The Effect of SNAP on the Composition of Purchased Foods: Evidence and Implications

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Online Appendix

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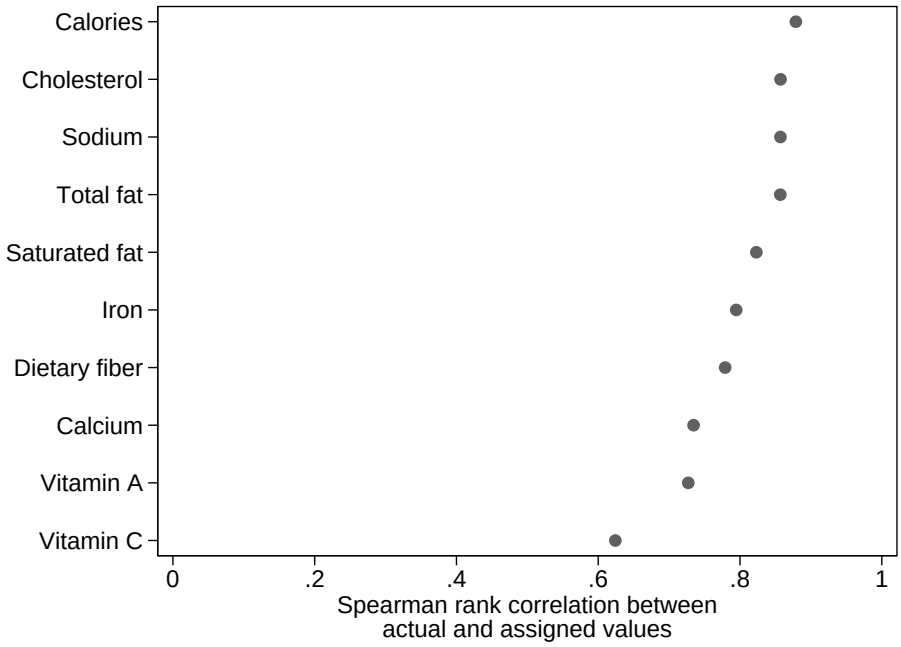
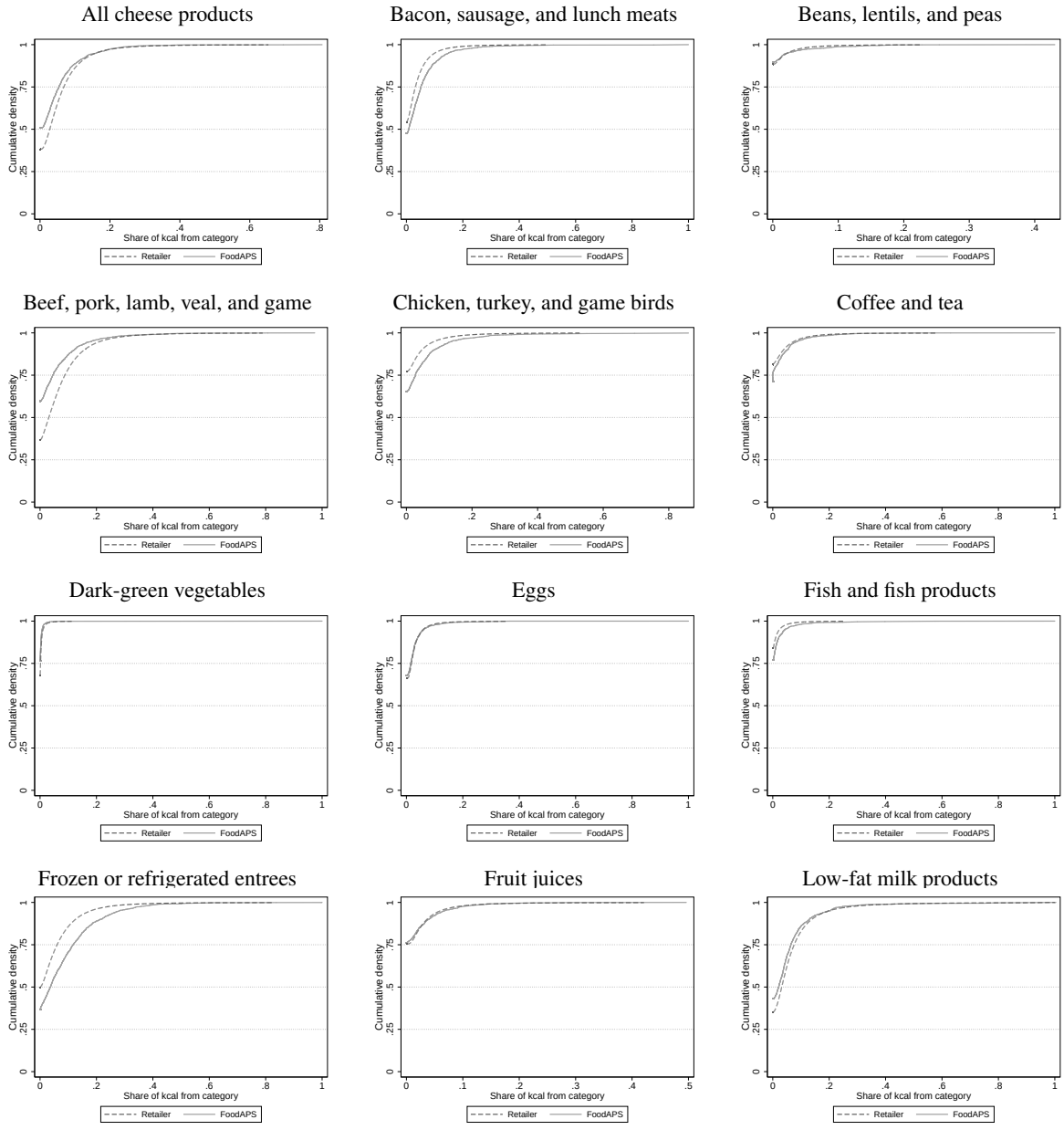
Online Appendix Figure 1: Product-level assessment of nutrient data assignment scheme

