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The Effect of Fast Food Restaurants on Obesity and Weight Gain
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ABSTRACT

We investigate the health consequences of changes in the supply of fast food using the exact geographical location of fast food restaurants. Specifically, we ask how the supply of fast food affects the obesity rates of 3 million school children and the weight gain of over 3 million pregnant women. We find that among 9th grade children, a fast food restaurant within a tenth of a mile of a school is associated with at least a 5.2 percent increase in obesity rates. There is no discernable effect at .25 miles and at .5 miles. Among pregnant women, models with mother fixed effects indicate that a fast food restaurant within a half mile of her residence results in a 1.6 percent increase in the probability of gaining over 20 kilos, with a larger effect at .1 miles. The effect is significantly larger for African-American and less educated women. For both school children and mothers, the presence of non-fast food restaurants is uncorrelated with weight outcomes. Moreover, proximity to future fast food restaurants is uncorrelated with current obesity and weight gain, conditional on current proximity to fast food. The implied effects of fast-food on caloric intake are at least one order of magnitude larger for students than for mothers, consistent with smaller travel cost for adults.

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1. Introduction

In the public debate over obesity it is often assumed the widespread availability of fast food restaurants is an important determinant of obesity rates. Policy makers in several cities have responded by restricting the availability or content of fast food, or by requiring posting of the caloric content of the meals (Abdollah, 2007; Mcbride, 2008; Mair et al. 2005). But the evidence linking fast food and obesity is not strong. Much of it is based on correlational studies in small data sets.

In this paper we seek to identify the causal effect of increases in the supply of fast food restaurants on obesity rates. Specifically, using a detailed dataset on the exact geographical location of restaurants, we ask how proximity to fast food affects the obesity rates of over 3 million school children and the weight gain of 3 million pregnant women. For school children, we observe obesity rates for 9th graders in California over several years, and we are therefore able to estimate cross-sectional as well as fixed effects models that control for characteristics of schools and neighborhoods. In the fixed effects models we focus on the openings of new restaurants and compare the *difference* in the *change* over time in obesity rates between schools that are located .1 miles from a new fast food restaurant and schools that are located .25 miles or more from a new fast food restaurant. For mothers, we employ the information on weight gain during pregnancy reported in the Vital Statistics data for Michigan, New Jersey, and Texas covering fifteen years. We focus on women who have at least two children so that we can follow a given woman across two pregnancies and estimate models that include mother fixed effects. In these models, we relate changes in weight gain for a mother between pregnancies to changes in proximity to fast food between the pregnancies.

The design employed in this study allows for a more precise identification of the effect of fast-food on obesity than the previous literature. First, we observe information on weight for millions of individuals compared to at most tens of thousand in the standard data sets used previously. This large sample size substantially increases the power of our estimates. Second, we exploit very detailed geographical location information, including distances of only one tenth of a mile. By comparing groups of individuals who are at only slightly different distances to a restaurant, we can arguably diminish the impact of unobservable differences in characteristics between the two groups. Moreover, we take the idea that fast food location might reflect characteristics of the area very seriously and test to see whether there are any observable patterns in restaurant location within the very small areas we focus on. Third, we have a more precise idea of the timing of exposure than many previous studies: The 9th graders are exposed to fast food near their new school from September until the time of a spring fitness test, while weight gain during pregnancy pertains to the 9 months of pregnancy.

While it is clear that fast food is often unhealthy, it is not obvious a priori that changes in the availability of fast food should be expected to have an impact on health. On the one hand, it is possible that proximity to a fast food restaurant simply leads local consumers to substitute away from unhealthy food prepared at home or consumed in existing restaurants, without significant changes in the overall amount of unhealthy food consumed. On the other hand, proximity to a fast food restaurant could lower the monetary and non-monetary costs of accessing unhealthy food.[1]

Ultimately, the effect of changes in the supply of fast food on obesity is an empirical question. We find that among 9th grade children, the presence of a fast-food restaurant within a tenth of a mile of a school is associated with an increase of about 1.7 percentage points in the fraction of students in a class who are obese relative to the presence of a fast food restaurant at .25 miles. This effect amounts to a 5.2 percent increase in the incidence of obesity among the affected children. Since grade 9 is the first year of high school and the fitness tests take place in the spring, the period of fast-food exposure is approximately 30 weeks, implying an increased caloric intake of 30 to 100 calories per school-day. The effect is larger in models that include school fixed effects. Consistent with highly non–linear transportation costs, we find no discernable effect at .25 miles and at .5 miles.

Among pregnant women, we find that a fast food restaurant within a half mile of a residence results in a 0.19 percentage points higher probability of gaining over 20 kilograms (kg). This amounts to a 1.6 percent increase in the probability of gaining over 20 kilos. The effect increases monotonically and is larger at .25 and yet larger at .1 miles. The increase in weight gain implies an increased caloric intake of 1 to 4 calories per day

[1] In addition, proximity to fast food may increase consumption of unhealthy food even in the absence of any decrease in cost if individuals have self-control problems.

in the pregnancy period. The effect varies across races and educational levels. It is largest for African American mothers and for mothers with a high school education or less. It is zero for mothers with a college degree or an associate's degree.

Our findings suggest that increases in the supply of fast food restaurants have a significant effect on obesity, at least in some groups. On the other hand, our estimates do not suggest that proximity to fast food restaurants is a major determinant of obesity: Calibrations using our estimates indicate that increased supply of fast food can account for 0.5 percent of the increase in obesity over the last 30 years among 9^{th} graders, and for 2.7 percent of the increase in obesity over the past 10 years for women under 30.

It is in principle possible that our estimates reflect unmeasured shifts in the demand for fast food. Fast food chains are likely to open new restaurants where they expect demand to be strong, and higher demand for unhealthy food is almost certainly correlated with higher risk of obesity. The presence of unobserved determinants of obesity that may be correlated with increases in the number of fast food restaurants would lead us to overestimate the role of fast food restaurants.

We can not entirely rule out this possibility. However, four points lend credibility to our interpretation. First, our key identifying assumption for mothers is that, in the absence of a change in proximity to fast food, and conditional on birth order, age, and so on, mothers would gain a similar amount of weight in each pregnancy. Given that we are looking at the change in weight gain for the same mother, this assumption seems credible. Our key identifying assumption for schools is that, in the absence of a fast food restaurant, schools that are .1 miles from a fast food and schools that are .25 miles from a fast food would have similar obesity rates.[2]

Second, we directly investigate the extent to which there is selection on observables. We find that observable characteristics of schools are not associated with changes in the availability of a fast food in the immediate vicinity of a school: Fast food restaurants are equally likely to be located within .1, .25, and .5 miles of a school. Also, the observable characteristics of mothers that predict high weight gain are negatively (not

[2] This assumption may appear problematic given previous research (Austin et al., 2005) which suggests that fast food restaurants are more prevalent within 1.5 miles of a school. However, we only require that, *within a quarter of a mile from a school,* the exact location of a new restaurant opening is determined by idiosyncratic factors such as where suitable locations become available.

positively) related to the presence of a fast-food chain, suggesting that any bias in our estimates for mothers may be downward, not upward.

Third, while proximity to a fast food restaurant is associated with increases in obesity rates and weight gains, proximity to non fast food restaurants has no discernible effect on obesity rates or weight gains. This suggests that our estimates are not just capturing increases in the local demand for restaurant establishments.

Finally, while current proximity to a fast food restaurant affects current obesity rates, proximity to *future* fast food restaurants, controlling for current proximity, has no effect on current obesity rates and weight gains. Taken together, the weight of the evidence is consistent with a causal effect of fast food restaurants on obesity rates among 9th graders and on weight gains among pregnant women.

The estimated effects of fast-food on obesity are consistent with a model in which access to fast-foods increases obesity by lowering food prices or by tempting consumers with self-control problems.[3] Differences in travel costs between students and mothers could explain the different effects of proximity. Ninth graders have higher travel costs in the sense that they are constrained to stay near the school during the school day, and hence are more affected by fast-food restaurants that are very close to the school. For this group, proximity to fast-food has a quite sizeable effect on obesity. In contrast, for pregnant women, proximity to fast-food has a quantitatively small (albeit statistically significant) impact on weight gain. Our results suggest that concerns about the effects of fast-foods in the immediate proximity of schools are well-founded, since these restaurants have a sizeable effect on obesity rates among affected students.

The remainder of the paper is organized as follows. In Section 2 we review the existing literature. In Section 3 we describe our data sources. In Section 4, we present the econometric models. In Sections 5 and 6 we present the empirical findings for students and mothers, respectively. In Section 7 we discuss policy implications and conclude.

2. Existing Literature

[3] See DellaVigna (2009). A model of cues in consumption (Laibson, 2001) has similar implications: a fast-food that is in immediate proximity from the school is more likely to trigger a cue that leads to over-consumption.

While there is considerable evidence in the epidemiological literature of correlation between fast food consumption and obesity, it has been more difficult to demonstrate a causal role for fast food. A recent review of about the relationship between fast food and obesity (Rosenheck, 2008) concludes that "Findings from observational studies as yet are unable to demonstrate a causal link between fast food consumption and weight gain or obesity."

A rapidly growing economics literature has focused on the link between declining in food prices and obesity (see Philipson and Posner, 2008 for a review).[4] A series of recent papers explicitly focus on fast food restaurants as potential contributors to obesity.[5] The two papers closest to ours are Anderson and Matsa (2009) and Brennan and Carpenter (2009). Anderson and Matsa focus on the link between eating out and obesity using the presence of Interstate highways in rural areas as an instrument for restaurant density. They find no evidence of a causal link between restaurants and obesity.

Our paper differs from Anderson and Matsa (2009) in three important dimensions, and these differences are likely to explain the discrepancy in our findings. First, we have a very large sample that allows us to identify even small effects. Our estimates of weight gain for mothers are within the confidence interval of Anderson and Matsa's two stage least squares estimates. Second, we have the exact location of each restaurant, school and mother. In contrast, Anderson and Matsa use a telephone exchanges the level of geographical analysis. Given our findings, it is not surprising that at this level of aggregation the estimated effect is zero. Third, the populations under consideration are different. Anderson and Matsa focus on predominantly white rural communities, while the bulk of both the 9th graders and the mothers we examine are urban. We show that the

[4] For example, Lakdawalla and Philipson (2002) argue that about 40% of the increase in obesity from 1976 to 1994 is attributable to lower food prices. Courtemanche and Carden examine the impact on obesity of Wal-Mart and warehouse club retailers such as Sam's club, Costco and BJ's wholesale club which compete on price.

