The Evolving Role of Food Sourced Outside the Home on Diets in the U.S.: 1977-2010

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Abstract

Food away from home (FAFH) is known to be of poorer nutritional quality. Given the increased prominence of FAFH over the past 35 years, some policymakers and health advocates seek to further regulate this market. This policy approach is only as strong as its expected impact. Using an individual fixed effects approach, we first document how FAFH (both fast food and restaurants) has had a relatively stable negative impact on dietary quality over 1977-2010. Yet, overall levels of dietary quality have increased over 20% during this period. To this end, we use an Oaxaca-Blinder decomposition approach to understand how changes in FAFH choices and observable characteristics of individuals have impacted the trajectory of dietary improvements. We find that increased consumption of FAFH plays a very small role in explaining changes in dietary quality (about 4%) as compared to changes in demographics (e.g., age and race/ethnicity – about 5%) and human capital (e.g., education – about 7.5%). We attribute the substantial residual, or unexplained, improvement to changes in unobservable factors (e.g., consumer preferences, the food environment, and overlapping nutrition policy initiatives).

Key Words: dietary quality, Oaxaca-Blinder decomposition, fixed effects

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1 Introduction

Poorer diet quality is associated with increased risks of coronary heart disease, stroke and diabetes (Chiuve et al., 2012), cardiovascular disease (Nicklas, O'Neil and Fulgoni, 2012) and several cancers (Shahril, 2012; Reedy et al., 2008; Bosire et al., 2013). The connection between diet and health is not lost on the public – the perception of what constitutes a healthy diet has improved over the last 25 years (Variyam and Smith, 2010), and consumers are more realistic about the quality of their own diets (Gregory, Smith and Wendt, 2011). Not only do consumers appear to be acting on this realization, producers also appear to be supplying healthier food options.[1] Nevertheless, there is substantial room for dietary improvement and understanding what factors contribute to such improvements can help better shape nutrition policy.

One of the largest shifts in the adult diet over the past 35 years is the increased consumption of food away from home (FAFH). FAFH constitutes a much larger portion of the adult diet today (about one-third of caloric intake) than in the late 1970's (about one-fifth). Despite the lower nutritional quality of FAFH (Lin and Guthrie, 2012), its increased popularity does not necessarily imply that overall dietary has worsened over time. Indeed, several researchers have documented an increase in the overall quality of the diet.[2] If the *relative* quality between FAFH and home food is constant over time while overall quality is improving, this may imply that policies generally focused on increasing nutritional knowledge

[1]Beatty, Lin and Smith (2014) show that since 1989-91 the quality of food consumed by Americans has improved at all points in the dietary quality distribution. Krebs-Smith, Reedy and Bosire (2010) show that the quality of the U.S. food supply has increased at a similar rate since 1970.

[2]Popkin, Zizza, and Siega-Riz (2003) analyzed data from 1965-1994 and found increased intakes of key nutrients, as well as overall dietary quality using the Dietary Quality Index-Revised (DQI-R), among lower and higher educational groups. Beatty, Lin and Smith (2014) analyzed distributional shifts in dietary quality using the Healthy Eating Index 2005 (HEI-2005) for lower- and higher-income groups. They found systematic increases at all levels of dietary intake.

impact all markets unilaterally. This research asks, how has the shift toward FAFH impacted the trajectories of diet quality since 1977-78? Absent this shift, what would the trajectory look like?

To answer these questions, some researchers taken a one-at-a-time approach to analyzing trends of particular nutrients and/or have shown positive correlations between FAFH consumption and diet quality (e.g., Bowman et al., 2004; Paeratakul et al, 2003). We take a holistic view of diet quality using a widely-used and validated measure, the Healthy Eating Index (HEI). This approach is similar to Mancino, Todd and Lin (2009) who examined a subset of the data to be examined in our study, over 1994-2004. In general, they find very small changes in the impact of an away-from-home meal on HEI scores in 1994-96 as compared to 2003-04.

When analyzing dietary indices, Variyam and Smith (2010) noted that researchers have been constrained by the fact that no consistent measure exists over a substantial period of time. In particular, data from the earliest survey, the 1977-78 Nationwide Food Consumption Survey (NFCS), contains a limited number of nutrients (e.g., it excludes sodium). Moreover, both the 1977-78 NFCS and the 1989-91 Continuing Survey of Food Intakes by Individuals (CSFII) lack a consistent mapping of individual foods to equivalent servings data, which are needed to create the HEI. Recognizing these limitations, this research takes advantage of a newly developed technique to link roughly 35 years of USDA intake data. These data allow for the creation of HEI scores dating back to 1977-78.

We first establish that there exists a steady increase in adult dietary quality from an average HEI-2005 score of 45 out of 100 in 1977-78 to an average of 55 in 2007-10 (about a 21% increase). We recognize that unobservable characteristics of individuals pose a significant threat to credibly identifying the impact of FAFH on diet quality and quantity. Therefore, we take a fixed effects approach by utilizing two days of dietary intake available in each of the USDA surveys. The idea being, within each cross-sectional survey the fixed, unobservable characteristics (e.g., the food environment and preferences) are "differenced out." The main objective of this research, however, is to identify *changes* in the effect of food source on diets. To do so, we use decomposition methods (Fortin, Lemieux and Firpo, 2011) to account for changes in the outcome resulting from changes in observable demographics and human capital measures. Under rather mild assumptions, the result is to consistently estimate the evolving impact of FAFH on diets.

