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Effects of Healthier Choices on Kid's Menu: A Difference-in-Differences Analysis

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Abstract

This study evaluates the effect of a quick-service restaurant (QSR) strategy which changes default calorie-dense menu items to healthier options on children' menu consumption behaviors. A series of difference-in-differences (DID) models are estimated to compare sales between treatment and control group restaurants in the Washington State. The results do not provide evidence that adding healthier options causes consumers to make healthier diet choices. This negative result suggests that more proactive interdiction is needed to make an impact on childhood obesity. Government policies such as those that require additional, possibly highlighted, information and/or education are likely to have a greater effect.

Keywords: quick service restaurants, children's diet, food away from home

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Introduction

Childhood obesity has been a worldwide problem in recent decades. The global proportion of childhood overweight and obesity rose from 4.2% in 1990 to 6.7% in 2010, and is expected to reach 9.1% in 2020 (Onis et al. 2010). With regard to the obesity prevalence among U.S. children, according to the Centers for Disease Control and Prevention (CDC), the obesity rate among children and adolescents had almost tripled in 2008 since 1980 with obesity rates at about 17% (or 12.5 million) of children and adolescents (aged 2 to 19 years) in 2007-08.

The increasing prevalence of childhood obesity coincides with increasing consumption of food away from home (FAFH) in recent decades. According to the USDA, the FAFH share of total food expenditures increased from roughly 34% in 1972 to approximately 50% in 2008 (USDA, 2010). Meanwhile, compared to home-cooked foods, FAFH meals are generally higher in over-consumed nutrients (calories, fat and saturated fat), and lower in under-consumed nutrients (such as calcium, fiber and iron) (Lin et al. 1999). Mancino et al (2010) discuss that energy intake is higher and diet quality is lower among children who eat FAFH than among those who do not.

Within the category of FAFH, quick-service restaurants (QSR) account for a large portion. Based on ConAgra Foodservice estimates (FAFH Monthly Industry Brief 2010), QSR purchases made up 77.7% of the annualized total commercial restaurant patron purchases in 2009-2010. At the same time, many claim that QSRs provide high-calorie, obesity-promoting foods to kids. O'Donnell et al. (2008) studied the nutrient quality of kids' meals provided by QSRs in Houston, Texas, and found that only 3% of kids' meals met all National School Lunch Program (NSLP) criteria. Meals not meeting the NSLP criteria were, on average, more than 1.5 times more energy dense than those satisfying the criteria.

Rydell et al. (2008) investigated factors affecting the popularity of QSR through a survey for patrons. They found the most frequent reasons for consumers to dine at QSRs were the following: "fast food is quick" (92%), the "restaurants are easy to get to," (80%) and the "food tastes good" (69%). There are few alternative quick and convenient restaurants that offer less calorie-dense choices. We ask the question of whether offering better nutritional quality on existing QSR menus will lead consumers to make better choices. Currently, many kids' meals have calorie-dense default items included. How will replacing the default items with a choice that includes a healthy option affect consumption?

Menu Labeling and Change

To improve the nutritional quality of QSR menus, there are two major approaches. The first is to add nutrition-related information to the menus, and the second is to add healthier options into QSR menus, which actually change those menus. Several studies have been undertaken to investigate the effect of menu labeling on promoting a healthier diet, but the results are ambiguous, while the studies for menu change are rather sparse.

Voluntary Menu Labeling

Regarding the comprehensive efforts to label menus, several restaurants voluntarily displayed nutrient information in their menus from time to time. Boon et al. (1998) demonstrated that under the stimulation of calorie information, cognition plays an important part in the regulation of the food intake of restrained eaters, which implies that consumers might be responsive to health-related nutritional information of the menus. Bassett et al. (2008) studied the voluntary menu labeling in Subway and found that the frequent Subway consumers who noticed calorie information bought 52 fewer calories than those who did not see it on average. Pulos and Leng (2010) investigated six full-service restaurants (FSR) in Washington which added nutrition information to their menus, and concluded that each calorie-reducing patron purchased roughly 75 fewer calories than what they ordered before labeling.

However, not all literature demonstrated a significant effect of providing nutrition information on reducing calorie intake. Berning et al. (2011) found that positive nutrition information led to decreased sales at times, and provided a potential explanation that customers recognize a tradeoff between healthiness and taste and prefer taste to healthiness.