[5] Chou et al. (2004) estimate models combining state-level price data with individual demographic and weight data from the Behavioral Risk Factor Surveillance surveys and find a positive association between obesity and the per capita number of restaurants (fast food and others) in the state. Rashad, Grossman, and Chou (2005) present similar findings using data from the National Health and Nutrition Examination Surveys. Anderson and Butcher (2005) investigate the effect of school food policies on the BMI of adolescent students. Anderson, Butcher, and Levine (2003) find that maternal employment is related to childhood obesity, and speculate that employed mothers might spend more on fast food. Cawley and Lui (2007) show that employed mothers spend less time cooking. Thomadsen (2001) estimate a discrete choice model of supply and demand that links prices to market structure and geographical dispersion of fast food outlets in California.

effects vary considerable depending on race. Indeed, when Dunn (2008) uses an instrumental variables approach similar to the one used by Anderson and Matsa, he finds no effect for rural areas or for whites in suburban areas, but strong effect for blacks and Hispanics. As we show below, we also find stronger effects for minorities.

Brennan and Carpenter (2009) use individual-level student data from the California Healthy Kids Survey. In contrast to our study, Brennan and Carpenter present only cross-sectional estimates, and pool data from grades 7-12. They focus on fast food restaurants within .5 miles of a school, although they also present results for within .25 miles of a school. Their main outcome measure is BMI, which is computed from self-reported data on height and weight. Relative to their study, our study adds longitudinal estimates, the focus on 9th graders, a better obesity measure, estimates for pregnant mothers, and checks for possible unobserved differences between people and schools located near fast food restaurants and others.

3. Data and Summary Statistics

Data for this project comes from three sources.

(a) School Data. Data on children comes from the California public schools for the years 1999 and 2001 to 2007. The observations for 9th graders, which we focus on in this paper, represent 3.06 million student-year observations. In the spring, California 9th graders are given a fitness assessment, the FITNESSGRAM®. Data is reported at the class level in the form of the percentage of students who are in the "healthy fitness zone" with regard to body fat, and who have acceptable levels of abdominal strength, aerobic capacity, flexibility, trunk strength, and upper body strength. What we will call obesity is the fraction of students whose body fat measures are outside the healthy fitness zone. For boys this means that they have body fat measures greater than 25% while for girls, it means that they have body fat measures greater than 32%. Body fat is measured using skin-fold calipers and two skinfolds (calf and triceps). This way of measuring body fat is considerably more accurate than the usual BMI measure (Cawley and Burkhauser, 2006).

Since grade 9 is the first year of high school and the fitness tests take place in the Spring, this impact corresponds to approximately 30 weeks of fast-food exposure.[6] [7]

(b) Mothers Data. Data on mothers come from Vital Statistics Natality data from Michigan, New Jersey, and Texas. These data are from birth certificates, and cover all births in these states from 1989 to 2003 (from 1990 in Michigan). Confidential data including mothers names, birth dates, and addresses, were used to construct a panel data set linking births to the same mother over time, and then to geocode her location (again using ArcView).[8] The Natality data are very rich, and include information about the mother's age, education, race and ethnicity; whether she smoked during pregnancy; the child's gender, birth order, and gestation; whether it was a multiple birth; and maternal weight gain. We restrict the sample to singleton births and to mothers with at least two births in the sample, for a total of over 3.5 million births.

(c) Restaurant Data. Restaurant data with geo-coding information come from the National Establishment Time Series Database (Dun and Bradstreet). These data are used by all major banks, lending institutions, insurance and finance companies as the primary system for creditworthiness assessment of firms. As such, it is arguably more precise and comprehensive than yellow pages and business directories.[9] We obtained a panel of virtually all firms in Standard Industrial Classification 58 ("Eating and Drinking Places") from 1990 to 2006, with names and addresses. Using this data, we constructed several different measures of "fast food" and "other restaurants," as discussed further in Appendix 1. In this paper, the benchmark definition of fast-food restaurants includes only the top-10 fast-food chains in the country, namely, Mc Donalds, Subway, Burger King, Taco Bell, Pizza Hut, Little Caesars, KFC, Wendy's, Dominos Pizza, and Jack In

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[6] In very few cases, a high school is in the same location as a middle school, in which case the estimates reflect a longer-term impact of fast-food.

[7] This administrative data set is merged to information about schools (including the percent black, white, Hispanic, and Asian, percent immigrant, pupil/teacher ratios, fraction eligible for free lunch etc.) from the National Center for Education Statistic's Common Core of Data, as well as to the Start test scores for the 9th grade. The location of the school was geocoded using ArcView. Finally, we merged in information about the nearest Census block group of the school from the 2000 Census including the median earnings, percent high-school degree, percent unemployed, and percent urban.

[8] In Michigan, the state created the panel and gave us de-identified data with latitude and longitude. In New Jersey, the matching was done at the state offices and then we used de-identified data. The importance of maintaining confidentiality of the data is one reason we do not use continuous distance measures in the paper.

[9] The yellow pages are not intended to be a comprehensive listing of businesses - they are a paid advertisement. Companies that do not pay are not listed.

The Box. We also show estimates using a broader definition that includes both chain restaurants and independent burger and pizza restaurants. Finally, we also measure the supply of non-fast food restaurants. The definition of "other restaurants" changes with the definition of fast food. Appendix Table 1 lists the top 10 fast food chains as well as examples of restaurants that we did not classify as fast food.

Matching was performed using information on latitude and longitude of restaurant location. Specifically, we match the schools and mother's residence to the closest restaurants using ArcView software. For the school data, we match the results on testing for the spring of year *t* with restaurant availability in year *t-1*. For the mother data, we match the data on weight gain during pregnancy with restaurant availability in the year that overlaps the most with the pregnancy.

<u>Summary Statistics.</u> Using the data on restaurant, school, and mother's locations, we constructed indicators for whether there were fast food or other restaurants within .1, .25, and .5 miles of either the school or the mother's residence. Table 1a shows summary characteristics of the schools data set by distance to a fast food restaurant, where distances are overlapping. Here, as in most of the paper, we use the narrow definition of fast-food, including the top-10 fast-food chains. Relatively few schools are within .1 miles of a fast food restaurant, and the characteristics of these schools are somewhat different than those of the average California school. Only 7% of schools have a fast food restaurant within .1 miles, while 65% of all schools have a fast food restaurant within 1/2 of a mile.[10] Schools within .1 miles of a fast food restaurant have more Hispanic students and lower test scores. They are also located in poorer and more urban areas. The last row indicates that schools near a fast food restaurant have a higher incidence of obese students than the average California school. Table 1b shows a similar summary of the mother data. Again, mothers who live very near fast food restaurants have different characteristics than the average mother. They are younger, less educated, more likely to be black or Hispanic, and less likely to be married.

[10] The average school in our sample had 4 fast foods within 1 mile and 24 other restaurants within the same radius.

4 Econometric Specifications

Our baseline specification for schools is

$$(1)\quad Y_{st} = \alpha\, F1_{st} + \beta\, F25_{st} + \gamma\, F50_{st} + \alpha'\, N1_{st} + \beta'\, N25_{st} + \gamma'\, N50_{st} + \delta\, X_{st} + \theta\, Z_{st} + d_s + e_{st},$$

where Y_{st} is the fraction of students in school *s* in a given grade who are obese in year *t*; $F1_{st}$ is an indicator equal to 1 if there is a fast food restaurant within .1 mile from the school in year *t*; $F25_{st}$ is an indicator equal to 1 if there is a fast food restaurant within .25 miles from the school in year *t*; $F50_{st}$ is an indicator equal to 1 if there is a fast food restaurant within .5 mile from the school in year *t*; $N1_{st,}$ $N25_{st}$ and $N50_{st}$ are similar indicators for the presence of non-fast food restaurants within .1, .25 and .5 miles from the school; d_s is a fixed effect for the school.

The vectors X_{st} and Z_{st} include school and neighborhood *time-varying* characteristics that can potentially affect obesity rates. Specifically, X_{st} is a vector of school-grade specific characteristics including fraction African-American, fraction native American, fraction Hispanic, fraction immigrant, fraction female, fraction eligible for free lunch, whether the school is qualified for Title I funding, pupil/teacher ratio, and 9th grade tests scores, as well as school-district characteristics such as fraction immigrants, fraction of non-English speaking students (LEP/ELL), share of IEP students. Z_{st} is a vector of characteristics of the Census block closest to the school including median income, median earnings, average household size, median rent, median housing value, percent white, percent black, percent Asian, percent male, percent unmarried, percent divorced, percent with a high school degree, percent with an associate degree, percent with college degree, percent with a post-graduate degree, percent in the labor force, percent employed, percent with household income under \$10,000, percent with household income above \$200,000, percent urban, percent of the housing stock that is owner occupied. To account for heteroskedasticity caused by the fact that cells vary in size, we weight all our models by the number of students in each cell. To account for the possible correlation of the residual e_s within a school, we report standard errors clustered by school. We run specifications both with and without school fixed effects.

The key identifying assumption is that after conditioning on the vector X and Z , the proximity of non-fast food restaurants and, in the panel specifications, also school fixed effects, changes in other determinants of obesity rates are not systematically correlated with changes in the proximity of fast food restaurants. In other words, in the absence of a fast food, schools that are .1 miles from a fast food and schools that are .25 miles from a fast food are assumed to have similar changes in obesity rates. This assumption is not incompatible with fast foods targeting schools when opening new locations. It only requires that, *within a quarter of a mile from a school,* the exact location of a new restaurant opening is determined by idiosyncratic factors. Since the exact location of new retail establishments is determined by many factors, including the timing of when suitable locations become available, this assumption does not appear unrealistic. Below we report a number of empirical tests of this assumption.

It is important to note that the fast food indicators $F1_{st,}$ $F25_{st}$ and $F50_{st}$ are not mutually exclusive. Similarly, we define the non-fast food indicators $N1_{st,}$ $N25_{st}$ and $N50_{st}$ as not mutually exclusive. This means that the coefficient α, for example, is the *difference* in the effect of having a fast food restaurant within .1 mile and the effect of having a fast food restaurant within .25 miles. To compute the effect of having a fast food restaurant within .1 mile (relative to the case where there is no fast food restaurant within at least .5 miles) one needs to sum the three coefficients α+β+γ.

When we use the sample of mothers, our econometric specification is

$$(2)\quad Y_{it} = \alpha\, F1_{it} + \beta\, F25_{it} + \gamma\, F50_{it} + \alpha'\, N1_{it} + \beta'\, N25_{it} + \gamma'\, N50_{it} + \delta\, X_{it} + d_i + e_{it},$$

where Y_{it} is either an indicator equal 1 if mother *i* gains more than 20Kg (or 15Kg) during her *t*th pregnancy or mother *i*'s weight gain during her *t*th pregnancy; X_{it} is a vector of time-varying mother characteristics including age dummies, four dummies for education, dummies for race, Hispanic status, an indicator equal to 1 if the mother smokes during pregnancy, and indicator for male child, dummies for parity, marital status and year dummies,[11] and d_i is a mother fixed effect. To account for the possible correlation of the residual e_{it} for the same individual over time, we report standard errors

[11] Also included are indicators for missing education, race, Hispanic status, smoking and marital status.

clustered by mother. In an alternative set of specifications we include fixed effects for the zip code of residence of the mother rather than mother fixed effects. This specification is similar to the fixed effect specification for the schools.