Consistent with previous results (e.g., Mancino et al., 2009), we find that the impact of substituting restaurant and fast food for home-prepared food has a negative impact on dietary quality in each sample period. A particular interesting finding is that the negative impact of FAFH was at its highest in 1994-96, but has since lessened to similar levels observed 1977-78. This implies that FAFH and home food have become more alike.

We then use an Oaxaca-Blinder decomposition approach to understand how changes in FAFH choices and observable characteristics of individuals have impacted the trajectory of dietary improvements. We find that increased consumption of FAFH plays a very small role in explaining changes in dietary quality (about 4%) as compared to changes in demographics (e.g., age and race/ethnicity – about 5%) and human capital (e.g., education – about 7.5%). We attribute the substantial residual, or unexplained, effect to changes in unobservable factors (e.g., consumer preferences and the food environment).

2 Data

This study uses nationally representative data from four U.S. individual food intake surveys: the 1977-78 Nationwide Food Consumption Survey (NFCS), the 1989-91 and 1994-96

Continuing Survey of Food Intakes by Individuals (CSFII), and the continuous waves of the National Health and Nutrition Examination Survey (NHANES, 2003-10). We focus on adults aged 20-79. The dietary intake component in each of the four surveys was overseen by the U.S. Department of Agriculture (USDA) and used similar sampling methods, survey methodologies, and dietary collection protocols.

Respondents reported 24-hour dietary intakes in all four surveys, as well as detailed demographic information. Day-one dietary recalls were conducted in-person by trained interviewers in each survey. A second day of intake was obtained in all surveys. The mode of survey collection on day-two has changed from self-reported diaries in 1977-78 to follow-up telephone calls by trained interviewers in NHANES.[3] Another notable difference is that the second day of intake was obtained consecutively in 1977-78 and 1989-91, whereas in 1994-2010 the second day of intake was administered randomly 3-10 days later.

2.1 Measuring Dietary Quality

We use the Healthy Eating Index-2005 (HEI-2005) as our measure of dietary quality. The HEI-2005 was designed to measure compliance to the 2005 Dietary Guidelines for Americans, the U.S. Government's official recommendations for healthful eating (Guenther et al., 2008a), and has been validated as a measure of overall dietary quality (Guenther et al., 2008b). In short, the HEI-2005 is the sum of 12 components based on the consumption of key foods and nutrients. Each component assigns a score ranging from 0 to 5 (total fruit, whole fruit, total vegetables, dark green/orange vegetables and legumes, total grains, whole grains), 0 to 10 (milk, meats and beans, oils, saturated fat, sodium) or 0 to 20 for the percentage of calories from solid fats, alcoholic beverages, and added sugars (SoFAAS) creating a maximum score

[3]Other minor differences exists, such as a change from pencil and paper to computer assistance recalls.

of 100 (for details of scoring see, Guenther et al., 2008).

To calculate the HEI-2005 for U.S. food intake surveys, we use the USDA's FPED for the 2007-10 NHANES and its predecessor the MyPyramid Equivalents Database (MPED) for all other surveys. The FPED and MPED are "recipe databases" that deconstruct the thousands of foods and food mixtures reported by survey respondents into serving equivalents (i.e., standardized portion units per 100 edible grams of food). For example, when a respondent reports eating two slices of pepperoni pizza, we can use the MPED to determine how many servings of grains, vegetables and meat are in every 100 grams, as well as the amount of saturated fat and oils.

In order to measure long-run changes in overall diet quality, a consistent measure must be used. However, no officially released servings database exists for the 1977-78 NFCS and 1989-91 CSFII. To address this issue, we follow Beatty et al., (2014) by backdating the MPED 1.0 values (used for the 1994-96 CSFII) to the earlier surveys. Of the 4,077 unique foods reported on day one by individuals in the 1989-91 CSFII, 4,013 (98.4 percent) of these foods are also found in the MPED 1.0. The remaining 64 foods were matched to closely related foods.

A similar approach to linking MPED 1.0 values to the 1977-78 NFCS was undertaken. Because the food coding scheme changed between the 1977-78 NFCS and 1989-91 CSFII, a linking database is first used to convert each 1977-78 food code to a corresponding 1989-91 food code value (Moshfegh, 1986). NFCS respondents reported 3,415 unique foods on day one, and 3,357 (98.3 percent) of these foods had an exact match to a MPED 1.0 value. The remaining 58 foods were matched to closely related foods.

Nutrient values for calories, saturated fat, carbohydrates, sodium, and alcohol for each food in the 1977-78 NFCS were obtained from the USDA Nutrient Database for Standard

Reference version 16-1, which corresponds to the 1994-96 CSFII. This was necessary due to advances in food science methodologies when determining nutrient values, especially saturated fats, per 100 grams of food.

2.2 Summary Statistics

Table 1 shows the mean HEI-2005 for adults in all survey periods as well as the average share of kilocalories attributed to each food source in the first interview day. Average diet quality has increased steadily over time at annual rate of about 0.6%. The share of kilocalories attributed to food from home (FFH) decreased from the earliest period to a minimum in 2003-06 before beginning to increase again between the final two survey periods. This mirrors the trend in consumption of both fast food and restaurant food, which increases over time before dropping slightly in the final periods. The shift from consuming food away from home (FAFH) to FFH could be attributed the effects of the economic recession present in the final years of the 2007-10 survey period (Todd, 2014).