Mandatory Menu Labeling

In order to combat obesity, government entities, such as New Your City (NYC), San Francisco, and King County (which includes Seattle, Washington), have passed laws that require posting of nutrition information, especially calories, on menus. Elbel et al. (2009) investigated the impact of the NYC menu-labeling law at 14 QSRs. They found no statistically significant effects on calories purchased after the introduction of this legislation. Finkelstein et al. (2011) studied mandatory menu labeling effect through 2009 on Taco Time Northwest in King County, Washington, and concluded that this policy did not change purchasing behavior.

Menu Change

In terms of adding new healthier menu items to QSR menus, the Subway restaurant chain has taken positive steps. For example, the Subway chain introduced “Fresh Fit for Kids’ meals nationwide in 2007. These meals are composed of a mini low-fat sandwich, apple slices, and low fat milk or 100% juice by default. Lundgren (2008) affirmed the effectiveness of Subway’s menu campaigns focusing on “healthiness” and studied its advertising strategy.

Study Framework

This study is motivated by the ambiguous results from researching “menu labeling” effects on promoting kids’ healthier food consumption and the sparse results relating to “menu change” effects on reducing children’s calorie intake. This article complements previous studies by providing evidence of the effect of only “menu change” strategy from one fast-food chain of Mexican QSRs (Taco Time Northwest) in Northwest Washington on kids’ meal side item purchases.

Taco Time Northwest's voluntary menu change went into effect on January 1, 2010, and was complemented with voluntary menu labeling on July 1, 2010 until December 2010. The changes to the kids' menu included, the addition of healthier options, consisting of beans and rice relative to the default side item of Mexi-Fries, and apple sauce to the default choice of dessert item consisting of Crustos and a toy.

Such a voluntary menu change provides an opportunity to examine the impact of adding menu choices on kids' purchasing behavior through DID analysis. Both pre-event and post-event data from Taco Time Northwest with restaurants within and without menu change policy were utilized to test the effect of such strategies on order counts of Mexi-Fries and Crustos from these outlets. It is hypothesized that the total monthly orders of Mexi-Fries and Crustos at restaurants implementing the menu change policy decreased after the policy change compared to stores without adoption of the strategy.

Methods

Difference-in-Differences Approach

The difference-in-differences (DID) technique is a quasi-experimental method used to measure the effect of an event at a given period of time. The DID approach generally differentiates the change induced by a specific treatment (e.g. policy or strategy) into a within-subjects treatment effect which measures the difference in the control group after and before treatment, a between-subjects pre-treatment effect which measures the difference between the treatment and control groups before treatment, and a DID estimator which represents the pre-post, within-subjects differences for the treatment group.

Since Ashenfelter and Card (1985) proposed the method to estimate the training effect for participants in the 1976 Comprehensive Employment and Training Act (CETA) programs, DID technique applications have become quite widespread. One main application is to utilize DID to study the effect of labor market related legislation or events on labor force and employment. For example, Card (1990) studied the effect of the Mariel Boatlift in 1980 on the Miami labor market. Card and Krueger (1994) evaluated the impact of New Jersey's mandatory minimum wage increase on employment in the fast-food industry. Meyer et al. (1995) examined the influence of increased maximum weekly benefit amount on time out of work in Kentucky. Michigan, and Eissa and Liebman (1996) investigated the effect of an expansion of the earned income tax credit (TRA86) on the labor force participation of single women with children.

There is also some research focused on the food industry and consumption using the DID approach, such as Jin and Leslie (2003) to study the effect of the hygiene quality grade cards policy in Los Angeles County (1998) on restaurants' choices of product quality, Abadie et al. (2010) to examine the impact of California Proposition 99 (a tobacco control program in 1988) on tobacco consumption in California, Kiesel and Villas-Boas (2010) to evaluate the influence of supermarket nutritional labels which reduce information costs on microwave popcorn purchases, and Finkelstein et al. (2011) to investigate the effect of the King County (WA) mandatory menu labeling regulation in 2009 on total transactions and average calories per transaction of one fast-food chain.

Data

This study is based on transaction data provided by Taco Time Northwest, which is a Mexican-style QSR chain with more than 70 outlets across Washington State. There are a total of thirteen restaurants' monthly sales data throughout two years from January 2009 to December 2010 provided for this analysis. Of the 13 stores, five from King County (which includes Seattle) constitute the *control group*, which did not implement the menu change and labeling strategy during 2010. The *treatment group* is composed of the remaining eight restaurants from adjacent counties, in which the menu change policy was put into practice on January 1, 2010, and the menu labeling strategy was added on July 1, 2010.