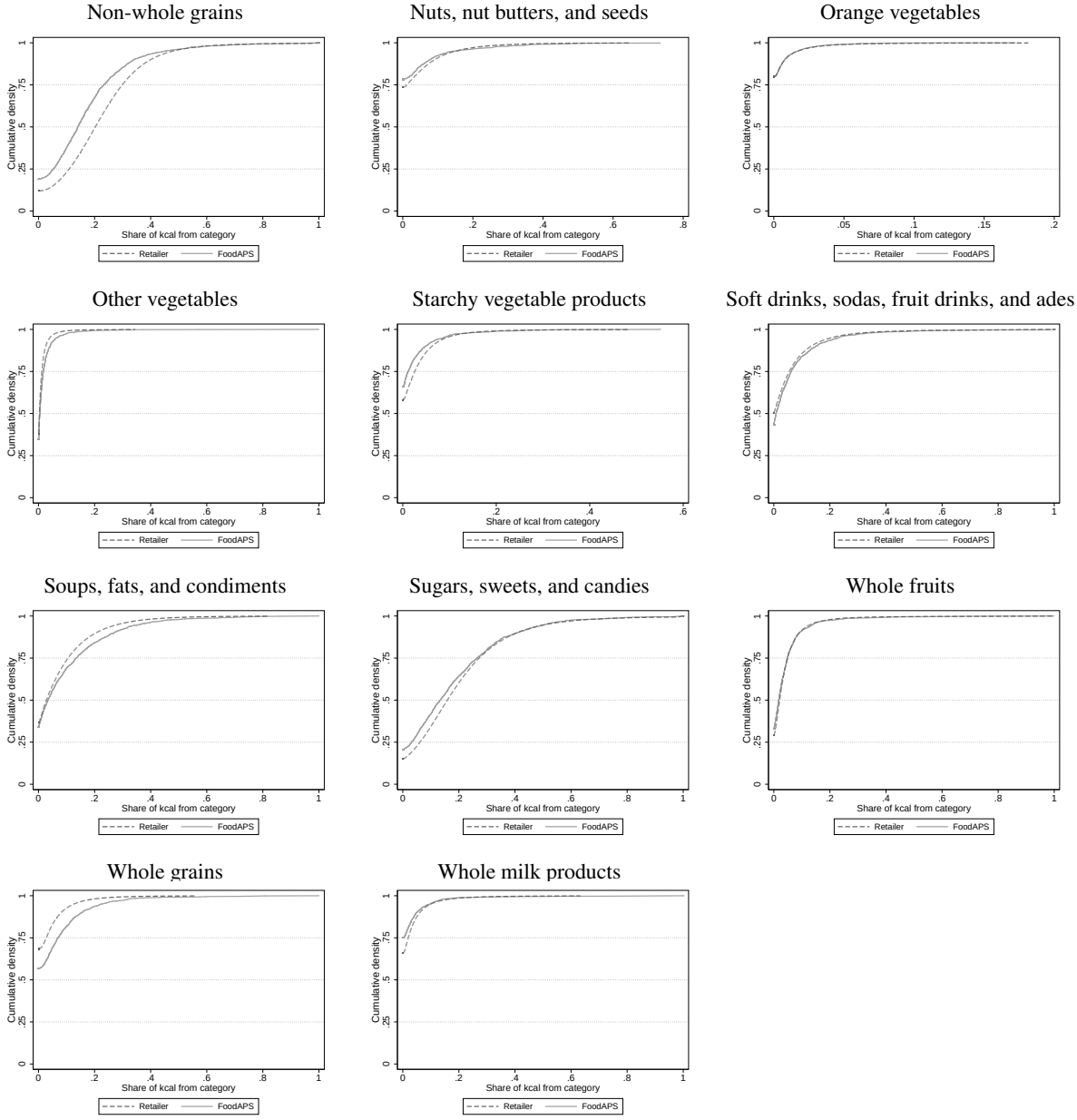


Notes: The figure presents Spearman rank correlations between actual and assigned nutrient values. The unit of observation is a product. The sample is a randomly-chosen subset of UPC food products for which UPC-level nutrition data are available that together account for 10 percent of UPC food spending. For each UPC food product, the actual nutrient values come from the UPC-level data sources outlined in section 2.3. The assigned values come from the assignment method defined in section 2.3, conducted as if nutrient values for the given product were not present in the UPC-level data sources.

Online Appendix Figure 2: Comparisons of distributions of TFP kilocalorie shares in the retail panel and FoodAPS data