Trends in both HEI and the proportion of daily energy from each food source remain consistent for Day 2 observations, presented in table 2. Increased HEI and share of daily kilocalories attributed to FFH for most survey periods is consistent with what is to be expected from the change in mode of interview between days.

Changes in demographic characteristics across time suggest that the United States is becoming more ethnically diverse (table 3). Greater ethnic variation is primarily driven by increases in Hispanic populations or those who belong to other race/ethnicities. The population has also become older, with decreases in the 20-29 and 30-44 year age groups, and significant growth in the 45-64 year group.

Education levels have increased over time, with more individuals completing one or more years of college and fewer not finishing high school or stopping at the high school level (table 4). The only notable trends in income and employment are the increased population of retired individuals, consistent with growth in older age groups, and the sharp decrease in those reporting their occupation as "housekeeping" over time.

3 Empirical Methods

We consider a simple reduced-form equation,

$$HEI_{it} = \beta_0 + D_{it}'\beta + \varepsilon_{it} \tag{1}$$

where HEI_{it} is a measure of diet quality on day t for individual i and D_{it} are food source choices, days of the week and a dummy for the first day of intake (i.e., the face-to-face interview).[4] Naturally, we are concerned that omitted variables in ε_{it} are correlated with both HEI_{it} and D_{it}, yielding inconsistent and biased estimates of β. For example, *observable* characteristics such as age influence both food choices and overall dietary quality. Moreover, *unobservable* characteristics such as culinary skills and nutritional knowledge are also a likely source of endogeneity. As will be apparent shortly, we could expand the error term ε_{it} to include these components so that equation (1) can be written,

$$HEI_{it} = \beta_0 + D_{it}'\beta + X_i'\delta + Z_i'\gamma + u_i + \nu_{it}. \tag{2}$$

where X_i are observable demographics (see table 3) and Z_i are observable human capital measures (see table 4). The composite error term $(u_i + \nu_{it})$ contains unobservable char-

[4] As explained in the previous section, we have five surveys/periods with two days of intake per individual in each period. We omit subscripts for the period.

acteristics u_i that still introduce endogeneity and an idiosyncratic term ν_{it} assumed to be uncorrelated with all covariates. This model allows us to estimate the (potentially biased) impact of observable fixed factors by running a pooled OLS regression.

With more than one day of intake, within-individual variation can be used to net out observable and unobservable characteristics by estimating a fixed effects model

$$HEI_{it} = \beta_0 + D_{it}'\beta + \alpha_i + \nu_{it} \quad \text{s.t.} \sum_i \alpha_i = 0 \tag{3}$$

where the individual fixed effect α_i controls for both observable and unobservable characteristics (i.e., $\alpha_i = X_i'\delta + Z_i'\gamma + u_i$) and ν_{it} random error. The constraint is without loss of generality and is necessary in the decomposition analysis below. Under the strict exogeneity assumption, $E[\nu_{it}|D_{it}, \alpha_i] = 0$, the model yields an unbiased and consistent estimate of β.[5] Equation (3) allows us to identify the within-period effect of food source choices on dietary quality.

3.1 Decomposing changes in diet quality

We begin with the well-know Oaxaca-Blinder decomposition,

$$\underbrace{HEI^B - HEI^A}_{\text{observed change}} = \underbrace{(D^B - D^A)'\hat{\beta}^A}_{\text{food choices}} + \underbrace{D^{B'}(\hat{\beta}^B - \hat{\beta}^A)}_{\text{returns to food choices}} + \underbrace{(\hat{\beta}_0^B - \hat{\beta}_0^A)}_{\text{reference group}} \tag{4}$$

where the superscripts $k = A, B$ represent the grand mean in period k.[6] The parameter estimates $\hat{\beta}^k$ are obtained from one of the three specifications above in equations (1)-(3). The first component "food choices" tells us how much of the unconditional improvement in

[5] Given each day of intake is collected within 10 days, this seems like a reasonable assumption.
[6] For example, the grand mean for D_{it} in period A is $D^A = (NT)^{-1}\sum_i \sum_t D_{it}$.

dietary quality can be attributed to changes in the share of calories consumed at each food source. The second component "returns to food choices" measures the expected change in dietary quality in period A if the returns to calories where held at period B's levels. Changes in the returns to food choices plus the reference group represent the "unexplained" portion.

The strength of the Oaxaca-Blinder decomposition is contingent on unbiased estimates of $\hat{\beta}^k$. Using the standard Oaxaca-type of decomposition found in equation (4) and excluding fixed factors will in most cases yield biased results. The intuition behind such a result appeals to the standard omitted variable case. Only in the special case where observable characteristics remain unchanged over time will decomposition results be unbiased (Heitmueller, 2005). To this end, Heitmueller (2005) shows how to reduce the bias in (4) by included within-period time-invariant characteristics. Fully written out, we have

$$\begin{aligned}\underbrace{HEI^B - HEI^A}_{\text{observed change}} &= \underbrace{(D^B - D^A)'\hat{\beta}^A}_{\text{food choices}} + \underbrace{D^{B'}(\hat{\beta}^B - \hat{\beta}^A)}_{\text{returns to food choices}} \\ &+ \underbrace{(X^B - X^A)'\hat{\delta}^A}_{\text{demographics}} + \underbrace{X^{B'}(\hat{\delta}^B - \hat{\delta}^A)}_{\text{returns to demographics}} \\ &+ \underbrace{(Z^B - Z^A)'\hat{\gamma}^A}_{\text{human capital}} + \underbrace{Z^{B'}(\hat{\gamma}^B - \hat{\gamma}^A)}_{\text{returns to human capital}} + \underbrace{(\hat{\beta}_0^B - \hat{\beta}^A)}_{\text{reference group}} \end{aligned} \tag{5}$$

From a policy perspective the "food choices" component allows one to understand how the increasing consumption of FAFH has impacted the trajectory of dietary quality over the past 40 years. The "returns to food choices" reflects changes in the impact of substituting a home-prepared calorie for a food-away-from-home calorie. By including the observable demographics, we can see what portion of the dietary improvement can be attributed to an aging, more education and wealthy United States.

