step allows us to observe whether the behavior changes with the unemployment rate and debt status. Then we add to equation (2) one of these behaviors at a time and observe the change in the coefficients on the unemployment rate, debt and the debt-unemployment rate interaction.[6] We then test whether there is any statistical difference between the coefficients of interest across regressions with and without the potential mechanism control. A statistically significant reduction in the marginal effect of the unemployment rate-debt interaction on child BMI may be interpreted as the part of the interaction effect that is operating through the mechanism.

4 Results

4.1 Unemployment rate, debt, and child weight

The main results documenting the relationship between the unemployment rate and child weight are presented in Table 3. The first two columns include state fixed effects, year fixed effects and state-specific time trends, as in equation (1). The last two columns add child fixed effects, as in equation (2). The first column of each pair uses 'any debt' as the debt measure and the second column of each pair uses the 'debt-to-income ratio' as the debt measure. Without child fixed effects, we find that for households without debt, an increase of one percentage point in the unemployment rate significantly lowers a child's percentile BMI by 3 points. For households holding any amount of consumer debt, the effect of the unemployment rate is not significantly different from the effect for households without debt. However, for households with a high debt-to-income ratio, the negative effect of the unemployment rate is even larger; a one percentage point increase in the unemployment rate for a household whose debt equals their income (true for only 2.5% of households in our sample) would decrease the percentile BMI by a total of over 8 points. This is likely to be an improvement in weight status, since children in these extremely high debt burden households have a percentile BMI that is 30 points higher than a child in a household without debt. However,

[6] This strategy is common in the literature. See Fertig, Glomm, and Tchernis (2009) for discussion and further references.

children from households with the average debt-to-income ratio of 10% have a percentile BMI that is only about 3 points higher (=30 points * 10%) than a child in a household without debt.

Table 3: Do recessions and parental debt affect child BMI?

Dependent Variable: **Child's Percentile BMI**	No child fixed effects		Child Fixed Effects	
Average Unemployment Rate	-3.182***	-3.037***	0.140	0.093
	(1.176)	(1.088)	(1.053)	(0.989)
Any Debt	5.116		8.884*	
	(4.134)		(4.552)	
Any Debt * UR	-0.887		-1.606*	
	(0.770)		(0.822)	
Debt to Income Ratio		30.132***		38.289***
		(9.864)		(10.849)
Debt to Income Ratio * UR		-5.300***		-7.058***
		(1.806)		(1.972)
Child is girl	-1.892**	-1.835**		
	(0.870)	(0.868)		
Age of child (months)	-0.741***	-0.738***	-0.361*	-0.371*
	(0.027)	(0.027)	(0.212)	(0.212)
Age of child squared/1000	2.427***	2.415***	2.450***	2.433***
	(0.113)	(0.113)	(0.138)	(0.138)
African-American	4.033***	4.083***		
	(1.381)	(1.378)		
Other race	5.725***	5.803***		
	(1.673)	(1.669)		
Head is high school dropout	4.032***	4.013***	3.397	3.703
	(1.353)	(1.346)	(2.466)	(2.454)
Head has some college	0.538	0.496	2.091	2.000
	(1.266)	(1.269)	(2.530)	(2.512)
Head has college degree	-2.385	-2.455	6.554**	6.268*
	(1.519)	(1.526)	(3.318)	(3.289)
Head is female	-2.188*	-2.178*	-2.185	-2.068
	(1.222)	(1.221)	(1.758)	(1.740)
Number of children in household	-0.907*	-0.925**	0.209	0.178
	(0.471)	(0.469)	(0.719)	(0.721)
Log Family Income	0.105	0.209	0.424	0.376
	(0.470)	(0.474)	(0.564)	(0.596)
Own home	-0.201	-0.203	-3.290**	-3.289**
	(1.095)	(1.092)	(1.531)	(1.525)
Head's average weekly hours worked	0.009	0.009	-0.013	-0.012
	(0.029)	(0.029)	(0.038)	(0.037)
Child-Year observations	6,525	6,525	6,525	6,525
Number of unique children	3,372	3,372	3,372	3,372

*** p<0.01, ** p<0.05, * p<0.1
The first two columns also include state fixed effects, year fixed effects, state-specific time trends, and missing indicators for race and education.
The second two columns include child fixed effects, year fixed effects, state-specific time trends, and a missing indicator for education.