For each kids' meal in both control and treatment groups during the *Pre-period*, there was a default energy-dense side item, Mexi-Fries (potato rounds deep-fried and lightly seasoned), and the choice of a high-calorie dessert item, Crustos (deep-fried flour tortilla strips sprinkled with cinnamon and sugar) or a toy. Then in period *POST*, the eight restaurants in the treatment group changed the menu from a default side Mexi-Fries to a side of choices among Mexi-Fries, beans and rice; meanwhile, the original Crustos/toy choice was also expanded to include an apple sauce option for the treatment group. According to the Taco Time Northwest website, within each kids' meal, Mexi-Fries (mini) has 250 calories and Crustos has 316 calories, compared to rice of 133 calories and apple sauce of 90 calories. Therefore, Mexi-Fries (mini) and Crustos are regarded as energy-dense items, while beans, rice and apple sauce are considered to be low-calorie healthier substitutes.

We focus on the monthly purchase counts data of Mexi-Fries and Crustos for each restaurant in both of the control group (five stores) and the treatment group (eight stores) across 12 months (Jan 2009 to June 2009; January 2010 to June 2010). However, due to missing data in January 2009 for the control stores, January is excluded from the DID analysis for Crustos. Therefore, for Crustos, the treatment group only contains seven stores, and the time periods are defined as *Pre-period* (February 2009 to June 2009) and *POST* (February 2010 to June 2010).

Prior to any statistical analysis, a simple comparison of per-store, per-month unit sales between the *Pre-period* (January/ February 2009 to June 2009) and the *POST* (January/ February 2010 to June 2010) on average in the control group and treatment group for Mexi-Fries in Figure 1 and Crustos is presented in Figure 2. Both Figures indicate that the average storewide monthly consumption slightly decreased over time in general within each of the two groups for both food products.

Although the count sales generally fell in the first half of 2010 relative to the corresponding periods of 2009 for both groups, we cannot simply conclude that the new menu with added options led to a reduction in both Mexi-Fries and Crustos. Without adopting the menu change strategy, the restaurants in the control group also have lower sales on both food items in 2010, due to the impact of certain observable and unobservable factors. Since all sampled outlets are close to each other geographically, the treatment group stores could have been affected by the same factors, which compromised the menu change policy impact. Therefore, to examine the pure effect of the menu option-adding strategy on consumption of Mexi-Fries and Crustos, a series of difference-in-differences regressions are defined and estimated. Next, we successively establish a benchmark model and a monthly model and interpret the corresponding estimation results.