4 Results

4.1 Pooled OLS Results

Table 5 contains results from equation (1). In this specification, only time-varying characteristics are included (i.e., food source choices, the day of the week that the intake was recorded, and a dummy variable for the first day of intake) and we exclude time-invariant characteristics. In this manner, the specification mirrors the individual effects model of equation (3) and provides a basis for comparison. Keeping in mind that food source shares fall between 0 and 1 with home food as the reference category, the parameter estimates are interpreted as a substitution away from home food to another food source, all else constant. For example, in 1977-78 the OLS model estimates that for a 10 percent shift in the average share of calories consumed at home to fast food, we should expect average HEI scores to fall by 0.75. As expected, fast food has the largest negative impact on diet quality followed by restaurant and other away-from-home food sources.

The negative effect of substitution toward fast food consumption on diet quality becomes stronger over time before waning in the 2003-06 survey period. On average, increasing the share of kilocalories allocated to restaurant food decreases HEI scores more drastically over time. However, the strengthening of this effect is interrupted in the 1994-96 survey period when the effect of substitution toward restaurant food becomes briefly less negative. The only notable aspect of the effect of substitution toward other food sources on HEI score is that it is most negative in the 1989-91 and 1994-96 survey periods.

Table 6 contains results from equation (2). In this specification, we include time-invariant demographics (i.e., gender, age, race/ethnicity and household size) and human capital measures (i.e., education, percent above the poverty line and employment). The trend in the impact of food source largely reflects those in table 5. Interestingly, the parameter estimates for fast food are attenuated, where as estimates for the impact of restaurant are larger in absolute value. This implies that observable fixed characteristics included in the model are positively (negatively) correlated with fast food (restaurant) choices.

4.2 Fixed Effects Results

Table 7 contains results from equation (3). This model controls for time-invariant observable and unobservable characteristics. As compared to the previous OLS results (tables 5 and 6) parameter estimates are mostly attenuated. Again, this implies that fixed characteristics of individuals are postively correlated with food source choices.[7]

For the purpose of comparison with the previously reported results, we will once again consider interpreting the estimated effect of a 10 percent shift, on average, away from home food consumption toward fast food. According to the fixed effects model, this shift would result in a 0.42 point decrease in mean HEI score during the 1977-78 survey period, a considerably smaller drop than that estimated via pooled OLS. Although trends in the impact of increasing energy allocation to each food source are less clear in this model, the overarching story remains the same. The negative effect of increased fast food consumption on diet quality remains strongest in the 1994-96 survey period. Between the initial and final survey periods, the dietary effect of shifting toward restaurant food consumption becomes more negative, despite a decrease in the strength of the effect during the 1989-91 and 1994-96 survey periods. As in the pooled OLS model, the negative effect of shifting toward other food sources on diet quality is strongest in the 1989-91 and 1994-96 survey periods.

[7]This causes no bias in estimation since arbitrary correlation between individual fixed effects and covariates is allowed in fixed effect models (Wooldridge).

4.3 Decomposition Results

In this section we compare the decomposition of a change in average HEI scores over 1977-2010 using the parameter estimates from each of the models presented above. Specifically, tables 8 and 9 correspond to estimates obtained from pooled OLS regressions using equations (1) and (2), respectively. Both of the pooled OLS models yield similar results, so we focus on table 9. We observe a 10 point increase in HEI over 1977-2010. Had individuals in 1977-78 consumed the amount of calories from FAFH as they did in 2007-10, we could have expected the average HEI score to increase by 0.58, or about 5.8% of the total improvement. As FAFH kilocalorie consumption increased throughout the 1990's and eventually dissipated slightly in the early 2000's, the counterfactual effect of FAFH lessened in absolute value and eventually flipped signs. Interestingly, FAFH choices represent a smaller share of the improvement in dietary quality as compared to human capital measures (e.g., education, income and employment) when comparing 2007-10 to either 1977-78 or 1989-91. For example, increasing stocks of human capital explain about 0.75 of the 10 point increase (or about 07.5%).

Using results from the pooled OLS equations in the decomposition analysis typical overestimates (in absolute value) the explained portion of dietary improvements attributed to food source choices. For example, in table 10 we can see that the 35-year improvement would have been about 0.4 points higher in the base year using the 2007-10 predictor values. The explained part due to changes in demographics and human capital tend to be slightly higher. In total, this strengthens the previous results that it is demographics and human capital measures that explain more of the improvement in HEI than food source choices.

5 Conclusions and Discussion

This study first documents the relative impact of food away from home (FAFH) on dietary quality over a much longer period of time than previously investigated. Like others (e.g., Mancino et al., 2009) we find that FAFH has a negative impact on the quality of the diet. The trend in the relative impacts of fast food and restaurant consumption exhibit much less variation once individual characteristics are controlled for. This implies that the substitution of a home calorie for an away-from-home calorie has had a similar effect on dietary quality in all sample periods.