Finally, there are two reasons for proximity to fast food to change for mothers. They could stay in the same place and have a restaurant open (or close) close to them. Or, they could move closer or further away from fast food between pregnancies. In order to determine which of these two effects dominate, we also estimate models using only women who stayed in the same place between pregnancies (These women are designated stayers). In these models, the estimates reflect the estimated effects of having a restaurant open (or close) near by between pregnancies.

One concern is the possible presence of measurement error. While our information about restaurants comes from one of the most reliable existing data sources on the location of retailers[12], it is probably not immune from measurement error. Our empirical findings point to an effect of fast food restaurants on obesity that declines with distance. It is unlikely that measurement error alone is responsible for our empirical finding. First, measurement error is likely to induce some attenuation bias in our estimates (i.e. a downward bias). Second, even if measurement error did not induce downward bias, it would have to vary systematically with distance, and there is no obvious reason why this would be the case.[13]

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[12] Our data on restaurant are considered by some as the "best data source for studying business location" (Kolko and Neumark, 2008).

[13] As an additional check, we used Google Map to check the distance between schools and restaurants for a random sample of our schools. This comparison is complicated by three problems. First, Google Map data are not immune from measurement error. In our search, we found some instances in which Google Map significantly misreported or missed the location of a business. Second, our data end in mid-2006, while current Google Maps reflect restaurant location at the end of 2008. There is considerable churning in this industry, so even if our data and Google data were perfectly correct, we could find some discrepancies. Third, our measure of distance is "as the crow flies", while Google Map only provides driving distance. This latter issue is a problem because the key variable of interest for us is a dummy equal to 1 if the distance between the school and the restaurant is $<.1$ miles. Even small differences between distance measured "as the crow flies" and driving distance may lead us to incorrectly label our indicator as incorrect, when in fact it is correct. In the sub-sample of 30 schools that we checked by hand, we estimate a reliability ratio of .75. Given the three limitations described above, we consider this evidence as quite encouraging.

5. Empirical Findings: School Sample

(**a) Benchmark Estimates.** Table 2 shows our baseline empirical estimates of the effect of changes in the supply of fast food restaurants on obesity rates (see equation 1 above). The dependent variable is the percentage of students in the 9th grade who are classified as obese. Each column is from a different regression. Entries are the coefficient on a dummy for the existence of a fast food restaurant at a given distance from the school (coefficients α, β, and γ in equation 1) and coefficients on dummies for the existence of a non-fast food restaurant at a given distance from the school (α', β' and γ' in equation 1). Recall that the fast food indicators are not mutually exclusive. Thus, the coefficient on the .1 miles dummy is to be interpreted as the *additional* effect of having a fast food restaurant within .1 mile over and above the effect of having a fast food restaurant within .25 miles.

In column 1 we report unconditional estimates. There is generally a positive association between availability of a fast food and obesity rates. Estimates in column 2 condition on school level controls, census block controls and year effects. We note that standard errors are smaller in column 2 than in column 1, indicating that our controls do a good job absorbing other determinants of obesity but leave enough variation for the identification of the effect of interest. With controls, the only statistically significant effect is associated with the availability of a fast food restaurant within .1 miles. To illustrate the interpretation of this coefficient, compare two schools that are identical, but one is located .09 miles from a fast food restaurant while the other one is located .24 miles from a fast food restaurant. The estimate of α in Column 2 indicates that in the former the obesity rate is 1.7 percentage points higher than in the latter. This estimate is both statistically significant and economically important: compared to a mean obesity rate of 32.9, a fast food restaurant within .1 miles from a school results in a 5.2 percent increase in the incidence of obesity. The coefficients on availability of fast food within .25 miles (β) and on availability of fast food within .50 miles (γ) are statistically insignificant. Increases in the number of non-fast food restaurants have no effect on obesity, indicating that the effect of fast-food restaurants is specific and does not generalize to any food establishment.

We can also use the estimates in Table 2 to compare the effect of having fast-food a distance j, compared to not having a fast-food (within .5 miles). The sum of coefficients $\alpha+\beta+\gamma$ captures the effect of exposure to a fast-food within .1 mile compared to exposure to no fast-food restaurant within .5 miles. Similar, the effect of exposure within .25 miles, compared to no fast-food, is captured by $\beta+\gamma$. Figure 1a plots these estimates for the specification with controls together with confidence intervals. The effect of fast-food at .5 and .25 miles is in fact (insignificantly) negative, while the effect of exposure at .1 miles (.81 = 1.7385-.891-.0391) is sizeable and positive. This pattern of effects – only fast-food restaurants that are very close have an effect -- is consistent with a non linear increase in transportation costs with distance, and/or with strong psychological effects of the availability of fast food restaurants, such as temptation for consumers with self-control problems. Notice that the cross-sectional estimate of the effect of exposure at .1 miles is statistically significant when compared to the effect of exposure at .25 miles (as in Table 2), but not when compared to no exposure (as in Figure 1a).

In columns 3 and 4 we present estimates with school fixed effects. By including indicators for each school, we absorb any time-invariant determinant of obesity. The estimates are identified only by schools where fast-food availability varies over time. At the .1 mile distance, for example, there are 13 schools that add a fast-food, 8 that lose a fast-food, and 1 school that does both. At the .25 (respectively, .5) mile distance, 63 (respectively, 117) schools switch fast-food availability in the sample. The estimates with school fixed effects point to a statistically significant effect of the availability of a fast food within .1 miles of 6.33 percentage points, which is larger than in the cross-sectional estimates of columns 1 and 2. This fast-food effect is the same in the specification without controls (Column 3) and with controls (Column 4), indicating that once we condition on school fixed effects there is very limited selection on the other observables. There is no evidence of a positive additional effect of the availability of a fast food within .25 miles or .5 miles. Figure 1a also plots the coefficients from this specification comparing the availability of fast-foods within j miles to no availability of fast-food (within .5 miles). The pattern is similar to the cross-section pattern: there is no significant effect of fast-food at .5 or .25 miles, and a large positive effect at .1 miles.

(b) Magnitude of the Estimated Effect. Are the estimated effects plausible? To investigate this question, we compute how many calories it would take per school day to move a 14-year old boy of median height across different cut-offs for overweight status and obesity. If a boy at the 80th percentile of BMI moves to the 85th percentile, which is the cutoff for overweight, this corresponds to about a 5% increase in the fraction overweight. Based on CDC (2000) growth charts, it only takes a weight gain of 3.6 pounds to move from the 80th to the 85th percentile of the BMI distribution. Over a period of 30 weeks[14], this corresponds to a gain of about 80 additional calories per school day. Similarly, it would take 300 additional calories to move from the 90th to the 95th percentile of BMI, where the later is the cutoff for obesity.

Based on these calibrations, the cross-sectional estimate of a 1.7 percentage point increase in the obesity rate due to the immediate proximity of a fast-food restaurant (column 2) corresponds to about 30 additional calories per day according to the first calculation and 100 calories per day according to the second. These amounts can be compared with the calories from a typical meal at a fast food restaurant, such as 540 calories for McDonald's Big Mac, 990 calories for Burger King's Double Whopper, 570 for McDonald's regular fries, and 200 calories for a 16 ounce regular Coke.[15] Even assuming that a large portion of the calories consumed in fast-food restaurants are offset by lower consumption at other meals, it is easy to obtain caloric intake increases that are consistent with the observed effects.[16] Ebbeling et al. (2004) report on a controlled experiment of energy intake among overweight and non-overweight adolescents that involved offering them a fast food meal during the day and found that energy intake from

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[14] 30 weeks is the average length of time that the 9th graders are exposed to a nearby restaurant between the beginning of high school in Sept. and the fitness test. BMI percentiles and median height for 14 year old boys are taken from the CDC(2000) growth charts available from www.cdc.gov/nchs/data/nhanes/growthcharts/set1/all.pdf.

[15] The fast food calories are from http://www.acaloriecounter.com/fast-food.php The estimate that it takes 3500 extra calories per week to gain a pound is from the CDC and is available from http://www.cdc.gov/nccdphp/dnpa/healthyweight/index.htm

[16] The calorie intake from the typical fast food meal is an order of magnitude larger than any plausible caloric expenditure in a round trip to a fast food restaurant. It would take at most 4 minutes to stroll the distance of 1-2 blocks to a fast food restaurant that is 0.1 miles away and a 14 year old boy of median weight (about 120 lbs) would expend about 30 calories on the trip. The weight for age charts for boys is available at http://www.cdc.gov/growthcharts/data/set1clinical/cj41c021.pdf while the calorie burn rate for walking at 3.5 mph can be computed at http://www.healthdiscovery.net/links/calculators/calorie_calculator.htm.

the meal among all participants was extremely large (1652 kcal). What is more striking is that overweight participants consumed approximately 400 more total calories on fast food days than non–fast food days while lean participants were able to offset their fast food intakes. Thus, there appears to be at least a subset of children who do not offset fast food calories effectively. The estimates in Table 2 appear therefore to be quite plausible.

(c) Additional Specifications. In Table 3 we present estimates from a variety of alternative specifications. In column 1 we test how sensitive our results are to our definition of fast food. Our estimates so far are based on our benchmark definition of fast-food restaurants, which includes the top 10 chains (McDonald's, Subway, Burger King, Pizza Hut, Jack in the Box, Kentucky Fried Chicken, Taco Bell, Domino's Pizza, Wendy's, and Little Ceasar's). As Appendix Table 1 shows, the top 10 restaurants account for 43 percent of all fast-food restaurants in the four states we study. In column 1 we add an indicator based on a broader definition of fast food based on the Wikipedia list of fast food chains. Our broad definition starts with this list, excludes ice cream, donut, and coffee shops, and adds in all independent restaurants that have the words "pizza" or "burger" in their names. This allows us to capture some of the effect of small independent restaurants, to the extent that they have the words "pizza" or "burger" in their names.[17] The model indicates that this measure does not have any additional impact over and above our baseline definition of fast food, suggesting that the top 10 fast foods are qualitatively different from other fast food establishments. In column 2 we show estimates using another alternative measure of fast food that excludes Subway restaurants, which are arguably healthier than the other chains, from our list of top 10 fast food restaurants. The results are essentially the same as using the benchmark definition.[18]

Column 3 shows estimates of a model in which we do not distinguish between fast food and non-fast food restaurants. The key independent variable here is an indicator equal to 1 for <u>any</u> restaurant. This specification is similar to the one emphasized by

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[17] The top restaurants in this classification are Starbucks, Dairy Queen, Baskin Robbins, and Jamba Juice (Appendix Table 1).