In the last two columns of Table 3, when child fixed effects are included, the main effect of debt and the interaction effect of debt and the unemployment rate remain the same in terms of sign but become slightly larger in terms of size and significance. However, the effect of recessions for those without debt drops to zero. The inclusion of child fixed effects identifies the effects of unemployment and debt based on changes in these variables across time. Thus, for families

who never hold consumer debt over this period, changes in the unemployment rate do not affect their children's weight. In addition, children whose families take on debt (or more debt relative to income) over this period gain weight while children whose families pay down their debt over this period lose weight. Finally, children in families who take on debt as the unemployment rate increases lose weight.

Table 4: Do the main findings vary by the gender of the child?

Dependent Variable: **Child's Percentile BMI**	Child FE-Girls only		Child FE-Boys only	
Average Unemployment Rate	1.093	0.541	-0.494	0.004
	(1.523)	(1.468)	(1.495)	(1.370)
Any Debt	10.331*		6.401	
	(6.202)		(6.408)	
Any Debt * UR	-1.943*		-1.159	
	(1.132)		(1.174)	
Debt to Income Ratio		25.355		50.490***
		(17.965)		(14.322)
Debt to Income Ratio * UR		-4.609		-9.256***
		(3.302)		(2.587)
Age of child (months)	-0.696**	-0.705**	0.005	0.001
	(0.273)	(0.274)	(0.300)	(0.298)
Age of child squared/1000	2.605***	2.589***	2.243***	2.229***
	(0.196)	(0.197)	(0.194)	(0.192)
Head is high school dropout	1.536	1.666	6.443*	7.075**
	(3.517)	(3.514)	(3.360)	(3.347)
Head has some college	2.920	2.715	2.443	2.596
	(3.314)	(3.302)	(3.670)	(3.640)
Head has college degree	10.401**	9.973**	0.081	0.448
	(4.393)	(4.445)	(4.889)	(4.957)
Head is female	-0.752	-0.626	-3.955	-3.706
	(2.353)	(2.338)	(2.540)	(2.489)
Number of children in household	-0.287	-0.331	0.579	0.607
	(0.974)	(0.977)	(1.104)	(1.108)
Log Family Income	0.326	0.308	0.292	0.264
	(0.740)	(0.850)	(0.847)	(0.843)
Own home	-3.093	-3.097	-2.608	-2.601
	(1.985)	(1.998)	(2.264)	(2.202)
Head's average weekly hours worked	-0.014	-0.013	-0.025	-0.024
	(0.051)	(0.051)	(0.052)	(0.052)
Child-Year observations	3,215	3,215	3,310	3,310
Number of unique children	1,655	1,655	1,717	1,717

*** p<0.01, ** p<0.05, * p<0.1
All regressions include child fixed effects, year fixed effects, state-specific time trends, and a missing indicator for education.
'Any Debt' is a binary variable for whether the household has debt or not.

Because Arkes (2009) finds that recessions affect the weight of teenage girls and boys differently, we examine the effects by gender in Table 4 using our preferred model displayed in equation

(2). We find that the effects of whether the household has any debt and the any debt-unemployment rate interaction are stronger for girls than for boys, while the effects of the debt-to-income ratio and the debt-to-income ratio-unemployment rate interaction are stronger for boys than for girls. Figure 1 illustrates the differences in these two debt measures by family income. The highest percent of households with any debt are middle-income families where the highest debt-to-income ratios are held by low-income families. Thus, these results suggest that a higher unemployment rate may reduce the body weight of a middle-income group of girls with household debt, and a low-income group of boys with high debt relative to income.

4.2 Potential Mechanisms

We now examine whether the unemployment rate and parental debt affect behaviors. Table 5 presents these results. The top panel uses our 'any debt' measure and the bottom panel uses the 'debt-to-income ratio' as the debt measure. In column 1 we find that mother's average weekly hours worked are not significantly affected by the unemployment rate, debt, or their interaction. In column 2, time spent with the mother is significantly lower when the unemployment rate is high.[7] A one percentage point increase in the unemployment rate reduces time spent with mother by 42-43 minutes on average.