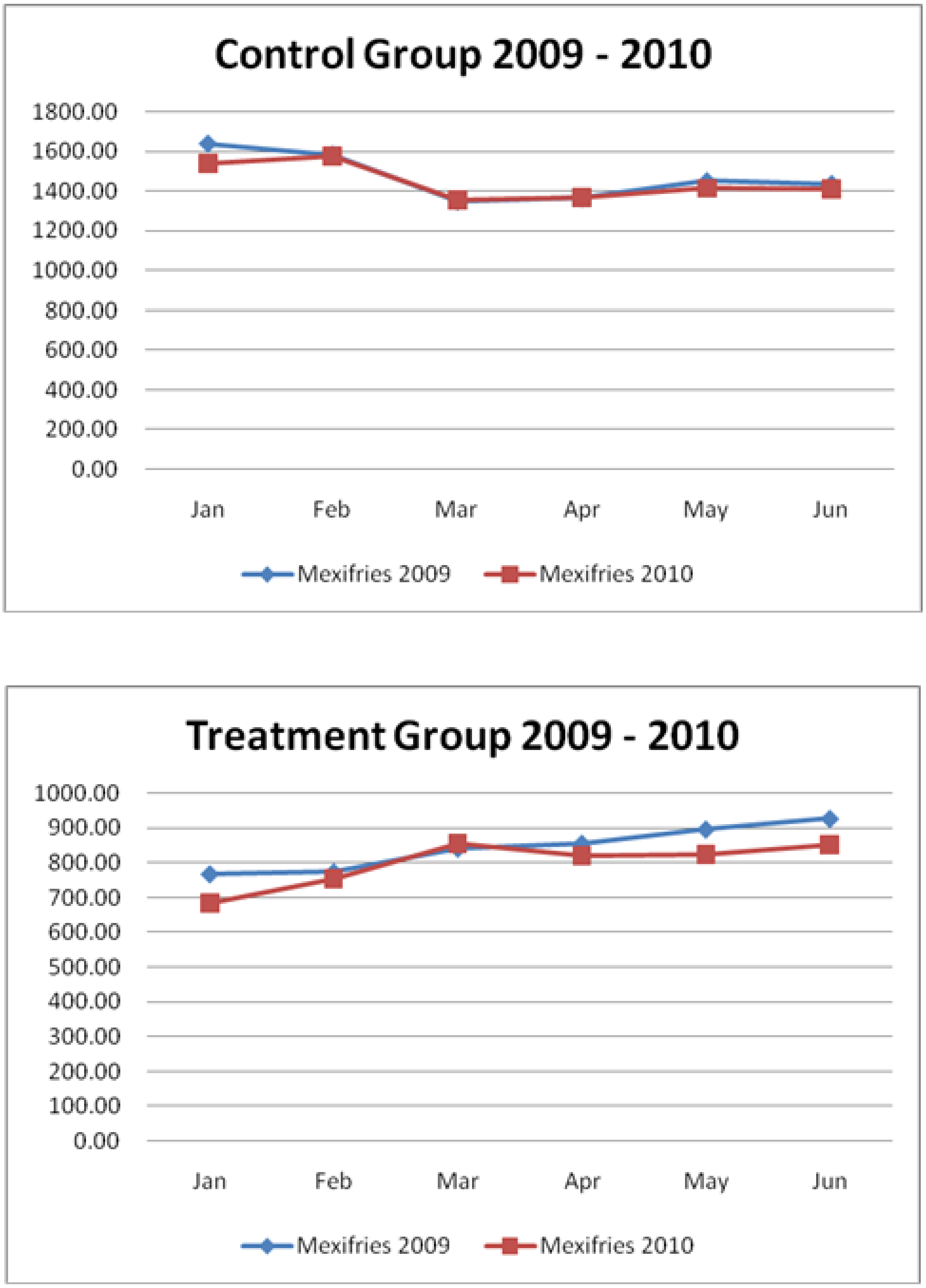

Figure 1. Monthly Comparisons of Average Values for Mexi-Fries

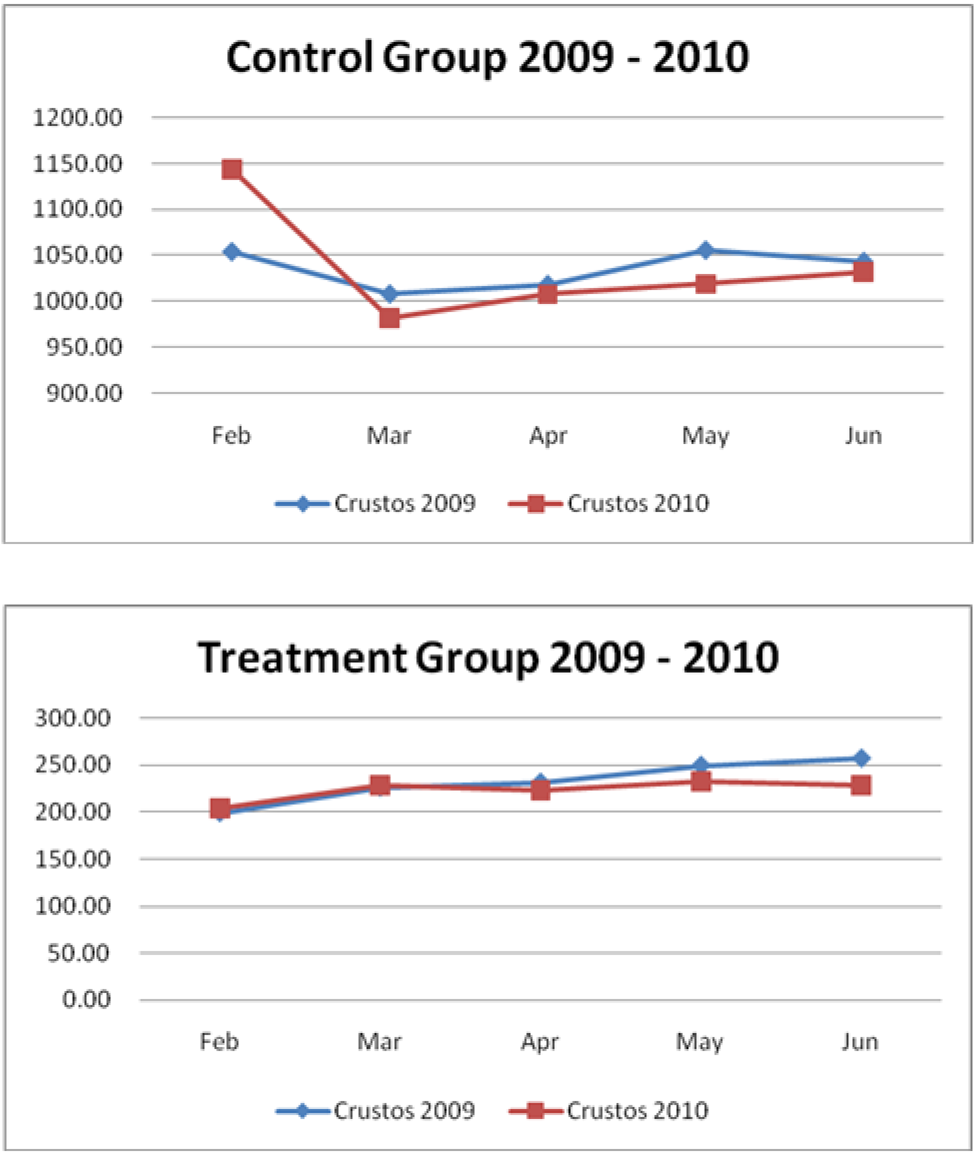

Figure 2. Monthly Comparisons of Average Values for Crustos

Benchmark Model

The standard DID regression for the benchmark model is the following:

$$(1)\ \ Q_{it} = \beta_0 + \beta_1 TG_i + \beta_2 POST_t + \beta_3 (TG_i \times POST_t) + \varepsilon_{it}$$

where Q_{it} is the response variable, representing unit sales of Mexi-Fries for each restaurant *i* (*i* = 1,...,13) in each month *t* (*t* = 1,…,6; 13,…,18). TG_i is a dummy variable for membership in the treatment group, which equals 1 if restaurant *i* belongs to the treatment group (i = 6,...,13); TG_i is the only variable that controls for the general *geographic variation* of the treatment group against the control group. $POST_t$ is a dummy variable for period *POST* when the menu change policy enacted, which equals one when month *t* falls between Jan 2010 and Jun 2010 (t = 13,…,18); $POST_t$ is also the only variable to control for the general *temporal variation* of period *POST* against *Pre-period*. The interaction term $TG_i \times POST_t$ represents the pure menu change policy effect excluded from the above two exogenous variations (geographic and temporal variations). Therefore it tests the key hypothesis that Pre-Post changes in average monthly sales measured in counts for Mexi-Fries are different in treatment stores than in control stores due to the added menu choices without menu labeling. $\beta_0, \beta_1, \beta_2, \beta_3$ are corresponding parameters, and negative parameter estimates $\hat{\beta}_3$ for $TG_i \times POST_t$ are capable of verifying the main hypotheses of a