When we apply an Oaxaca-Blinder decomposition analysis to our preferred regression results using individual fixed effects, we find that changes in the amount of FAFH consumed has had a relatively small impact on dietary trends. Specifically, the increased consumption of FAFH accounts for about 4% of the total change in HEI-2005 scores. Changes in demographics and human capital measures (e.g., education) have had larger impacts on diets. For example, we estimate that increases in human capital explain about 7.5% of the 35 year dietary improvement.

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6 Tables

Table 1: Food consumption summary statistics, Day 1

	1977-78	1989-91	1994-96	2003-06	2007-10
HEI-2005	45.94	49.96	50.13	52.32	55.48
	(0.16)	(0.31)	(0.29)	(0.46)	(0.45)
Share of calories:					
Home	82.11	74.84	70.05	68.47	70.76
	(0.60)	(0.83)	(0.65)	(0.67)	(0.67)
Fast food	7.52	14.03	13.09	15.38	13.64
	(0.31)	(0.65)	(0.44)	(0.61)	(0.48)
Restaurant	4.87	6.64	9.85	10.69	10.00
	(0.28)	(0.54)	(0.39)	(0.43)	(0.38)
Other	5.50	4.49	7.02	5.46	5.61
	(0.26)	(0.24)	(0.40)	(0.30)	(0.23)
Sunday	3.55	14.19	14.19	13.79	13.59
	(0.52)	(0.81)	(0.64)	(0.61)	(0.74)
Monday	19.36	14.28	14.34	14.15	13.97
	(0.35)	(0.94)	(0.68)	(1.02)	(0.77)
Tuesday	19.55	14.38	14.30	13.94	13.90
	(0.56)	(0.96)	(0.58)	(1.24)	(0.91)
Wednesday	18.34	14.17	14.20	14.35	14.41
	(0.55)	(0.86)	(0.81)	(0.91)	(0.98)
Thursday	16.31	14.18	14.27	14.60	14.46
	(0.57)	(0.88)	(0.84)	(1.07)	(0.94)
Friday	12.16	14.30	14.37	13.88	13.98
	(0.35)	(0.90)	(0.68)	(0.61)	(0.42)
Saturday	10.74	14.50	14.34	15.29	15.70
	(0.72)	(1.64)	(0.84)	(0.62)	(0.68)
Obs.	14773	7683	8683	7212	8274

Standard errors in parentheses

Table 2: Food consumption summary statistics, Day 2

	1977-78	1989-91	1994-96	2003-06	2007-10
HEI-2005	46.10	50.24	50.16	53.91	56.61
	(0.20)	(0.33)	(0.31)	(0.43)	(0.34)
Share of calories:					
Home	84.63	77.62	69.12	72.92	74.81
	(0.54)	(0.65)	(0.62)	(0.55)	(0.69)
Fast food	7.48	11.91	13.47	14.12	12.62
	(0.36)	(0.45)	(0.45)	(0.40)	(0.54)
Restaurant	4.21	6.38	10.44	9.20	9.02
	(0.21)	(0.41)	(0.39)	(0.38)	(0.42)
Other	3.68	4.10	6.97	3.76	3.54
	(0.17)	(0.29)	(0.29)	(0.18)	(0.14)
Sunday	10.74	14.40	14.28	23.91	27.37
	(0.72)	(1.63)	(0.61)	(0.80)	(0.87)
Monday	3.55	14.29	14.30	20.78	19.32
	(0.52)	(0.81)	(0.50)	(0.87)	(0.61)
Tuesday	19.36	14.23	14.23	17.56	15.39
	(0.35)	(0.95)	(0.69)	(0.59)	(0.55)
Wednesday	19.55	14.33	14.17	17.07	14.09
	(0.56)	(0.96)	(0.52)	(0.76)	(0.53)
Thursday	18.34	14.21	14.24	5.20	8.02
	(0.55)	(0.87)	(0.78)	(0.52)	(0.66)
Friday	16.31	14.15	14.31	10.97	12.38
	(0.57)	(0.87)	(0.86)	(0.77)	(0.81)
Saturday	12.16	14.38	14.48	4.52	3.42
	(0.35)	(0.90)	(0.82)	(0.38)	(0.34)
Obs.	14773	7683	8683	7212	8274