Debt, regardless of the unemployment rate, does not appear to play a role in a mother's decision to spend time with children. So, while the average mother is not working more hours in the labor force as the unemployment rate rises, she is spending less time with children. We can speculate that mothers may be spending more time on home production during recessions(Aguiar et al., 2011; Edwards, 2011), leaving less time for being around children.

[7]The difference across these two measures is not due to sample size differences; the results for mother's average weekly hours worked are still insignificant if the sample is restricted to the time use data sample (N=5260).

Table 5: What behaviors do recessions and debt affect?

Dependent Variable:	Mother's avg weekly hours worked	Time with mother	Log(Weekly Home Food Expenditures)	Log(Weekly Eating Out Expenditures)	Time spent playing sports	Time spent watching TV
Average Unemployment Rate	0.693	-42.926**	0.220***	0.118*	4.381	-13.177
	(0.760)	(20.339)	(0.079)	(0.065)	(8.640)	(11.333)
Any Debt	-1.195	-56.102	0.237	0.371	-47.696	11.329
	(3.085)	(78.977)	(0.305)	(0.255)	(32.110)	(45.263)
Any Debt * UR	0.291	6.971	-0.055	-0.072	8.237	-0.119
	(0.565)	(14.366)	(0.056)	(0.046)	(5.730)	(8.258)
Child-Year observations	6,525	5,260	6,479	6,478	5,260	5,260
Number of unique children	3,372	2,909	3,364	3,361	2,909	2,909
Average Unemployment Rate	1.070	-41.685**	0.190***	0.074	6.468	-12.353
	(0.723)	(18.264)	(0.069)	(0.059)	(7.541)	(10.168)
Debt to Income Ratio	9.787	-135.216	-0.115	-0.215	-126.960	34.069
	(7.430)	(197.912)	(1.000)	(0.718)	(78.951)	(123.078)
Debt to Income Ratio * UR	-1.633	13.049	-0.061	-0.011	24.910*	-9.367
	(1.365)	(35.156)	(0.185)	(0.133)	(14.753)	(21.929)
Child-Year observations	6,525	5,260	6,479	6,478	5,260	5,260
Number of unique children	3,372	2,909	3,364	3,361	2,909	2,909

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

All regressions include child's age (and its square), the head's education, whether the head is female, number of children in the household, log family income, whether the household owns their home, the head's average weekly hours worked, child fixed effects, year fixed effects, state-specific time trends, and a missing indicator for education.

'Any Debt' is a binary variable for whether the household has debt or not.

Consistent with this hypothesis, we find that expenditures on food purchased for home use increases significantly during recessions in column 3. A one percentage point increase in the unemployment rate increases weekly home food expenditures by 19-22%, regardless of debt status. While only significant in the top panel, we also observe that eating out expenditures rise with the unemployment rate in column 4. Because the coefficients on the debt variables are not significantly for the food expenditure outcomes, we argue that we do not observe evidence of consumption smoothing using debt with respect to food. However, there may be other types of consumption that are affected by debt that we have not measured in this analysis.

In the bottom panel (column 5) of Table 5, we observe that for children in households with high debt-to-income ratios, time spent playing sports rises significantly when the unemployment rate rises. The average effect is small; a one percentage point increase in the unemployment rate would raise time spent in sports for children in households with an average debt-to-income ratio (10%) by 2.5 minutes. To save space, we do not show the effects for boys and girls separately, but we find that this sports effect is larger and more significant for girls. We do not observe any effect of recessions or debt on time spent watching TV in column 6.