negative effect of the menu change strategy on Mexi-Fries consumption. The variables are defined basically the same for Crustos. However, since there were only seven treatment stores for Crustos, TG_i = 1 if i = 6,…,12, due to the elimination of January, $POST_t$ = 0 under t = 2,…,6; $POST_t$ = 1 under t = 14,…,18.

Monthly Model

Recall that we observe a prominent monthly difference on the Pre-Post average sales variations for both Mexi-Fries and Crustos. Although the benchmark model is able to examine the overall impact of the menu change policy, the monthly temporal effect has been concealed. To investigate such policy effects on an individual monthly basis, we propose a monthly model composed of six regressions (five for Crustos), each having the same structure as the benchmark model, but only utilizing the observations of one month in 2009 and the same month in 2010. Specifically, the general form of the monthly regressions is exactly the same as Equation (1), shown as below:

$$(2)\quad Q_{it} = \beta_0 + \beta_1 TG_i + \beta_2 POST_t + \beta_3 (TG_i \times POST_t) + \varepsilon_{it}$$

where the variables and coefficients are defined the same as the benchmark model, but each DID regression is exclusively for the comparison during January when t = (1,13) (only for Mexi-Fries), February when t = (2,14), March when t = (3,15), April when t = (4,16), May when t = (5,17), and June when t = (6,18). We still focus on the parameter estimates $\hat{\beta}_3$ for all six regressions (five for Crustos) to determine the amount of menu change strategy effect on sales of both products for each month. Summary statistics of response variables for both benchmark model and monthly model are presented in Table 1.