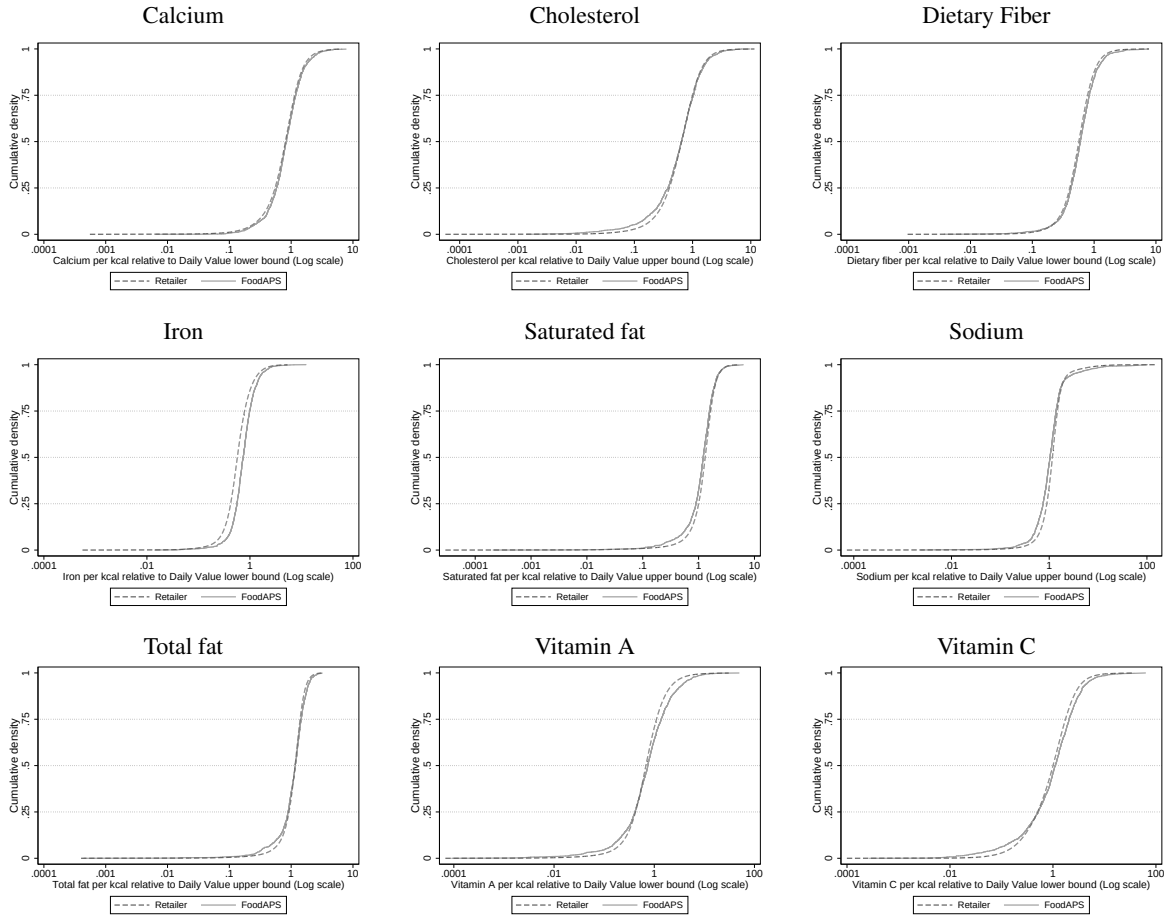


Online Appendix Figure 2: Comparisons of distributions of TFP kilocalorie shares in the retail panel and FoodAPS data (continued)



Notes: Each panel plots the cumulative distribution function of a measure of food healthfulness across households in two different samples. For the line labeled "FoodAPS", the sample is the set of households surveyed in the FoodAPS data, described in section 2.5. Each FoodAPS household is weighted according to the FoodAPS household weights such that the overall sample is nationally representative. For each household, the measure of food healthfulness is calculated from all observed food-at-home acquisitions during the survey week. For the line labeled "Retailer", the sample is all households in the retail panel during a randomly-assigned pseudo-survey week. Pseudo-survey weeks are randomly assigned to retailer households such that the distribution of pseudo-survey weeks in the retail panel equals the distribution of actual survey weeks in the FoodAPS data. For each household, the measure of food healthfulness is calculated from all food purchases at the retailer during their given pseudo-survey week. Each outcome is the share of kilocalories from a given product category underlying the Thrifty Food Plan, as described in section 2.4.1. The horizontal dotted lines intersect the 25th, 50th, and 75th percentiles of the distributions.