Table 6 shows the results of adding these behaviors as control variables in our preferred specification (equation (2)). If the inclusion of a behavior as a control changes the coefficients on the unemployment rate, debt, or their interaction, we argue that it is a mechanism that contributes to the effect of these key variables on percentile BMI. The top and bottom panels have a similar pattern of results. Before we discuss the impact of the potential mechanism on the coefficients of interest, it is interesting to note the effect of the potential mechanism on percentile BMI. Four of the six behaviors have a significant effect on percentile BMI. However, more time with the mother, time playing sports and spending on eating out have unexpected effects. If mother's time is an input into child health, then mother's time should reduce weight, but we find the opposite. It may be that if mothers are spending time with children, then they are not spending time in healthy home production activities. We also expect eating out to be unhealthy but we find that higher expenditures indicated reduced weight. Unhealthy restaurant meals may be inexpensive so higher

expenditures could signal higher quality restaurant meals. Playing sports should reduce weight but it results in higher percentile BMI. As muscle weight more than fat, and expending energy makes children hungry, it is plausible that sports induces weight gain. The only behavior effect that is consistent with expectations is TV watching, which does appear to increase weight.

Despite these main behavior effects, the inclusion of these controls do not significantly change the coefficients on unemployment, debt, or their interaction. These results therefore suggest that our mechanisms do not help to explain the result that a rising unemployment rate reduces child body weight for households who take on debt.

Finally, because these behaviors may differ by the gender of the child, we separate the sample by gender and examine whether our six mechanisms explain the lower percentile BMI observed in Table 4. Because we found in Table 4 that 'any debt' mattered for girls and the 'debt-to-income ratio' mattered for boys, the top panel includes girls only and uses 'any debt' measure while the bottom panel includes boys only and uses the 'debt-to-income ratio'.[8] Table 7 reports these results. We find that for girls, the mother's work hours significantly reduces the percentile BMI and time spent with mothers increases percentile BMI. This is inconsistent with the literature that finds that mother's employment increases child weight, however, that literature focuses on highly educated or high income mothers. If we restrict our sample to college-educated heads, we find that mother's work hours increase the child's percentile BMI, consistent with the existing literature. Mother's employment or time does not affect percentile BMI in boys (shown in the bottom panel). We find that time spent playing sports and watching TV both increase the percentile BMI for boys significantly. The effects of spending on food and on eating out are not significant for either boys or girls. As in Table 6, the inclusion of the potential mechanism controls do not significantly affect the coefficients of interest for boys or girls.

[8]The coefficients on the potential mechanisms are the same for girls when using the 'debt-to-income ratio' and for boys when using the 'any debt' measure.

Table 6: Do the potential mechanisms affect the main findings?

Dependent Variable: **Child's Percentile BMI**	Mother's avg weekly hours		Log(Weekly Home Food	Log(Weekly Eating Out		
Potential Mechanism:	worked	Time with mother	Expenditures)	Expenditures)	Time spent playing sports	Time spent watching TV
Average Unemployment Rate	0.153	0.612	0.227	0.273	0.440	0.550
	(1.052)	(1.181)	(1.063)	(1.069)	(1.173)	(1.183)
Any Debt	8.863*	12.880**	9.446**	9.424**	13.009**	12.623**
	(4.554)	(5.307)	(4.558)	(4.562)	(5.305)	(5.278)
Any Debt * UR	-1.601*	-2.242**	-1.755**	-1.716**	-2.273**	-2.218**
	(0.822)	(0.952)	(0.823)	(0.825)	(0.953)	(0.947)
Potential Mechanism	-0.018	0.003**	-0.010	-0.912**	0.007*	0.006**
	(0.036)	(0.002)	(0.366)	(0.419)	(0.004)	(0.003)
Child-Year observations	6,525	5,260	6,479	6,478	5,260	5,260
Number of unique children	3,372	2,909	3,364	3,361	2,909	2,909
Average Unemployment Rate	0.116	-0.011	0.062	0.178	-0.193	-0.074
	(0.987)	(1.100)	(1.001)	(1.001)	(1.091)	(1.096)
Debt to Income Ratio	38.500***	32.607***	36.798***	39.011***	33.003***	31.949***
	(10.863)	(12.165)	(11.068)	(11.008)	(12.245)	(12.212)
Debt to Income Ratio * UR	-7.094***	-5.746**	-6.846***	-7.217***	-5.868**	-5.645**
	(1.974)	(2.261)	(2.020)	(2.005)	(2.282)	(2.275)
Potential Mechanism	-0.022	0.003**	-0.006	-0.887**	0.007*	0.006**
	(0.037)	(0.002)	(0.364)	(0.417)	(0.004)	(0.003)
Child-Year observations	6,525	5,260	6,479	6,478	5,260	5,260
Number of unique children	3,372	2,909	3,364	3,361	2,909	2,909

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

All regressions include child's age (and its square), the head's education, whether the head is female, number of children in the household, log family income, whether the household owns their home, the head's average weekly hours worked, child fixed effects, year fixed effects, state-specific time trends, and a missing indicator for education.