Standard errors in parentheses

Table 3: Demographic summary statistics

	1977-78	1989-91	1994-96	2003-06	2007-10
Female	59.37	52.41	51.83	52.36	52.74
	(0.77)	(0.60)	(0.64)	(0.73)	(0.58)
Non-hispanic white	83.65	79.62	75.47	72.58	69.94
	(3.47)	(1.79)	(1.92)	(2.38)	(2.40)
Non-hispanic black	10.44	10.40	11.20	11.61	11.17
	(2.65)	(1.24)	(1.06)	(1.42)	(1.10)
Hispanic	4.77	7.48	9.10	10.92	13.23
	(1.10)	(1.23)	(1.55)	(1.35)	(1.75)
Other race/ethnicity	1.13	2.51	4.23	4.89	5.66
	(0.18)	(0.45)	(0.45)	(0.53)	(0.69)
Age 20-29	23.05	21.77	20.89	19.62	19.92
	(1.00)	(1.44)	(0.83)	(0.84)	(0.94)
Age 30-44	31.92	36.22	35.64	30.88	29.53
	(0.76)	(1.06)	(0.78)	(1.33)	(0.86)
Age 45-64	31.55	27.85	29.91	35.20	37.47
	(0.68)	(0.98)	(0.71)	(1.11)	(0.85)
Age 65+	13.48	14.16	13.56	14.30	13.08
	(0.73)	(0.63)	(0.60)	(0.70)	(0.62)
hhsize 1	16.31	12.47	12.19	13.19	12.29
	(1.49)	(0.95)	(0.70)	(0.83)	(0.61)
hhsize 2	28.30	33.00	33.09	35.53	33.85
	(0.66)	(1.18)	(0.75)	(1.38)	(1.39)
hhsize 3	17.74	21.62	21.34	18.93	18.54
	(0.43)	(1.05)	(0.66)	(0.96)	(0.78)
hhsize 4	19.17	19.51	18.87	16.02	18.60
	(0.92)	(1.19)	(0.81)	(0.90)	(0.76)
hhsize 5+	18.48	13.39	14.50	16.33	16.72
	(0.82)	(0.98)	(0.77)	(1.12)	(0.99)
Obs.	14773	7683	8683	7212	8274

Standard errors in parentheses

Table 4: Human capital summary statistics

	1977-78	1989-91	1994-96	2003-06	2007-10
Less than high school	29.14	17.55	14.60	15.81	18.08
	(2.12)	(0.89)	(0.78)	(0.87)	(0.94)
High school	36.25	35.21	34.73	25.61	23.31
	(0.84)	(1.17)	(1.15)	(1.07)	(0.90)
Some college	17.35	23.03	23.84	32.34	30.15
	(0.94)	(1.14)	(0.61)	(0.85)	(0.75)
4+ yrs college	17.26	24.22	26.84	26.23	28.46
	(1.31)	(1.27)	(1.49)	(1.55)	(1.33)
Percent poverty (<130)	17.90	13.91	14.70	18.18	21.46
	(1.76)	(0.79)	(0.80)	(1.24)	(1.23)
Percent poverty (130-250)	27.32	21.62	22.41	22.38	21.39
	(1.11)	(1.30)	(0.78)	(0.88)	(0.82)
Percent poverty (250-500)	49.65	44.73	46.23	43.89	38.85
	(1.39)	(1.24)	(1.04)	(1.05)	(1.14)
Percent poverty (>500)	15.62	28.44	25.32	25.11	26.35
	(1.30)	(1.55)	(1.24)	(1.42)	(1.47)
Full-time worker	47.46	50.82	49.49	56.50	53.41
	(0.99)	(0.98)	(0.83)	(1.20)	(1.04)
Part-time workter	12.70	11.68	12.85	10.65	10.82
	(0.45)	(0.66)	(0.48)	(0.65)	(0.60)
Retired	10.74	10.66	14.19	13.02	12.09
	(0.69)	(0.55)	(0.67)	(0.81)	(0.58)
Housekeeping	23.11	13.84	8.66	6.64	6.82
	(0.91)	(0.72)	(0.40)	(0.39)	(0.45)
Not working, other	6.05	9.98	10.97	13.16	16.81
	(0.38)	(0.55)	(0.64)	(0.63)	(0.78)
Obs.	14773	7683	8683	7212	8274

Standard errors in parentheses

Table 5: Pooled OLS, time-varying charateristics only

	1977-78	1989-91	1994-96	2003-06	2007-10
Fast food share	-7.50***	-9.01***	-14.47***	-11.73***	-10.14***
	(0.50)	(0.67)	(0.56)	(0.69)	(0.67)
Restaurant share	-3.77***	-5.23***	-4.51***	-5.59***	-6.43***
	(0.58)	(0.99)	(0.59)	(0.83)	(0.80)
Other share	-2.99***	-5.73***	-5.47***	-2.21*	-3.11***
	(0.57)	(1.14)	(0.69)	(1.14)	(1.18)
Constant	45.53***	50.89***	51.11***	52.19***	54.87***
	(0.45)	(0.58)	(0.45)	(0.61)	(0.61)
Day of interview	Yes	Yes	Yes	Yes	Yes
Day of week	Yes	Yes	Yes	Yes	Yes
Observations	29546	15366	17366	14424	16548
R-squared	0.020	0.033	0.062	0.047	0.038

Notes: Standard errors in parentheses and clustered at the individual level.

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

Table 6: Pooled OLS, time-varying and time-invariant charateristics

	1977-78	1989-91	1994-96	2003-06	2007-10
Fast food share	-6.52***	-7.39***	-11.78***	-9.84***	-8.20***
	(0.52)	(0.66)	(0.55)	(0.68)	(0.66)
Restaurant share	-4.55***	-6.41***	-4.88***	-6.67***	-7.28***
	(0.58)	(0.99)	(0.58)	(0.81)	(0.80)
Other share	-3.53***	-6.37***	-5.70***	-3.75***	-3.95***
	(0.57)	(1.07)	(0.66)	(1.11)	(1.12)
Constant	45.33***	51.68***	52.42***	55.11***	55.83***
	(0.84)	(1.24)	(0.95)	(1.45)	(1.19)
Day of interview	Yes	Yes	Yes	Yes	Yes
Day of week	Yes	Yes	Yes	Yes	Yes
Demographics	Yes	Yes	Yes	Yes	Yes
Human capital	Yes	Yes	Yes	Yes	Yes
Observations	29546	15366	17366	14424	16548
R-squared	0.066	0.130	0.153	0.137	0.144