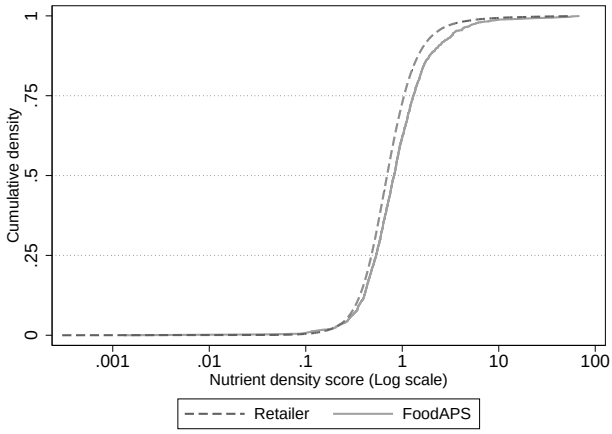
Online Appendix Figure 3: Comparisons of distributions of nutrient density indexes in the retail panel and FoodAPS data



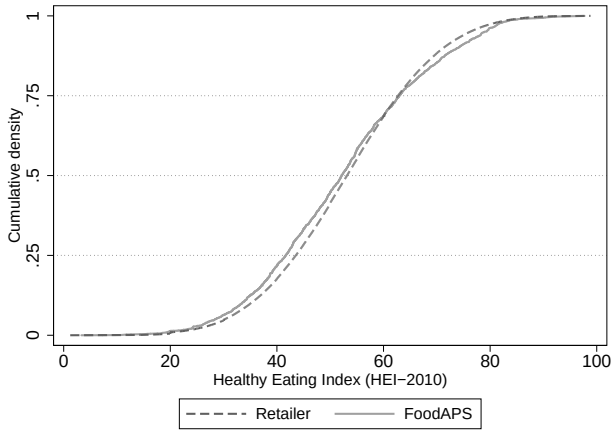
Notes: Each panel plots the cumulative distribution function of a measure of food healthfulness across households in two different samples. For the line labeled "FoodAPS", the sample is the set of households surveyed in the FoodAPS data, described in section 2.5. Each FoodAPS household is weighted according to the FoodAPS household weights such that the overall sample is nationally representative. For each household, the measure of food healthfulness is calculated from all observed food-at-home acquisitions during the survey week. For the line labeled "Retailer", the sample is all households in the retail panel during a randomly-assigned pseudo-survey week. Pseudo-survey weeks are randomly assigned to retailer households such that the distribution of pseudo-survey weeks in the retail panel equals the distribution of actual survey weeks in the FoodAPS data. For each household, the measure of food healthfulness is calculated from all food purchases at the retailer during their given pseudo-survey week. Each outcome is a nutrient density index defined as the amount of a given nutrient purchased per kilocalorie divided by the corresponding nutrient density implied by the Food and Drug Administration (FDA) Daily Value (DV) bounds, as described in section 2.4.2. All measures are shown on a log scale. The horizontal dotted lines intersect the 25th, 50th, and 75th percentiles of the distributions.

Online Appendix Figure 4: Comparisons of distributions of summary measures of food healthfulness in the retail panel and FoodAPS data

Panel A: Nutrient density score



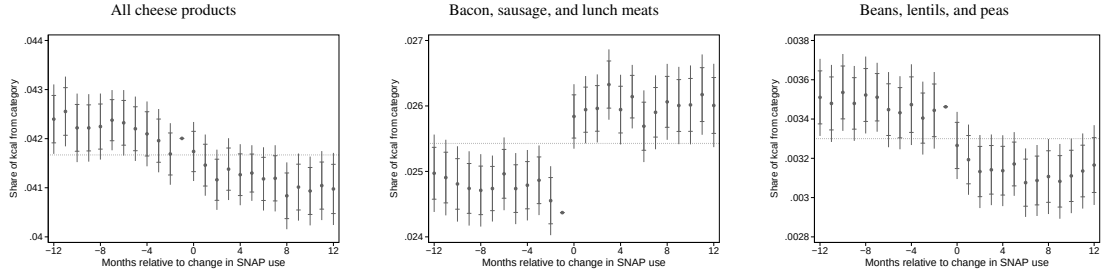
Panel B: Healthy Eating Index (HEI-2010)