Table 1. Summary Statistics of Dependent Variables

Variable		Obs	Mean	Std.Dev.	Min	Max
	Q of Mexi-Fries	156	1065.270	453.921	398	2430
	Q of Crustos	119	560.807	442.776	78	1705
JAN	*Q of Mexi-Fries*	26	1057.730	592.219	398	2430
FEB	*Q of Mexi-Fries*	26	1077.880	570.759	405	2392
	Q of Crustos	23	554.696	527.385	78	1705
MAR	*Q of Mexi-Fries*	26	1041.230	371.742	485	1862
	Q of Crustos	24	547.167	420.263	115	1285
APR	*Q of Mexi-Fries*	26	1040.120	381.958	421	1814
	Q of Crustos	24	554.833	434.197	100	1367
MAY	*Q of Mexi-Fries*	26	1080.000	405.134	452	2000
	Q of Crustos	24	572.917	435.063	104	1414
JUN	*Q of Mexi-Fries*	26	1094.650	387.502	458	1944
	Q of Crustos	24	574.167	429.822	109	1335

Results

Benchmark Model

Here we utilize ordinary least squares (OLS) to estimate the benchmark model regressions for Mexi-Fries and Crustos, and obtain the estimation results in Table 2. The benchmark model fits the data better for Crustos than Mexi-Fries, since the coefficient of determination R^2 is only 46.81% for Mexi-Fries regression but 81.35% for Crustos regression. Both significantly negative parameter estimates for the treatment group dummy variables indicate that treatment stores generally have much lower monthly sales of both Mexi-Fries and Crustos compared to control stores in the *Pre-period*. Both insignificant coefficient estimates for the *POST* period dummies suggest that there are no remarkable Pre-Post temporal effects on the consumptions of both products in general.

The difference-in-differences parameter estimates for the interaction terms in Table 2 test the key hypotheses. Since both estimates are not significantly different from zero, we could not reject the hypotheses that the new menu with added options had no effect on the consumptions of both Mexi-Fries and Crustos. Although not statistically significant, the DID estimates both have a negative sign.

Table 2. Summary Statistics of Dependent Variables

	Mexi-Fries			Crustos		
	Parameter	*Std*	*P-value*	*Parameter*	*Std*	*P-value*
Constant	1469.93***	61.04	<.0001	1035.08***	39.54	<.0001
TG	-626.18***	77.81	<.0001	-802.40***	51.33	<.0001
POST	-27.80	86.32	0.7478	2.00	55.35	0.9713
$TG \times POST$	-17.62	110.03	0.8730	-11.17	72.16	0.8773
R^2		46.81%			81.35%	

***, **, * denotes significance at .01, .05, .1 level, respectively.

Monthly Model

We apply OLS to estimate the monthly model and obtain the corresponding estimation results for each month in Table 3 for Mexi-Fries and in Table 4 for Crustos. Similar to the benchmark model, the monthly model fits the Crustos sales better than the Mexi-Fries sales. The R^2 statistics is about 50% for Mexi-Fries regressions on average and about 80% for Crustos regressions in general. All significantly negative coefficient estimates for the treatment group dummies illustrate constantly lower consumptions of both products in treatment stores than in control stores among each month before the menu change policy. All insignificant parameter estimates for the *POST* dummy variables imply that the general Pre-Post temporal impact on Mexi-Fries and Crustos sales are not prominent.