Notes: Standard errors in parentheses and clustered at the individual level.
See tables 3 and 4 for demographics and human capital variables, respectively.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 7: Individual fixed effects regressions

	1977-78	1989-91	1994-96	2003-06	2007-10
Fast food share	$-4.17{*}{*}{*}$	$-2.58{*}{*}$	$-6.65{*}{*}{*}$	$-4.09{*}{*}{*}$	$-4.48{*}{*}{*}$
	(1.05)	(1.22)	(1.04)	(1.21)	(1.15)
Restaurant share	$-3.18{*}{*}{*}$	$-3.14{*}$	$-2.30{*}{*}$	$-2.73{*}$	$-5.24{*}{*}{*}$
	(1.09)	(1.82)	(1.14)	(1.41)	(1.39)
Other share	$-2.75{*}{*}{*}$	$-4.42{*}$	$-3.69{*}{*}{*}$	-2.71	$-3.22{*}$
	(1.05)	(2.27)	(1.26)	(1.85)	(1.81)
Constant	$45.07{*}{*}{*}$	$49.03{*}{*}{*}$	$50.27{*}{*}{*}$	$50.91{*}{*}{*}$	$54.72{*}{*}{*}$
	(0.79)	(0.84)	(0.66)	(0.83)	(0.80)
Day of interview	Yes	Yes	Yes	Yes	Yes
Day of week	Yes	Yes	Yes	Yes	Yes
Observations	29546	15366	17366	14424	16548
Individuals	14773	7683	8683	7212	8274
R-squared	0.012	0.013	0.025	0.030	0.033

Notes: Standard errors in parentheses and clustered at the individual level.

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

Table 8: Oaxaca-Blinder decomposition using pooled OLS results from equation (1)

Base Period	1977-78	1989-91	1994-96	2003-06
Differential				
$\overline{HEI}_{2007-10}$	56.05***	56.05***	56.05***	56.05***
	(0.37)	(0.20)	(0.21)	(0.18)
$\overline{HEI}_{\text{base period}}$	46.02***	50.10***	50.14***	53.12***
	(0.05)	(0.19)	(0.14)	(0.21)
Difference	10.03***	5.95***	5.90***	2.93***
	(0.37)	(0.28)	(0.25)	(0.28)
Explained				
Food choices	−0.61***	−0.19***	0.18***	0.22***
	(0.03)	(0.05)	(0.06)	(0.05)
Day of week	−0.41***	0.01	−0.06**	−0.04*
	(0.03)	(0.04)	(0.03)	(0.02)
Total Explained	−1.02***	−0.17***	0.12*	0.18***
	(0.04)	(0.06)	(0.07)	(0.06)
Unexplained				
Food choices	−0.61**	−0.14	0.49***	0.09
	(0.28)	(0.21)	(0.19)	(0.21)
Day of week	2.32**	2.29***	1.53**	−0.02
	(1.03)	(0.73)	(0.68)	(0.76)
Reference group	9.34***	3.98***	3.76***	2.68***
	(1.19)	(0.85)	(0.78)	(0.87)
Total Unexplained	11.04***	6.12***	5.78***	2.75***
	(0.37)	(0.28)	(0.25)	(0.28)
Observations	46094	31914	33914	30972

Notes: Standard errors in parentheses and clustered at the individual level.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 9: Oaxaca-Blinder decomposition using pooled OLS results from equation (2)

Base Period	1977-78	1989-91	1994-96	2003-06
Differential				
$\overline{HEI}_{2007-10}$	56.05***	56.05***	56.05***	56.05***
	(0.35)	(0.20)	(0.21)	(0.18)
$\overline{HEI}_{\text{base year}}$	46.02***	50.10***	50.14***	53.12***
	(0.06)	(0.19)	(0.15)	(0.21)
Difference	10.03***	5.95***	5.90***	2.93***
	(0.35)	(0.28)	(0.26)	(0.28)
Explained				
Food choices	−0.58***	−0.22***	0.19***	0.19***
	(0.03)	(0.05)	(0.05)	(0.05)
Day of week	−0.41***	0.01	−0.05*	−0.04*
	(0.03)	(0.03)	(0.03)	(0.02)
Demographics	0.45***	0.49***	0.55***	0.18**
	(0.05)	(0.10)	(0.07)	(0.07)
Human capital	0.72***	0.29**	−0.01	0.03
	(0.06)	(0.11)	(0.09)	(0.08)
Total Explained	0.17**	0.56***	0.67***	0.36***
	(0.09)	(0.16)	(0.13)	(0.12)
Unexplained				
Food choices	−0.51*	−0.08	0.33*	0.14
	(0.28)	(0.21)	(0.18)	(0.21)
Day of week	2.40**	2.31***	1.82***	−0.04
	(0.99)	(0.70)	(0.66)	(0.73)
Demographics	0.80	1.16	0.27	0.60
	(1.24)	(0.97)	(0.85)	(0.94)
Human capital	−3.28***	−1.71***	−0.78	−0.27
	(0.76)	(0.59)	(0.50)	(0.58)
Reference group	10.43***	3.70**	3.59***	2.15
	(1.91)	(1.46)	(1.29)	(1.46)
Total Unexplained	9.85***	5.39***	5.23***	2.57***
	(0.35)	(0.28)	(0.24)	(0.26)
Observations	46094	31914	33914	30972