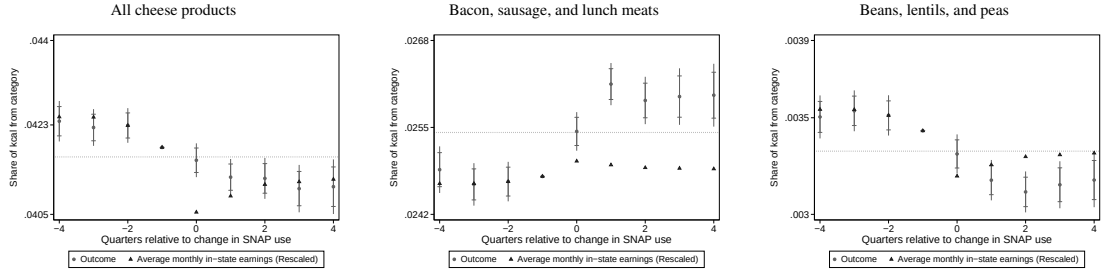
Notes: Each panel plots the cumulative distribution function of a measure of food healthfulness across households in two different samples. For the line labeled "FoodAPS", the sample is the set of households surveyed in the FoodAPS data, described in section 2.5. Each FoodAPS household is weighted according to the FoodAPS household weights such that the overall sample is nationally representative. For each household, the measure of food healthfulness is calculated from all observed food-at-home acquisitions during the survey week. For the line labeled "Retailer", the sample is all households in the retail panel during a randomly-assigned pseudo-survey week. Pseudo-survey weeks are randomly assigned to retailer households such that the distribution of pseudo-survey weeks in the retail panel equals the distribution of actual survey weeks in the FoodAPS data. For each household, the measure of food healthfulness is calculated from all food purchases at the retailer during their given pseudo-survey week. In panel A, the measure of healthfulness is the nutrient density score, described in section 2.4.2. The nutrient density score is shown on a log scale. In panel B, the measure of healthfulness is the Healthy Eating Index (HEI-2010), described in section 2.4.3. The horizontal dotted lines intersect the 25th, 50th, and 75th percentiles of the distributions.

Online Appendix Figure 5: Dynamics of TFP kilocalorie shares before and after entry into SNAP

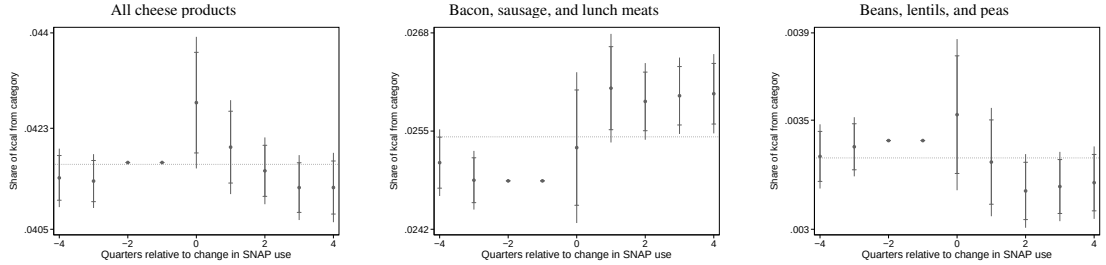
Panel A: Monthly frequency



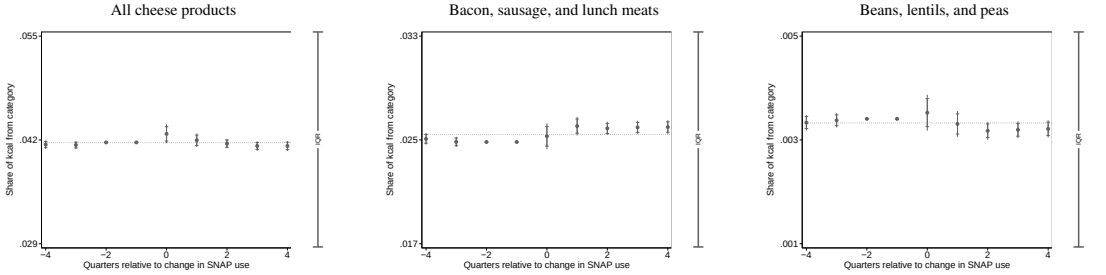
Panel B: Quarterly frequency with in-state earning dynamics