[18] We also asked whether the availability of two or more fast foods within .1 miles had a greater impact than the availability of one fast food within .1 miles, but did not find any difference. This is not surprising, given the small number of cases with two or more fast-foods within .1 miles. See the web appendix Table 2 for details.

Anderson and Matsa (2009). Consistent with their findings, we find no evidence that the presence of any restaurant affects obesity.

In columns 4 and 5 we test for racial differences. The estimates for whites (not shown) are not very different from estimates based on the entire sample. The point estimates are similar for Hispanic students (larger in the fixed effect estimates) and smaller and not significant for African American students. One limitation is that reporting is restricted to groups with at least 10 students. This restriction induces censoring that varies by demographic group, which is of particular concern for African American students, since the number of African American residents in California is limited. When we split the sample by gender (not shown), the effect is substantially larger for female students than for male students. We also attempted to consider variation in effects by family income, using whether children were eligible for free school lunch as an income proxy. The difference in the effects for the groups with and without free lunch status is small and not statistically significant at conventional levels (not shown).

We have also considered a number of alternative specifications (see the Web Appendix): (i) an optimal trimming model, where we include only schools that have a propensity score between .1 and .9; (ii) a nearest neighborhood matching specification, where we match on all the school level and block level covariates; and a (iii) a proximity regression where we use only the subsample of schools that are within .25 miles of a fast food restaurant and examine the effect of being within .1 miles. All of these specifications yield estimates similar to those described above.

We also present results on the effect of fast food restaurants on alternative measures of fitness in the web appendix including: abdominal strength, aerobic capacity, flexibility, trunk strength and upper body strength. Cross-sectional estimates point to a negative effect of fast food restaurant on flexibility. However, fixed effects estimates are generally insignificant except for obesity. This finding is consistent with Cutler et al.'s (2003), and Bleich et al.'s (2007) argument that rising obesity is linked to increased caloric intake and not to reduced energy expenditure.

(d) Threats to Identification and Placebo Analysis. One concern with our estimates is that even after conditioning on school fixed effects and time varying student and neighborhood characteristics, the location of fast food restaurant may still be associated with other determinants of obesity that we cannot control. After all, fast food chains do not open restaurants randomly. Presumably, they open new restaurants in areas where they expect demand for fast food to be strong.

We now turn to a discussion of the plausibility of our identifying assumptions. We begin by asking whether observable characteristics of students are associated with levels of (and changes in) the availability of a fast food near a school. In Table 4 we replicate the main regressions of Table 2 but use as dependent variables six characteristics of the school, such as the fraction of the students in the school who are Black (column 1), share with free lunch (column 5), and average test scores (column 6). These models exclude the relevant left hand side variable from the regressions. Panel A reports cross-sectional estimates, while panel B reports estimates from fixed effects models. Of the 36 estimated coefficients, only one is statistically significant, indicating that student characteristics do not appear to be systematically associated with the presence of fast food restaurants.

To implement a further placebo test, we generate the best linear predictor of the share of obese students using the full set of controls X and Z. Then in Column 7 we regress this variable on the variables for fast-food availability, as in Table 2, with no controls (since these controls are now used as left-hand side variable). The regression coefficients indicate how much fast-food availability loads on the same observables that predict obesity. We find that, while this obesity predictor is significantly correlated with availability of fast-food within .5 miles of a school in the cross-section, it is not correlated with the availability of fast-food at closer distances (.25 miles or .1 mile), or in the panel specification. This indicates that selection on unobservables is not likely an important concern at close distances.

In the Web Appendix, we present an alternative approach to documenting the extent of selection. We regress the availability of fast-food at different distances on the set of demographic variables, essentially reversing the dependent and independent variables relative to Table 4. This alternative specification allows us to conduct F-tests for on the significance of all the controls. The finding, as in Table 4, is that there is no evidence of selection at very close distances from a fast-food restaurant.

In panel C of Table 4 we present a geographic placebo: we test for whether fast food restaurant are geographically uniformly distributed in the area around schools. If they are, we expect the number of fast-foods within .25 (respectively, .5) miles of a school to be 2.5^2 (respectively, 5^2) larger than the number of fast-foods within .1 mile of a school. To make the test clearer and more conservative, we do not condition on the controls that we use in the regressions. The results at the bottom of table 2A indicate that we cannot reject the null hypothesis of uniform placement of fast-foods at either horizon. While the placement of fast-foods may still be endogenous when comparing availability at greater distances (Austin et al. 2005), at the distances that we consider in this paper we find no evidence of endogenous placement. Overall, we find no systematic evidence of an effect of demographic controls on fast-food availability at very small distances from a school.

Table 5 presents a placebo test based on timing. This specification asks whether changes in obesity rates are a function of *future* fast food restaurant locations and *past* fast-food locations. If fast food restaurants open in areas that experience unobserved upward trends in the demand for fast food, it is possible that current obesity rates may be correlated with future (or lagged) fast food restaurant availability. Otherwise, we expect that future fast-food exposure should not affect obesity rates. Similarly, lagged fast-food presence near the school should not affect obesity rates since students in 9th grade are typically starting high-school in a different location from where they attended middle school. We include availability in year t and in year $t+3$ (t-3) of restaurants (fast-food and not) within .1 miles, as well as the availability in year t of restaurants (fast-food and not) within .25 and .5 miles (coefficients on .25 and .5 miles not reported in the Table).[19]

The findings in column 1 indicate that conditional on the availability of fast food restaurants in year t, availability in year $t+3$ does not appear to be positively correlated with obesity rates. The coefficient on availability of fast food restaurants 3 years later is not statistically significant at conventional levels. Of course, since the availability of fast food restaurants now and in 3 years is highly correlated, the standard errors are fairly large. In column 2 the sample is restricted to schools that did not have a fast food restaurant within .1 miles at time t. For these schools, the opening of a fast food

[19] The results are similar if we use as placebo the availability of fast-food 2 years ahead and 2 years earlier.

restaurant 3 years later has virtually no correlation with current obesity rates. In Column 3 we report the results of exposure to lagged fast-food. We do not find any significant effect of fast-food presence within .1 mile of the school 3 years prior, even though the estimates are noisy and the contemporaneous effect is no longer significant.

(e) Effect by Grade. While in the remainder of the paper we focus on 9th graders who are the most likely to be able to access fast-foods, Table 6 shows estimates for 5th and 7th graders. We expect that younger students should have less freedom to leave school for lunch and less pocket money, and hence that the effects should be smaller. The estimates are largely supportive of this hypothesis, with one exception. Compared to the estimates for 9th graders (reported for convenience in Columns 1 and 2), the estimated effect of fast-food at .1 miles for 7th graders is much smaller and close to zero. The effect is also small for 5th graders in the cross-section, but quite large (and significant) in the panel. We do not see an obvious interpretation of this isolated finding.

6. Empirical Findings: Mother Sample

We now turn to results based on weight gain during pregnancy from the Vital Statistics data. There are several motivations for this part of our analysis. While an important reason for focusing on pregnant women is the availability of geographically detailed data on weight measures for a very large sample, weight gain for pregnant women is an important outcome in its own right. Excessive weight gain during pregnancy is often associated with higher rates of hypertension, C-section, and large-for-gestational age infants, as well as with a higher incidence of later maternal obesity (Gunderson and Abrams, 2000; Lin, forthcoming; Rooney and Schauberger, 2002; Thorsdottir et al., 2002; Wanjiku and Raynor, 2004). Figure 2 indicates that the incidence of low APGAR scores (APGAR scores less than 8), an indicator of poor fetal health, increases significantly with weight gain above about 15-20kg.

From the statistical point of view, the mother sample has important advantages over the school sample, since it varies at the individual level and is longitudinally linked. Since we observe weight gains for multiple pregnancies for the same mother, we can ask how weight gain is affected by changes in the proximity to fast food between pregnancies. It is important to examine the impact of exposure to fast foods on adults, as well as school children. Moreover, one advantage of the weight gain measure is that unlike weight in levels, only recent exposure to fast food should matter. For these reasons, despite the lack of information on weight level and therefore obesity for mothers, the results for mothers complement the results for school children.

(a) Benchmark Estimates. Table 7 presents our estimates of equation 2. The dependent variable in columns 1, 2 and 3 is an indicator equal to 1 if weight gain is above 20kg. The dependent variable in column 4 is an indicator equal to 1 if weight gain is above 15kg. We chose these measures given that the cutoff for adverse affects of pregnancy weight gain is around 15-20kg. However, we also show estimates for continuous weight gain in column 5.

The fixed-effect models with zip-code fixed effects (Column 1) and with mother fixed effects (column 2) point to a positive effect of proximity to fast food on probability of weight gain above 20 kg. We obtain similar results for the probability of weight gain above 15kg. (Column 4) and continuous weight gain (Column 5), in both cases using the specification with mother fixed effects. The availability of a fast food restaurant within .5 miles is associated with an increase of .19 percentage points (1.6 percent) in the probability of weight gain larger than 20kg, an increase of .44 percentage points (1.3 percent) in the probability of weight gain larger than 15kg, and an increase of 0.049kg (04 percent) in weight gain. Compared to the effect of exposure at .5 miles, the effect is larger at .25 miles or at .1 miles, though the difference from the effect at .5 miles is not statistically significant. As in the school sample, we find no evidence that non-fast food restaurants are associated with positive effects on weight gain.

In these mother fixed effects models, proximity to a restaurant may change either because a restaurant opens or closes, or because the mother changes location. In order to isolate the effect of the former, we restrict the sample to mothers who did not move between births. Results for this subsample (Column 3) on the effect of fast food availability are somewhat larger than for the full sample (Column 2).

As we did for the school sample, we plot the cumulative effect of fast-food exposure compared to no fast-food availability. Figure 1b shows the benchmark estimates (from Column 2). There is a monotonic increase in the effect of availability from .5 miles, to .25 miles, and .1 miles. The effect of fast-food is significantly different from zero at all distances. For 9th graders, instead, only availability of fast food within .1 miles seems to matter, and fast food restaurants further away have no discernible impact on obesity.

(b) Magnitude of the Estimated Effect. The estimated effect of exposure to fast-food restaurants at a .5 mile distance is to increase the weight gain of mothers during pregnancy by 49 grams (Table 7, Column 5). Dividing this weight gain of about 0.1 pounds by the approximately 270 days of pregnancy yields an increase in caloric intake due to fast-food of about 1.3 calories per day. (This calculation uses the CDC estimate that 3,500 additional calories induces a 1-pound weight increase). Even the larger estimate of weight gain for fast-food proximity at .1 mile corresponds to only an additional 4 calories per day. It is the large size of the data set that provides us with the precision needed to identify such small effects. Overall, the caloric impacts of fast food proximity for mothers are one to two orders of magnitude smaller than the estimates for children. The findings are consistent with higher transport costs for the 9th graders (who cannot drive) relative to mothers.