Notes: Standard errors in parentheses and clustered at the individual level.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 10: Oaxaca-Blinder decomposition using pooled fixed effects results from equation (3)

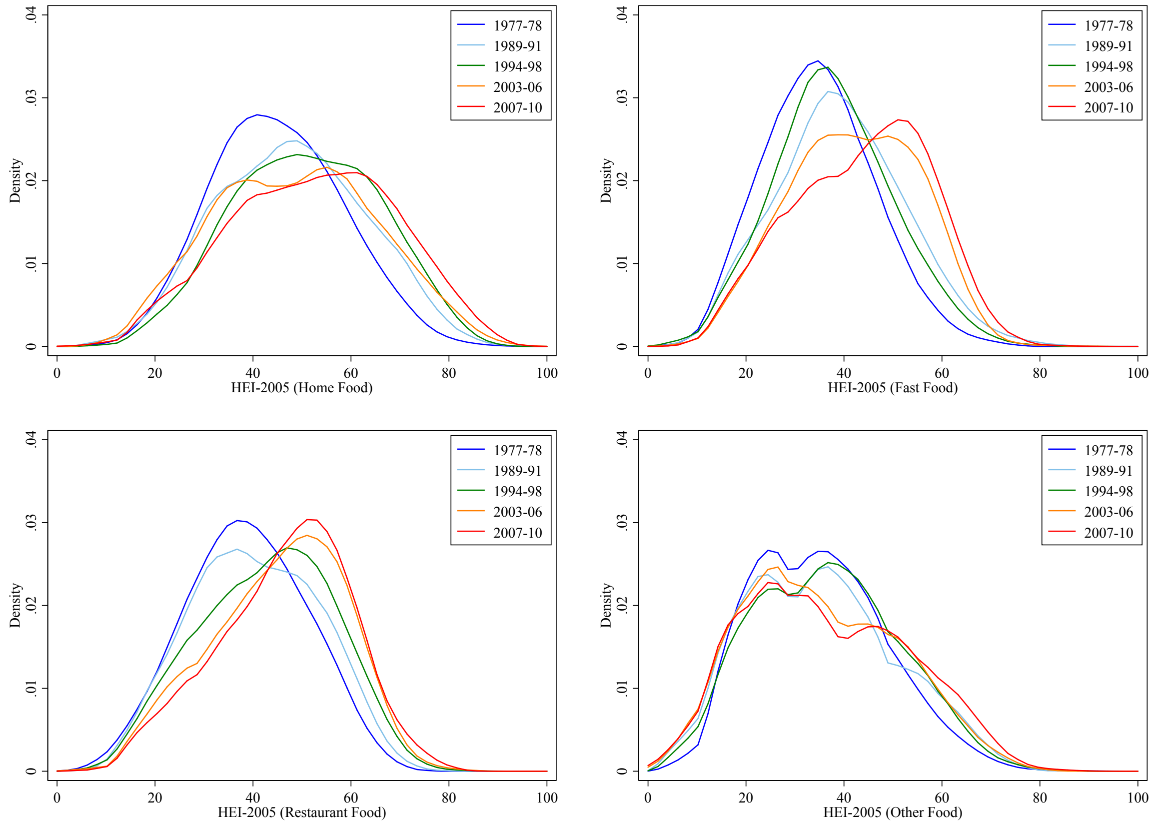
Base Period	1977-78	1989-91	1994-96	2003-06
Differential				
$\overline{HEI}_{2007-10}$	56.05***	56.05***	56.05***	56.05***
	(0.35)	(0.20)	(0.21)	(0.18)
$\overline{HEI}_{\text{base year}}$	46.02***	50.10***	50.14***	53.12***
	(0.06)	(0.19)	(0.15)	(0.21)
Difference	10.03***	5.95***	5.90***	2.93***
	(0.35)	(0.28)	(0.26)	(0.28)
Explained				
Food choices	−0.39	−0.11	0.11	0.08
	(−)	(−)	(−)	(−)
Day of week	−0.34	−0.01	−0.02	−0.05
	(−)	(−)	(−)	(−)
Demographics	0.50***	0.57***	0.61***	0.18
	(0.14)	(0.16)	(0.15)	(0.15)
Human capital	0.76***	0.30*	0.06	0.06
	(0.14)	(0.18)	(0.17)	(0.17)
Total Explained	0.53	0.75	0.77	0.27
	(−)	(−)	(−)	(−)
Unexplained				
Food choices	−0.26	−0.40	0.03	−0.31
	(−)	(−)	(−)	(−)
Day of week	1.38	0.77	1.33	−0.60
	(−)	(−)	(−)	(−)
Demographics	−0.97	2.31	3.60**	1.10
	(1.73)	(2.11)	(1.61)	(2.30)
Human capital	−3.22***	−1.69***	−0.76	−0.36
	(0.65)	(0.63)	(0.56)	(0.63)
Reference group	12.56	4.20	0.94	2.84
	(−)	(−)	(−)	(−)
Total Unexplained	9.50	5.19	5.13	2.66
	(−)	(−)	(−)	(−)
Observations	46094	31914	33914	30972

Notes: Standard errors in parentheses and clustered at the individual level.

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

7 Figures

Figure 1: Density of dietary quality by food source over 1977-2010, Day 1



Sources: First day of intake: NFCS, CSFII and NHANES.