Panel C: Two stage least squares estimator

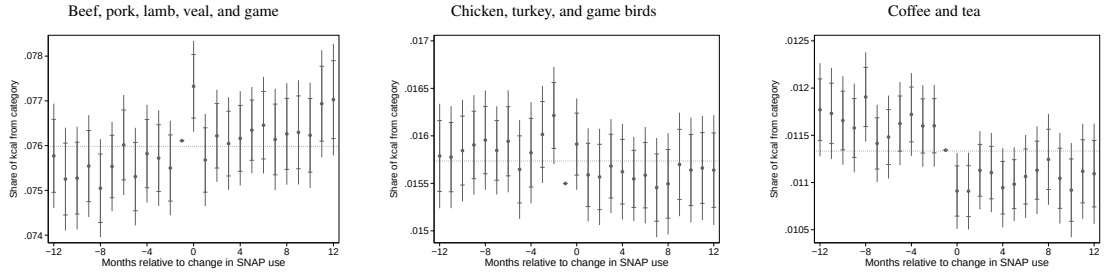


Panel D: Two stage least squares estimator relative to the IQR

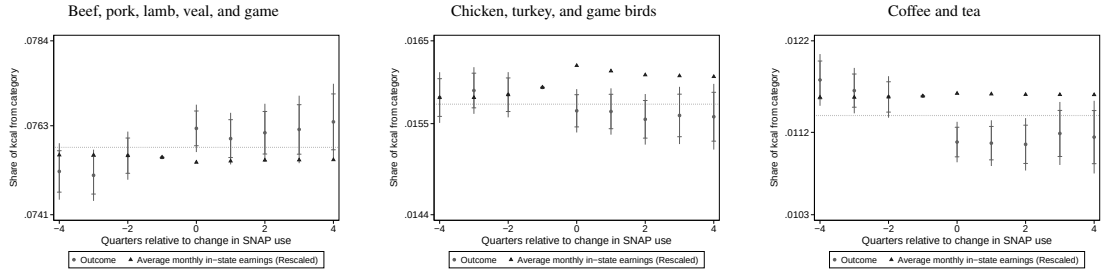


Online Appendix Figure 5: Dynamics of TFP kilocalorie shares before and after entry into SNAP (continued)