(c) Additional Specifications. Table 8 shows estimates from a number of additional specifications. This Table follows the structure of Table 3. Columns 1 to 3 present estimate models in which only one measure of restaurant availability is included in each regression, namely availability within .5 miles.

In column 1, we test whether a broader definition of fast food generates different results. As we did for schools, the broader definition is based on the Wikipedia, excludes ice cream, donut, and coffee shops, and adds in all independent restaurants that have the words “pizza” or “burger” in their names. The model includes the indicator for one of the top 10 fast food restaurants within .5 miles, an indicator for the presence of another fast food restaurant within .5 miles, and an indicator for the presence of a non fast food restaurant in this radius. The broader definition does not have any additional impact over and above the baseline “top 10” definition, suggesting that there is something unique about the largest and most widely known fast food brands.[20] Column 2 shows estimates from a model which excludes Subway from the top 10, since Subway is arguably

[20] Robinson et al. (2007) report that young children consistently prefer food wrapped in familiar fast food packaging, suggesting that the advertising conducted by large chains is effective in spurring demand.

healthier than the other chains. Column 3 reports estimates of a model where the independent variable is an indicator equal to 1 for any restaurant. Similar to our findings for schools and consistent with Anderson and Matsa (2009), we find no evidence that the presence of any restaurant affects weight gain during pregnancy.

In columns 4 to 7 we investigate whether weight gain varies by ethnicity and maternal education. The effect of a new fast food restaurant is largest for African American mothers followed by Hispanic mothers, with no effect for non-Hispanic white mothers. In particular, the coefficient for African American mothers, .0066, is three times the coefficient for the average mother. Relative to the average of the dependent variable for African-Americans this amounts to a 5 percent increase in the probability of weight gain over 20 kilos, a large effect. When we consider differences on the basis of education, we find that the impact is much larger in the less educated group, and that indeed, there is no effect on more educated mothers. The effect of non fast food restaurants is reliably zero across the different racial and educational categories.

We have also estimated the effects of fast food on some additional birth outcomes. The results suggest that the availability of a top 10 fast food restaurant within .5 miles of the mother's residence is associated with a slightly higher incidence of diabetes. There is no effect on the probability that the mother had a very low weight gain (clinically defined as less than 7.26kg) or on the probability of low birth weight.[21]

(d) Threats to Identification and Placebo Analysis. In column 1 of Table 9 we ask whether there is evidence of changes in pregnancy weight gain as a function of *future* fast food restaurant openings. While *current* fast food restaurants within 0.50 miles increase the current probability of weight gain above 20Kg, there is no evidence that *future* fast food restaurants increase weight gain. This is consistent with our identifying assumption. Column 2 shows estimates from models that include indicators for whether there was a fast food restaurant in the mother's current location 3 years ago. This test is not as strong as the other because it is possible that lagged fast food exposure could have an effect on current weight gain. Here both current fast food and lagged fast food have

[21] We also estimated an optimal trimming model, where we included only mothers with a propensity to have weight gain over 20kg of between .1 and .9 and models that only used the sample of mothers who lived within 1 mile of a fast food restaurant. The results were consistent with the benchmark estimates.

positive coefficients in the regression for weight gain over 20Kg, but neither coefficient is statistically significant.[22]

In columns 3 and 4, we undertake a placebo test of a different type, asking whether the availability of fast-food restaurants is correlated with individual-level demographics, conditional on mother fixed effects. The few variables that are time-varying within mothers include smoking during pregnancy and marital status. If our identifying assumption is correct, these two outcome variables should not be correlated with availability of fast food restaurants. Indeed, we find no evidence that probability of smoking or marriage rates are correlated with fast food restaurants at any distance, although the probability of smoking appears to be correlated with availability of non fast food restaurants. In the Web Appendix we present further evidence on predictors of the availability of fast-food restaurants.

7. Conclusions

This paper investigates the health consequences of proximity to fast food for two vulnerable groups: young teens and pregnant women. The focus on very close distances and the presence of a large array of controls alleviates issues of endogenous fast-food placement. Our results point to a significant effect of proximity to fast food restaurant on the risk of obesity, though the magnitude of the effect is very different for school children and adults. The presence of a fast food restaurant within a tenth of a mile of a school is associated with at least a 5.2 percent increase in the obesity rate in that school (relative to the presence at .25 miles). Consistent with highly non-linear transportation costs for school children, we find no evidence of an effect at .25 miles and at .5 miles. The effect at .1 miles distance is equivalent to an increase in daily caloric consumption of 30 to 100 calories due to proximity of fast-food. The effect for pregnant women is quantitatively smaller and more linear in distance. A fast food restaurant within half a mile of a residence results in a 1.6 percent increase in the probability of gaining over 20 kilos. This effect increases to a 5.5 percent increase when a fast-food is within .1 miles from the

[22] We obtained very similar results if we examined 1 year or 2 year leads and lags.

residence of the mother. The effect at .5 miles translates into a daily caloric intake of 1 to 4 calories, two orders of magnitudes smaller than for school children.

The quantitative difference in the impact of fast-food between school children and mothers has policy implications. To the extent that the estimates for mothers are representative of the estimates for adults, attempts to limit the presence of fast-food throughout residential areas are unlikely to have a sizeable impact on obesity. Instead, narrower policies aimed at limiting access to fast food could have a sizable impact on populations with limited ability to travel, such as school children.

Using our estimates, we can do a calibration of the impact of fast-food penetration on school children and women. Taking into account that only about 6.7 percent of schools (in our sample) have a fast-food restaurant within .1 miles, fast-food restaurants near schools can be responsible for only 0.5 percent of the increase in obesity over the last 30 years among 9th graders.[23] This is because, although having a fast food restaurant very close to the school has a large effect on affected ninth graders, relatively few children have a restaurant so close. Still, the results suggest that measures designed to limit access to fast food among teenagers more broadly (such as restrictions on advertising to children, or requirements to post calorie counts) could have a beneficial effect.[24]

For mothers, if we assume that the effect of fast-food on weight gain for pregnant mothers is the same as for non-pregnant women, then fast-food restaurants near a women's residence could be responsible for about 2.7 percent of the increase in weight in the last ten years among women.[25] While we cannot explain a large share of the changes

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[23] According to our measure, about 33% of 9th graders in California were obese during 1999-2007. Since obesity among adolescents (age 12-19) approximately tripled from 1970 to late 1990s, we estimate the increase in obesity of 9th graders in the past 30 years to be about 22 percentage points. Hence, we compute the effect as 1.7 percentage points (the estimated impact of fast-food on obesity at .1 miles) multiplied by .067 (the share of schools at .1 miles in 1999-2007, assumed to be zero in the 1960s) divided by 22 percentage points.

[24] Bollinger et al. (2009) find that posting calorie counts in Starbucks in New York City reduced calories consumed by about 6%, which is significant, but not large enough to have a major impact on obesity rates by itself.

[25] CDC (using NHANES data) reports that obesity has risen by about 10 percentage points for 20-34 year old females over the past 10 years (from 18.5% in the 1988-94 wave to 28.4% in the 1999-2002 wave) and that the average weight in this group has increased by about 6.7 kilograms. Our estimates indicate that a fast-food restaurant within .5 miles of a residence increases weight gain by 49 grams over 9 months, which over a ten-year period translate to 650 grams. Since fast-foods are within .5 miles of a residence (in our

in obesity and weight in either case, one explanation of the larger fraction explained for mothers is that the effect is found at a longer distance (.5 miles); the second is the longer assumed exposure time. If, for example, having a fast food restaurant near the school continued to influence children's eating habits throughout highschool, then the cumulative effect for teens might well be larger than that estimated here.

These findings add new evidence to the debate about the impact of fast-food on obesity by providing credible evidence on magnitudes of the effect of fast-food. Still, this research leaves several questions unanswered. We cannot speculate about the generalizability of our research to other samples; it is possible that adolescents and pregnant women are uniquely vulnerable to the temptations of fast food. In addition, our research cannot distinguish between a rational price-based explanation of the findings and a behavioral self-control-based explanation. Finally, since fast food is ubiquitous in America, we cannot study the impact of fast-food entry in a society where fast food is scarce. We hope that some of these questions will be the focus of future research.

data) for 27.7 percent of women, fast-food can have contributed to 650 grams times .277 divided by 6,700 grams, which equals 2.7 percent.

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Appendix 1: Definition of Fast Food Restaurant

There is little consensus about the definition of fast food in the literature. For example, the American Heritage Dictionary definies fast food as "Inexpensive food, such as hamburgers and fried chicken, prepared and served quickly." While everyone agrees that prominent chains such as McDonald's serve fast food, there is less agreement about whether smaller, independent restaurants are also "fast food."

The Census of Retail trade defines a fast food establishment as one that does not offer table service. Legislation recently passed in Los Angeles imposing a moratorium on new fast food restaurants in south central L.A. defined fast food establishments as those that have a limited menu, items prepared in advance or heated quickly, no table service, and disposable wrappings or containers (Abdollah, 2007). However, these definitions do not get at one aspect of concern about fast food restaurants, which is their heavy reliance on advertising, and easy brand recognition.

We constructed several different measures of fast food. Our benchmark definition of fast-food restaurants focuses on the top 10 chains, which are McDonald's, Subway, Burger King, Pizza Hut, Jack in the Box, Kentucky Fried Chicken, Taco Bell, Domino's Pizza, Wendy's, and Little Ceasar's. We have also constructed a broader definition using Wikipedia's list of national fast food chains (en.wikipedia.org/wiki/Fast_food). Wikipedia considers fast food to be "Food cooked in bulk and in advance and kept warm, or reheated to order." Our broadest definition starts with this list, excludes ice cream, donut, and coffee shops, and adds in all independent restaurants from our Dun and Bradstreet list that have the words "pizza" or "burger" in their names. The definition of "other restaurant" depends on the definition of fast food.

As discussed in the paper, we find a larger impact of the top 10 fast-food chains than for the broader definition of fast-foods. To conserve space, we show estimates for the broad definition excluding ice cream, donuts, and coffee shops, and for the top 10 chains.

Appendix Table 1 shows more information about the top 10 fast food restaurants, other major restaurant chains, and chains that are not counted as fast food for the four states in our study (California, Michigan, New Jersey, and Texas).