Table 3. Estimation Results for Mexi-Fries (Monthly Model)

Mexi-Fries	Jan			Feb		
	Parameter	*Std*	*P-value*	*Parameter*	*Std*	*P-value*
Constant	1640.20***	193.82	<.0001	1584.80***	191.74	<.0001
TG	-872.58***	247.08	0.0019	-811.30***	244.42	0.0031
POST	-103.00	274.11	0.7107	-9.40	271.16	0.9727
$TG \times POST$	19.50	349.42	0.9560	-9.60	345.66	0.9781
R^2	52.87%			50.35%		
	Mar			**Apr**		
	Parameter	*Std*	*P-value*	*Parameter*	*Std*	*P-value*
Constant	1346.60***	131.66	<.0001	1362.40***	132.83	<.0001
TG	-504.85***	167.83	0.0065	-506.65***	169.32	0.0067
POST	6.40	186.19	0.9729	2.60	187.84	0.9891
$TG \times POST$	6.85	237.35	0.9772	-38.35	239.45	0.8742
R^2	44.81%			46.79%		
	May			**Jun**		
	Parameter	*Std*	*P-value*	*Parameter*	*Std*	*P-value*
Constant	1450.00***	137.34	<.0001	1435.60***	134.19	<.0001
TG	-553.50***	175.07	0.0045	-508.23***	171.06	0.0071
POST	-37.60	194.22	0.8483	-25.80	189.77	0.8931
$TG \times POST$	-34.40	247.59	0.8908	-49.70	241.91	0.8391
R^2	49.44%			47.24%		

All of the DID coefficient estimates for interaction terms are not significantly different from zero. Therefore, the hypotheses of no effect of the menu change policy on both product consumptions are not rejected from each month (January to June for Mexi-Fries and February to June for Crustos). Although not statistically different from zero, most DID estimates are negative valued for Mexi-Fries (except for January and March). As for Crustos, the DID estimates are negative only among February and June, compared to positive among the months March, April and May. This may imply that the menu change policy effect on reducing Crustos sales is compromised during Spring (March, April. and May).

Table 4. Estimation Results for Crustos (Monthly Model)

Crustos	Feb			Mar		
	Parameter	*Std*	*P-value*	*Parameter*	*Std*	*P-value*
Constant	1053.75***	146.70	<.0001	1008.40***	78.89	<.0001
TG	-854.75***	183.90	0.0002	-782.26***	103.29	<.0001
$POST$	90.85	196.82	0.6496	-26.80	111.57	0.8126
$TG \times POST$	-85.99	251.66	0.7363	29.09	146.08	0.8442
R^2	73.27%			84.68%		
	Apr			**May**		
	Parameter	*Std*	*P-value*	*Parameter*	*Std*	*P-value*
Constant	1018.40***	85.67	<.0001	1055.40***	80.96	<.0001
TG	-786.97***	112.17	<.0001	-805.83***	106.00	<.0001
$POST$	-10.40	121.15	0.9324	-36.60	114.49	0.7525
$TG \times POST$	2.40	158.63	0.9881	20.17	149.91	0.8943
R^2	83.07%			84.94%		
	Jun					
	Parameter	*Std*	*P-value*			
Constant	1043.20***	74.90	<.0001			
TG	-785.91***	98.07	<.0001			
$POST$	-10.80	105.93	0.9198			
$TG \times POST$	-17.77	138.70	0.8993			
R^2	86.80%					

***, **, * denotes significance at .01, .05, .1 level, respectively.

Conclusions

This study examined the effect of a menu change strategy which alters default energy-dense menu items to choices including healthier products on kids' menu purchase behaviors. Two difference-in-differences models (benchmark model and monthly model) are used to compare monthly unit sales between eight treatment QSR stores and five control QSR stores focusing on

one time period immediately following the menu change policy until the appearance of promotional phrases (Jan 2010 to Jun 2010).
The estimation results of two DID models do not provide strong evidence that adding healthier options into a menu with calorie-dense default items could significantly promote consumers to make healthier diet choices. Further related studies should be taken to identify the conditions under which menu change policy is most likely to be effective and efficient. The results in this study provide directions for future research. In the monthly model estimation, the spring season offsets the decreasing effect of the menu change strategy on Crustos consumptions. Future studies could be undertaken to investigate the seasonal patterns of the impact of such option-adding new menus. Also, further explorations can be taken to examine the effect of menu change combined with menu labeling on consumptions of both food items.

The lack of statistical significance of the menu change on consumption of the calorie dense menu items suggests that more proactive interdiction is needed to make an impact on childhood obesity. Government policies such as those that require additional, possibly highlighted, information and/or education are likely to have a greater effect. There might be gains in health from mandating a standardized format, such as the British traffic light system (TLS). Calorie-dense items could have a red traffic light next to them. Since the QSRs' objective is to maximize profits, their incentives are to highlight only the healthy items (green light items). Consequently identifying red lights would need to be mandated by government policy and may result in QSRs changing their menus to offer fewer of these items.

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