'Any Debt' is a binary variable for whether the household has debt or not.

Table 7: Does gender affect whether the potential mechanisms affect the main findings?

Dependent Variable: **Child's Percentile BMI**	Mother's avg weekly hours	Time with	Log(Weekly Home Food	Log(Weekly Eating Out	Time spent	Time spent
Potential Mechanism:	worked	mother	Expenditures)	Expenditures)	playing sports	watching TV
			Girls only			
Average Unemployment Rate	1.014	2.332	1.185	1.052	2.102	2.125
	(1.527)	(1.791)	(1.537)	(1.552)	(1.772)	(1.776)
Any Debt	9.845	16.748**	10.326*	9.782	16.658**	16.434**
	(6.194)	(6.959)	(6.246)	(6.255)	(6.959)	(6.945)
Any Debt * UR	-1.858	-3.263**	-1.985*	-1.873	-3.274***	-3.242**
	(1.130)	(1.264)	(1.142)	(1.145)	(1.268)	(1.263)
Potential Mechanism	-0.097**	0.004**	0.536	-1.007	0.004	0.005
	(0.049)	(0.002)	(0.557)	(0.620)	(0.006)	(0.004)
Child-Year observations	3,215	2,592	3,189	3,191	2,592	2,592
Number of unique children	1,655	1,435	1,649	1,648	1,435	1,435
			Boys only			
Average Unemployment Rate	-0.111	-0.741	0.015	0.156	-0.853	-0.647
	(1.366)	(1.530)	(1.377)	(1.378)	(1.527)	(1.533)
Debt to Income Ratio	49.630***	31.409**	49.580***	51.681***	32.192**	31.632**
	(14.429)	(15.415)	(14.392)	(14.440)	(15.515)	(15.537)
Debt to Income Ratio * UR	-9.117***	-5.550**	-9.156***	-9.414***	-5.734**	-5.555**
	(2.602)	(2.768)	(2.617)	(2.623)	(2.772)	(2.784)
Potential Mechanism	0.057	0.001	-0.654	-0.790	0.010**	0.007**
	(0.050)	(0.002)	(0.482)	(0.575)	(0.005)	(0.003)
Child-Year observations	3,310	2,668	3,290	3,287	2,668	2,668
Number of unique children	1,717	1,474	1,715	1,713	1,474	1,474

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

All regressions include child's age (and its square), the head's education, whether the head is female, number of children in the household, log family income, whether the household owns their home, the head's average weekly hours worked, child fixed effects, year fixed effects, state-specific time trends, and a missing indicator for education.

'Any Debt' is a binary variable for whether the household has debt or not.

5 Conclusions

This study examines how recessions affect childhood obesity and whether the effect differs for those living in households with debt in the US. Using a nationally representative sample of children between 1997-2007, we find that children lose weight when their families take on debt as the unemployment rate rises. We also find that some household behaviors change in response to the unemployment rate: mothers spend less time with their children, and home food and eating out expenditures rise during recessions. Children in households with high debt relative to income spend more time playing sports when the unemployment rate rises. While these behaviors affect the child's percentile BMI – girls lose weight when they spend less time with mom and boys gain weight when they play more sports – none of the behaviors examined can explain the relationship we observe between recessions, debt, and child weight. While our results are consistent with increases in home production and households using debt to smooth consumption during recessions, we are unable to provide definitive evidence in support of these particular mechanisms.

This study provides evidence that in one dimension at least, body weight, children are likely not harmed by recessions. The findings with respect to household debt are intriguing and, we think, merit further research. If debt is being used to protect health during economic downturns, imposing credit constraints, particularly among vulnerable populations, could be detrimental to the health of these households.

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