Figure 1a: Impact of Fast Food Availability on Weight Gain of 9th Graders

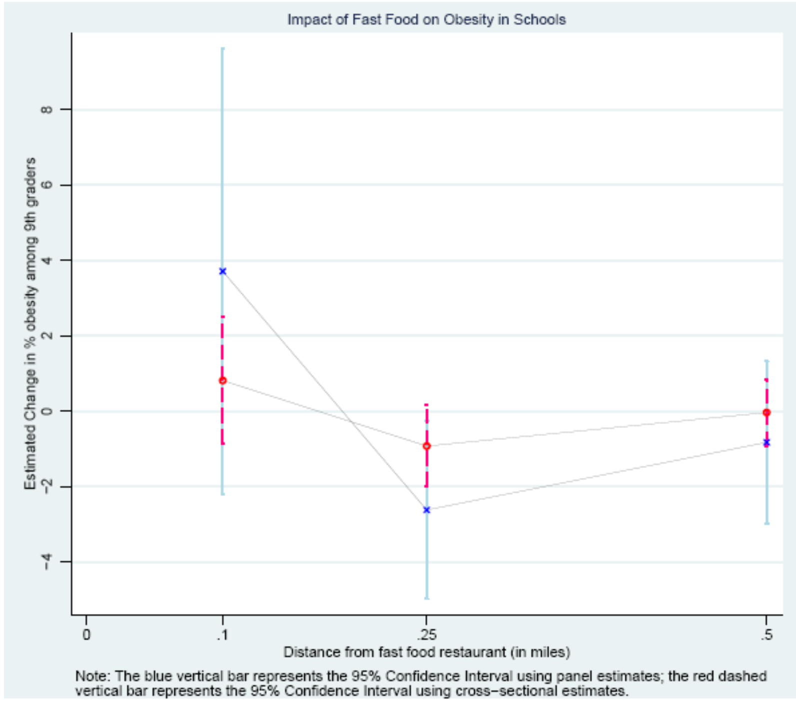
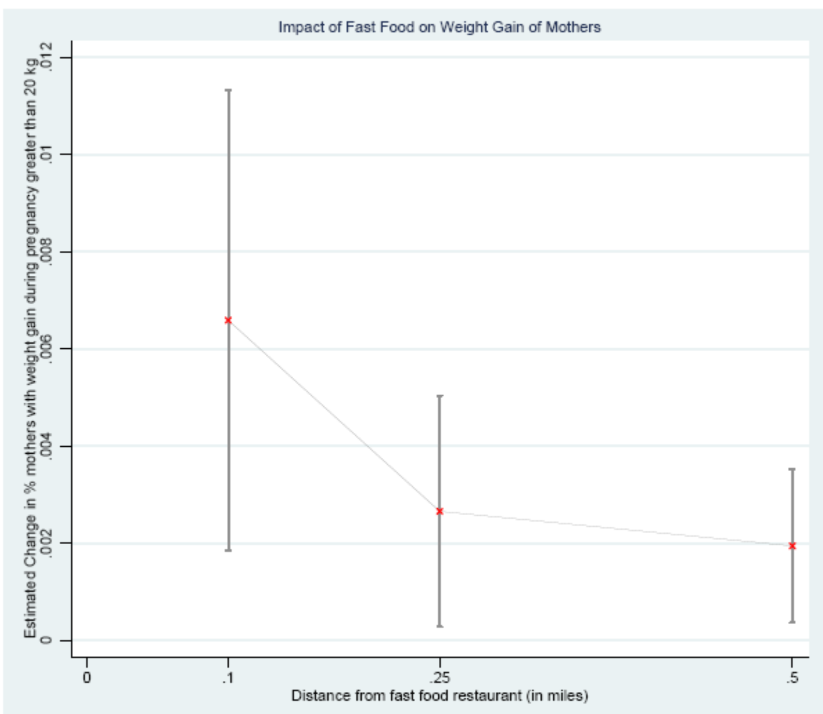


Figure 1b: Impact of Fast Food Availability on Weight Gain of Mothers



Notes: Figure 1a plots the estimated impact of exposure to fast-food at .1, .25, and .5 miles on the obesity rate of 9th graders in the cross-section (Column 2 in Table 2) and in the panel (Column 4 in Table 2). Figure 1b plots the estimated impact on the probability of weight gain above 20 kg for mothers, in the specification with mother fixed effects (Column 2 in Table 7). The Figure plots the effect of exposure at distance j relative to no exposure within .5 miles. As such, the effect for .1 miles is the sum of the coefficients in rows 1, 3, and 5 (that is, it is the sum $\alpha+\beta+\gamma$ in equation 1. Similarly, the effect for .25 miles is the sum of the coefficients in rows 3 and 5, that is, $\beta+\gamma$.

Figure 2. Gestational Weight Gain and Low APGAR Scores

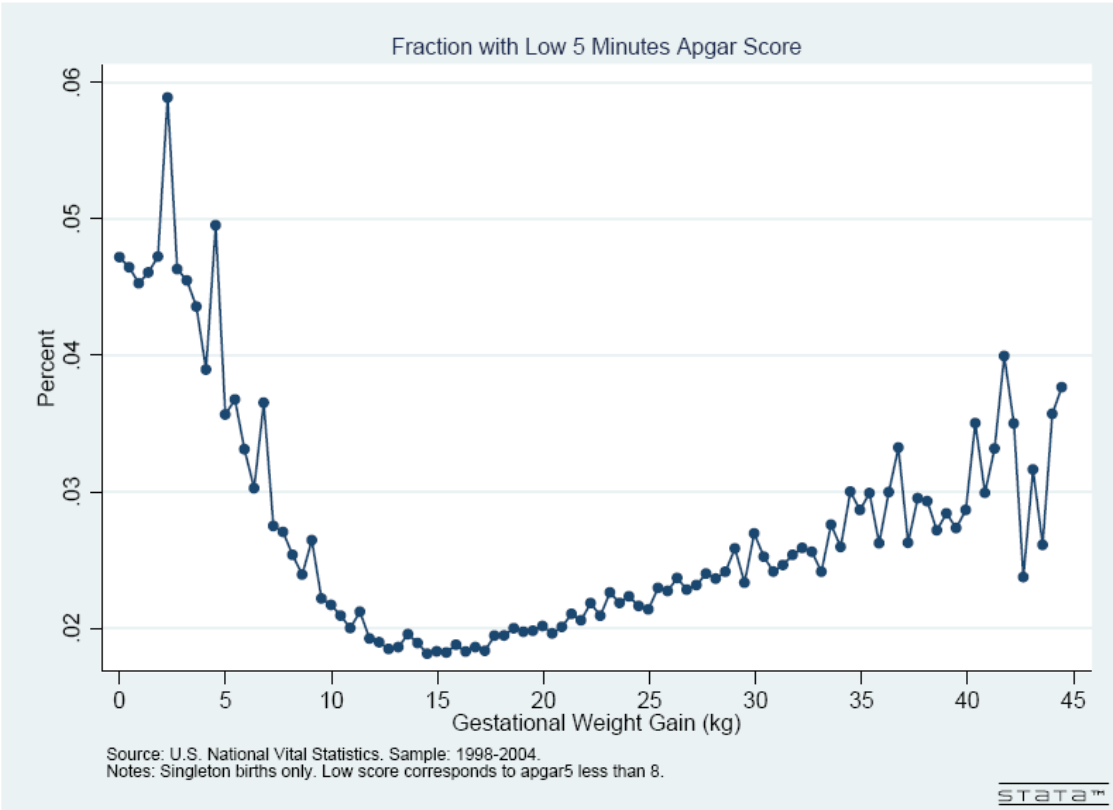


TABLE 1A
SUMMARY STATISTICS FOR SCHOOL DATA

	CA All	CA <.5 miles FF	CA <.25 miles FF	CA <.1 miles FF
# School-Year Observations	8373	5188	2321	559
No. Students per grade	366.27	384.30	383.05	400.74
School Characteristics				
Share Black students	0.084	0.093	0.093	0.086
Share Asian students	0.107	0.117	0.118	0.116
Share Hispanic students	0.380	0.409	0.416	0.436
Share immigrant students	0.034	0.029	0.030	0.033
Share eligible for free lunch	0.290	0.306	0.313	0.311
Average Test Scores 9th grade	56.255	54.964	54.737	52.291
Census Demographics of nearest block				
Median earnings	25674	24668	24271	23942
Share High-School degree	0.220	0.219	0.219	0.220
Share unemployed	0.083	0.085	0.088	0.079
Share Urban	0.912	0.974	0.971	0.987
Outcomes				
Percent obese students	32.949	33.772	33.724	35.733

TABLE 1B
SUMMARY STATISTICS FOR BIRTH DATA

	All Births	Siblings Only	Siblings <=.5 mi	Siblings <=.25 mi	Siblings <=.1 mi
# Mother-Year Observations	5683798	3019256	835798	258707	44828
Demographic Characteristics					
Mean age of mother	26.975	26.772	26.450	26.249	25.963
% age 15-24	.285	.292	.313	.327	.349
% age 25-34	.500	.511	.495	.484	.470
% 35+	.119	.101	.092	.087	.080
% high school	.320	.310	.312	.315	.314
% some college	.332	.333	.301	.288	.268
% college or more	.079	.077	.065	.059	.050
% black	.156	.164	.196	.195	.202
% hispanic	.278	.263	.309	.324	.348
% smoking	.107	.107	.108	.111	.111
% child is male	.512	.512	.512	.511	.507
Parity	1.016	1.180	1.200	1.190	1.180
% married	.687	.696	.651	.639	.623
Outcomes					
% weight gain greater than 20kg	.126	.118	.120	.121	.123
Mean weight gain	13.664	13.491	13.410	13.412	13.400

TABLE 2
IMPACT OF FAST-FOOD ON OBESITY IN SCHOOLS: BENCHMARK RESULTS

Dep. Var.:	Percent of 9th graders that are obese			
	(1)	(2)	(3)	(4)
Availability of Fast Food Rest.	3.0807	1.7385	6.1955	6.3337
Within .1 miles	(1.6072)*	(0.8740)**	(2.9446)**	(2.8752)**
Availability of Other Restaurant	0.6817	-0.6162	1.0939	1.0026
Within .1 miles	(1.0308)	(0.5704)	(1.9123)	(1.8238)
Availability of Fast Food Rest.	-2.4859	-0.891	-1.8486	-1.7947
Within .25 miles	(1.1112)**	(0.5452)	(1.1812)	(1.2096)
Availability of Other Restaurant	2.1416	0.0505	0.269	0.0375
Within .25 miles	(0.8757)**	(0.4895)	(1.0113)	(0.9429)
Availability of Fast Food Rest.	1.3903	-0.0391	-0.9173	-0.8311
Within .5 miles	(0.8219)*	(0.4475)	(1.1152)	(1.0872)
Availability of Other Restaurant	1.2266	0.4638	0.1266	-0.4151
Within .5 miles	(0.8407)	(0.4881)	(0.9083)	(0.8161)
Specification:	Cross-Sect. Regression No Controls	Cross-Sect. Regression Controls	School f.e. Panel No Controls	School f.e. Panel Controls
R^2	0.0209	0.4296	0.5544	0.6512
N	8373	8373	8373	8373

Notes: Each column is a different OLS regression. The regressions are weighted by the number of students. The dependent variable is the percentage of students in the 9th grade who are classified as obese. The mean of the dependent variable is 32.9494. The unit of observation is a school-grade-year for schools in California in the years 1999 and 2001-2007. Entries in rows 1, 3 and 5 are the coefficient on a dummy for the existence of a fast food restaurant at a given distance from the school. Entries in rows 2, 4 and 6 are coefficient on dummy for the existence of a non-fast food restaurant at a given distance from the school. The school-level controls are from the Common Core of Data, with the addition of Star test scores for the 9th grade. The Census block controls are from the closest block to the address of the school. Standard errors clustered by school in parenthesis.

* significant at 10 percent; ** significant at 5 percent; *** significant at 1 percent

TABLE 3
IMPACT OF FAST-FOOD ON OBESITY IN SCHOOLS: ADDITIONAL MODELS

Dep. Var.:	Percent of 9th graders that are obese				
	All Students			Hispanic St.	Black Stud.
	(1)	(2)	(3)	(4)	(5)
Availability of Fast Food Rest. Within .1 miles	3.015 (1.6378)*			2.0067 (1.0135)**	-1.5417 (1.2056)
Availability of Fast Food (Broad Def.) Restaurant Within .1 miles	0.0887 (1.7305)				
Availability of Non-Fast Food Rest. Within .1 miles	0.3447 (1.0437)				
Availability of Fast Food Rest. (Exclud. Subway) Within .1 miles		1.7223 (0.9071)*			
Availability of Other Rest. Within .1 miles		-0.6134 (0.5648)		-0.3049 (0.6169)	-0.4451 (0.8610)
Availability of Any Restaurant Within .1 miles			-0.4719 (0.5393)		
Specification:	Cross-Section OLS	Cross-Section OLS	Cross-Section OLS	Cross-Section OLS	Cross-Section OLS
Includes Controls for Restaurants at .25 and .5 miles	Yes	Yes	Yes	Yes	Yes
Average of Dependent Variable	32.9494	32.9494	32.9494	36.9517	35.4517
R^2	0.0219	0.4295	0.4287	0.2215	0.2512
N	8373	8373	8373	6946	2851

Notes: Each column is a different OLS regression. The regressions are weighted by the number of students. The dependent variable in columns 1-3 is the percentage of students in the 9th grade who are classified as obese. The dependent variable in columns 4 and 5 is the percentage of Hispanic and Black students respectively in the 9th grade who are classified as obese.The unit of observation is a school-grade-year for schools in California in the years 1999 and 2001-2007. Entries in row 1 and 3 are the coefficient on a dummy for the existence of a fast fast food restaurant and a non-fast food restaurant closer than .1 miles from the school. The entry in row 2 is the coefficient on a dummy for whether there is a fast food restaurant according to a broader definition (and not included in the benchmark definition) less than .1 miles from the school. The broad definition includes all restaurants classified as fast-foods by Wikipedia. The entry in row 4 is the coefficient on a dummy for proximity to one or more of the top 10 fast food chains excluding Subway.

The school-level controls are from the Common Core of Data, with the addition of Star test scores for the 9th grade. The Census block controls are from the closest block to the address of the school. Standard errors clustered by school in parenthesis. The specifications in Columns (4) and (5) include fewer observations because only school-year observations with at least 10 students in the race category report the data.

* significant at 10 percent; ** significant at 5 percent; *** significant at 1 percent

TABLE 4
IMPACT OF FAST-FOOD ON OBESITY IN SCHOOLS: PLACEBOS USING DEMOGRAPHIC VARIABLES

Dep. Var.:	Share Black	Share Hispanic	Share Asian	Share Title I Students	Share Free Lunch	Average Test Score	Pred. Obesity Based on Controls
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Panel A. Cross-Section							
Availability of Fast Food Rest.	-0.0072	-0.004	-0.0205	0.0459	-0.0426	-2.6323	1.4362
Within .1 miles	(0.0097)	(0.0215)	(0.0158)	(0.0678)	(0.0260)	(1.4392)*	(1.3380)
Availability of Fast Food Rest.	-0.0062	0.0186	0.0092	-0.0633	0.0165	1.2676	-1.6125
Within .25 miles	(0.0073)	(0.0145)	(0.0093)	(0.0375)*	(0.0135)	(0.9118)	(0.9583)*
Availability of Fast Food Rest.	0.0113	-0.0026	-0.0021	0.0266	0.0004	0.8849	1.4154
Within .5 miles	(0.0058)*	(0.0105)	(0.0068)	(0.0303)	(0.0088)	(0.5992)	(0.6624)**
Controls for availability of Other Restaurants	X	X	X	X	X	X	X
Panel B. Fixed-Effect Panel							
Availability of Fast Food Rest.	-0.004	-0.0016	-0.0037	-0.0365	-0.0408	-0.332	-0.0092
Within .1 miles	(0.0042)	(0.0081)	(0.0036)	(0.0390)	(0.0281)	(1.4578)	(0.5481)
Availability of Fast Food Rest.	0.0028	-0.0017	0.0064	0.0403	0.0028	0.6032	-0.0483
Within .25 miles	(0.0025)	(0.0061)	(0.0037)*	(0.0482)	(0.0153)	(1.1248)	(0.4146)
Availability of Fast Food Rest.	-0.0033	-0.0038	0.0009	0.0028	0.0137	-2.6662	-0.2734
Within .5 miles	(0.0021)	(0.0047)	(0.0026)	(0.0346)	(0.0120)	(0.8019)***	(0.1914)
Controls for availability of Other Restaurants	X	X	X	X	X	X	X
Controls included	No school Demogr.	No school Demogr.	No school Demogr.	No school Demogr.	No school Demogr.	No test Score	No demographics
Average of Dependent Variable	0.0843	0.3804	0.1072	0.3971	0.2901	57.6665	32.8015
N	8373	8373	8373	8373	8373	8168	8373

Panel C. Test of Uniform Distribution of Fast-Foods

No. fast foods at .25 miles - (No. fast foods at .1 miles * (2.5)^2) = -.0135 (s.e. .0552), n.s.
No. fast foods at .5 miles - (No. fast foods at .1 miles * 5^2) = -.1335 (s.e. .2245), n.s.

Notes: Each column is a different OLS regression. The regressions are weighted by the number of students. The dependent variables are different school-level demographic variables. The dependent variable in Column 7 is the predicted share of obese students based on a regression of the share obese on all the demographic controls. The unit of observation is a school-grade-year for schools in California in the years 1999 and 2001-2007. The school-level controls are from the Common-Core data, with the addition of Star test scores for the 9th grade. The Census block controls are from the closest block to the address of the school. Standard errors clustered by school in parenthesis.

* significant at 10 percent; ** significant at 5 percent; *** significant at 1 percent

TABLE 5
IMPACT OF FAST-FOOD ON OBESITY IN SCHOOLS: PLACEBOS USING TIMING

	Placebos based on lead		Placebo based on lag
Dep. Var.:	% of obese 9th graders		% of obese 9th graders
	(1)	(2)	(3)
Availability of Fast Food Rest.	5.9191	-	1.0343
Within .1 miles	(2.3877)**	-	(1.3777)
Availability of Other Restaurant	0.414	0.2828	1.1174
Within .1 miles	(1.6475)	(1.7644)	(1.0583)
Availability of Fast Food Rest.	-4.0011	-1.1628	
Within .1 miles 3 Years Later	(2.1361)*	(1.9063)	
Availability of Other Restaurant	-0.5785	-0.6153	
Within .1 miles 3 Years Later	(1.6646)	(1.7710)	
Availability of Fast Food Rest.			0.7887
Within .1 miles 3 Years Earlier			(1.3720)
Availability of Other Restaurant			-2.0254
Within .1 miles 3 Years Earlier			(1.0353)*
Sample:	All Schools	Schools with no Fast-Food at .1 miles	All Schools
Includes Controls for Restaurants at .25 and .5 miles	Yes	Yes	Yes
R^2	0.3877	0.3869	0.4302
N	4734	4551	8373

Notes: The regressions are weighted by the number of students. The dependent variable is the percentage of students in the relevant grade who are classified as obese. The unit of observation is a school-grade-year for schools in California in the years 1999 and 2001-2005. The sample in column 2 includes only schools that do not have a fast food restaurant located within .1 mile. Entries in row 1 (respectively, row 2) are the coefficient on a dummy for the existence of a fast food restaurant (respectively, non-fast-food restaurant) less than .1 miles from the school. The entry in row 3 (respectively, row 4) is the coefficient on a dummy for the existence of a fast food restaurant (respectively, non-fast-food restaurant) less than .1 miles from the school 3 years after obesity is measured. The entry in row 5 (respectively, row 6) is the coefficient on a dummy for the existence of a fast food restaurant (respectively, non-fast-food restaurant) less than .1 miles from the school 3 years before obesity is measured. The school-level controls are from the Common Core of Data. The Census block controls are from the closest block to the address of the school. Standard errors clustered by school in parenthesis.

* significant at 10 percent; ** significant at 5 percent; *** significant at 1 percent

TABLE 6
IMPACT OF FAST-FOOD ON OBESITY IN SCHOOLS BY GRADE

Dep. Var.:	Percent of obese 9th graders		Percent of obese 7th graders		Percent of obese 5th graders	
	(1)	(2)	(3)	(4)	(5)	(6)
Availability of Fast Food Rest.	1.7385	6.3337	0.1233	1.2712	0.8946	6.1332
Within .1 miles	(0.8740)**	(2.8752)**	(1.1135)	(1.1135)	(0.7124)	(2.8281)**
Availability of Other Restaurant	-0.6162	1.0026	-0.2018	-0.4833	0.4267	0.629
Within .1 miles	(0.5704)	(1.8238)	(0.4239)	(1.0045)	(0.2997)	(0.6281)
Availability of Fast Food Rest.	-0.891	-1.7947	0.0777	-1.5916	-0.279	-1.0562
Within .25 miles	(0.5452)	(1.2096)	(0.4439)	(1.1223)	(0.2811)	(0.7568)
Availability of Other Restaurant	0.0505	0.0375	0.6333	1.2198	0.2501	-0.3428
Within .25 miles	(0.4895)	(0.9429)	(0.3186)**	(0.5830)**	(0.1918)	(0.4126)
Availability of Fast Food Rest.	-0.0391	-0.8311	-0.4059	0.6946	0.4341	0.0418
Within .5 miles	(0.4475)	(1.0872)	(0.3157)	(0.6353)	(0.1844)**	(0.4985)
Availability of Other Restaurant	0.4638	-0.4151	0.2137	-1.209	0.2879	0.7276
Within .5 miles	(0.4881)	(0.8161)	(0.3748)	(0.8322)	(0.2312)	(0.3905)*
Specification:	Cross-Sect. Regression Controls	School f.e. Panel Controls	Cross-Sect. Regression Controls	School f.e. Panel Controls	Cross-Sect. Regression Controls	School f.e. Panel Controls
Average of Dependent Variable	32.9494	32.9494	32.5601	32.5601	31.7794	31.7794
R^2	0.4296	0.6512	0.465	0.6684	0.3666	0.5582
N	8373	8373	13422	13422	37351	37351

Notes: Each column is a different OLS regression. The regressions are weighted by the number of students. The dependent variable is the percentage of students in the specified grade who are classified as obese. The unit of observation is a school-grade-year for schools in California in the years 1999 and 2001-2007. Entries in rows 1, 3 and 5 are the coefficient on a dummy for the existence of a fast food restaurant at a given distance from the school. Entries in rows 2, 4 and 6 are coefficient on dummy for the existence of a non-fast food restaurant at a given distance from the school. The school-level controls are from the Common Core of Data, with the addition of Star test scores for the 9th grade. The Census block controls are from the closest block to the address of the school. Standard errors clustered by school in parenthesis.

* significant at 10 percent; ** significant at 5 percent; *** significant at 1 percent

TABLE 7
FAST-FOOD AND WEIGHT GAIN FOR MOTHERS: BENCHMARK RESULTS

Dep. Var.:	Weight Gain During Pregnancy Larger than 20kg			Weight Gain > 15 Kg.	Weight Gain (in kg.)
	(1)	(2)	(3)	(4)	(5)
Availability of Fast Food Rest.	0.0007	0.0039	0.0054	0.0051	0.0704
Within .1 miles	(0.0018)	(0.0025)	(0.0045)	(0.0035)	(0.0432)*
Availability of Other Restaurant	-0.0001	-0.0012	-0.0007	0.0003	-0.0048
Within .1 miles	(0.0007)	(0.0010)	(0.0017)	(0.0014)	(0.0169)
Availability of Fast Food Rest.	0.0014	0.0007	0.0006	0.0022	0.0250
Within .25 miles	(0.0009)	(0.0013)	(0.0022)	(0.0018)	(0.0215)
Availability of Other Restaurant	0.0002	0.0009	0.0006	0.0016	0.0185
Within .25 miles	(0.0005)	(0.0008)	(0.0013)	(0.0011)	(0.0129)
Availability of Fast Food Rest.	0.0011	0.0020	0.0028	0.0044	0.0491
Within .5 miles	(0.0006)*	(0.0008)**	(0.0014)**	(0.00113)***	(0.0135)***
Availability of Other Restaurant	0	-0.0001	-0.0033	-0.0019	-0.0165
Within .5 miles	(0.0006)	(0.0008)	(0.0014)**	(0.0012)	(0.0136)
Specification:	Zip-Code Fixed Effects Panel	Mother Fixed Effects Panel	Mother Fixed Effects, Stayers	Mother Fixed Effects Panel	Mother Fixed Effects Panel
Average of Dependent Variable	0.118	0.118	0.11	0.352	13.49
R^2	0.008	0.007	0.009	0.012	0.023
N	3019194	3019256	1584414	3019256	3019256

Notes: Each column is a different OLS regression. The unit of observation is a pregnancy for mothers with at least two births in the sample. Entries in rows 1, 3 and 5 are the coefficients on a dummy for the existence of a fast food restaurant at a given distance from the mother's residence. Entries in rows 2, 4 and 6 are coefficients on dummy for the existence of a non-fast food restaurant at a given distance from the mother's residence. All the regressions include a full set of demographic controls listed in the text. Standard errors clustered by zip code in column 1 and by mother (columns 2-5) in parenthesis.
* significant at 10 percent; ** significant at 5 percent; *** significant at 1 percent

TABLE 8
IMPACT OF FAST-FOOD ON WEIGHT GAIN LARGER THAN 20KG: ADDITIONAL MODELS

Dep. Var.:	Weight Gain During Pregnancy Larger Than 20kg						
Sample:	All Mothers			Hispanic Mothers	Black Mothers	High School or Less	Some College or More
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Availability of Fast Food Rest.	0.0019			0.0022	0.0066	0.0033	0.0002
Within .5 miles	(0.0009)*			(0.0013)*	(0.0016)***	(0.0009)***	(0.0012)
Availability of Fast Food (Broad Def.)	0.0009						
Restaurant Within .5 miles	(0.0009)						
Availability of Non-Fast Food Rest.	-0.0002			-0.0015	-0.0032	0.0000	0.0004
Within .5 miles	(0.0008)			(0.0015)	(0.0021)	(0.0010)	(0.0011)
Availability of Fast Food Rest.		0.0025					
Within .5 miles excluding Subway		(0.0007)***					
Availability of Other Rest.		0.0002					
Within .5 miles		(0.0008)					
Availability of Any Restaurant			0.0011				
Within .5 miles			(0.0007)				
Specification:	Mother Fixed Effects	Mother Fixed Effects	Mother Fixed Effects	Mother Fixed Effects	Mother Fixed Effects	Mother Fixed Effects	Mother Fixed Effects
Average of Dependent Variable	0.126	0.126	0.126	0.101	0.131	0.126	0.106
R^2	0.006	0.007	0.007	0.011	0.002	0.007	0.007
N	3019256	3019256	3019256	794535	495045	1779895	1236989

Notes: Each column is a different OLS regression. The unit of observation is a pregnancy for mothers with at least two births in the sample. Entries in row 1 and 3 are the coefficients on a dummy for the existence of a fast fast food restaurant and a non-fast food restaurant within 0.5 miles from the mother's residence. The entry in row 2 is the coefficient on a dummy for whether there is a fast food restaurant according to a broader definition (and not included in the benchmark definition) within 0.5 miles from the mother's residence. The entry in row 4 is the coefficient on a dummy for the existence of a fast food restaurant from one of the top 10 fast food chains excluding Subway. All the regressions include a full set of demographic controls listed in the text. Standard errors clustered by mother in parenthesis.

* significant at 10 percent; ** significant at 5 percent; *** significant at 1 percent

TABLE 9
IMPACT OF FAST-FOOD ON WEIGHT GAIN: PLACEBOS

Dep. Var.:	Weight Gain During Pregnancy > 20 Kg.		Mother Smokes	Mother is Married
	Placebos based on leads	Placebos based on lags	Placebos based on demographic variables	
	(1)	(2)	(3)	(4)
Availability of Fast Food Rest.			0.0001	0.0007
Within .1 miles			(0.0019)	(0.0028)
Availability of Other Restaurant			0.0012	-0.0016
Within .1 miles			(0.0007)	(0.0011)
Availability of Fast Food Rest.			0.0002	-0.0002
Within .25 miles			(0.0009)	(0.0014)
Availability of Other Restaurant			0.0001	-0.0008
Within .25 miles			(0.0006)	(0.0008)
Availability of Fast Food Rest.	0.0035	0.0010	0.0007	0.0002
Within .5 miles	(0.0011)***	(0.0012)	(0.0006)	(0.0009)
Availability of Other Restaurant	-0.0006	-0.0021	0.0021	-0.0001
Within .5 miles	(0.0011)	(0.0012)*	(0.0006)***	(0.0009)
Availability of Fast Food Rest.	-0.0014			
Within .5 miles 3 Years Later	(0.0011)			
Availability of Other Restaurant	0.0012			
Within .5 miles 3 Years Later	(0.0012)			
Availability of Fast Food Rest.		0.0019		
Within .5 miles 3 Years Earlier		(0.0013)		
Availability of Other Restaurant		0.0025		
Within .5 miles 3 Years Earlier		(0.0012)**		
Specification:	Mother Fixed Effects	Mother Fixed Effects	Mother Fixed Effects	Mother Fixed Effects
R^2	0.007	0.008	0.008	0.047
N	3019256	2694834	3005825	2889618

Notes: Each column is a different OLS regression. The unit of observation is a pregnancy for mothers with at least two births in the sample. Entries in rows 1, 3 and 5 are coefficients on dummies for the existence of a fast food restaurant and the entries in rows 2, 4 and 6 are coefficients on dummies for the existence of a non-fast food restaurant respectively within the specified distances from the mother's residence. Entries in rows 7 and 8 are coefficients on a dummy for the existence of a fast food restaurant and a non-fast food restaurant respectively within 0.5 miles from the mother's residence three years after the pregnancy. Entries in rows 9 and 10 are coefficients on a dummy for the existence of a fast food restaurant and a non-fast food restaurant respectively within 0.5 miles from the mother's residence three years before the pregnancy. All the regressions include a full set of demographic controls listed in the text. Standard errors clustered by mother in parenthesis.

* significant at 10 percent; ** significant at 5 percent; *** significant at 1 percent

APPENDIX TABLE 1

FAST-FOOD RESTAURANTS AND OTHER RESTAURANTS

Top-10 Fast-Food Restaurants			Major Fast-Food Restaurants in Wikipedia List and not in top-10 List			Major Restaurants in non-Fast Food Category		
Rank (1)	Name (2)	Percent (3)	Rank (4)	Name (5)	Percent (6)	Rank (7)	Name (8)	Percent (9)
1	Mc Donalds	8%	1	Starbucks	12%	1	Ihop	0.002%
2	Subway	7%	2	Dairy Queen	7%	2	Sizzler	0.002%
3	Burger King	5%	3	Baskin Robbins	6%	3	Togos Eatery	0.001%
4	Taco Bell	4%	4	Jamba Juice	5%	4	Chilis	0.001%
5	Pizza Hut	4%	5	Fosters Freeze	5%	5	Applebees	0.001%
6	Little Caesars	3%	6	Orange Julius	4%	6	Tcby	0.001%
7	Kfc	3%	7	Smoothie King	4%	7	Cocos	0.001%
8	Wendys	3%	8	Juice Stop	4%	8	Aramark	0.001%
9	Dominos Pizza	3%	9	Braums	3%	9	Big Boy	0.001%
10	Jack In The Box	3%	10	Moes Southwest	2%	10	Outbak	0.001%

Notes: Data on restaurant establishments are from Dun & Bradstreet. "Percent" in column 3 is the number of establishments of the relevant chain over the total number of fast food restaurants. "Percent" in column 6 is the number of establishments of the relevant chain over the total number of restaurants in the Wikipedia list excluding the top 10 chains. "Percent" in column 9 is the number of establishments of the relevant chain over the total number of restaurants, excluding fast food restaurants and restaurants on the Wikipedia list. See discussion in Appendix 1 for more details on our classification of restaurants.