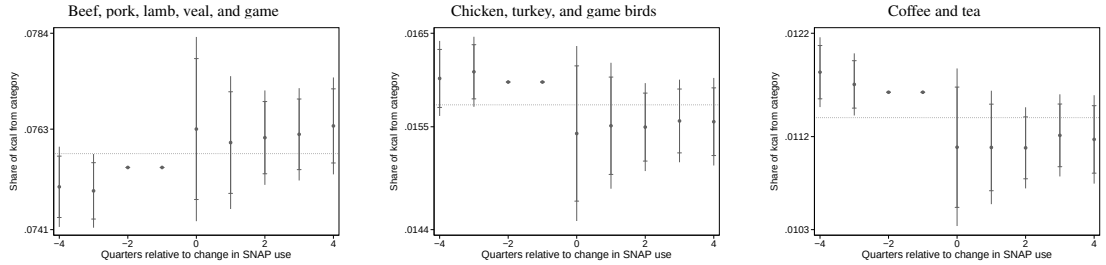
Panel A: Monthly frequency



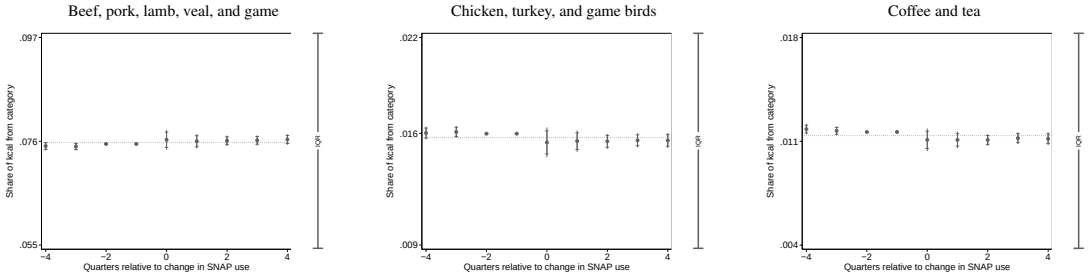
Panel B: Quarterly frequency with in-state earning dynamics



Panel C: Two stage least squares estimator

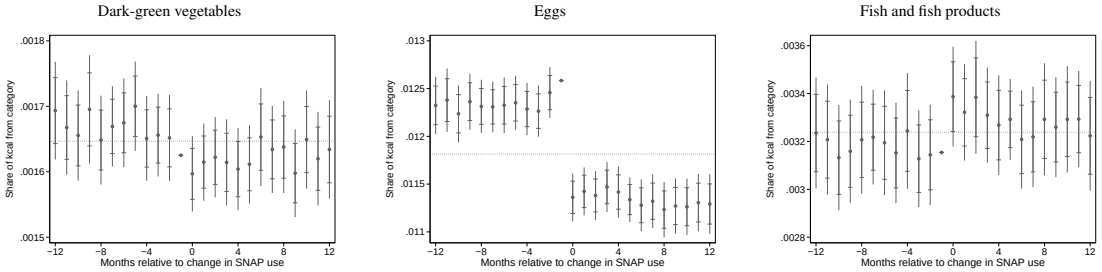


Panel D: Two stage least squares estimator relative to the IQR

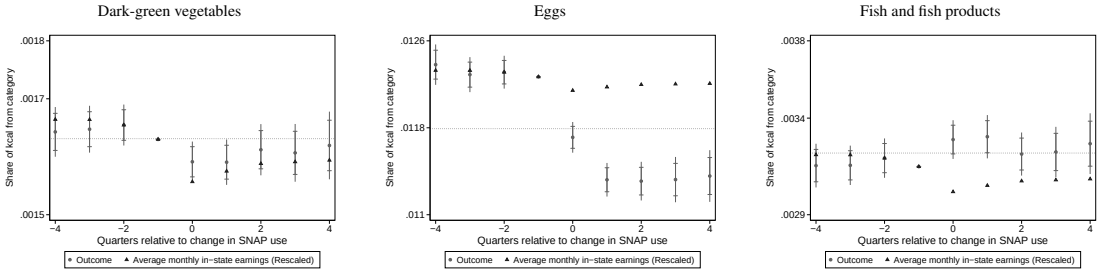


Online Appendix Figure 5: Dynamics of TFP kilocalorie shares before and after entry into SNAP (continued)

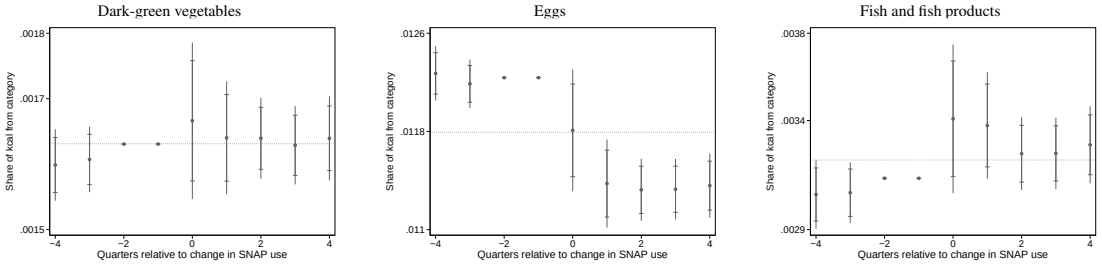
Panel A: Monthly frequency



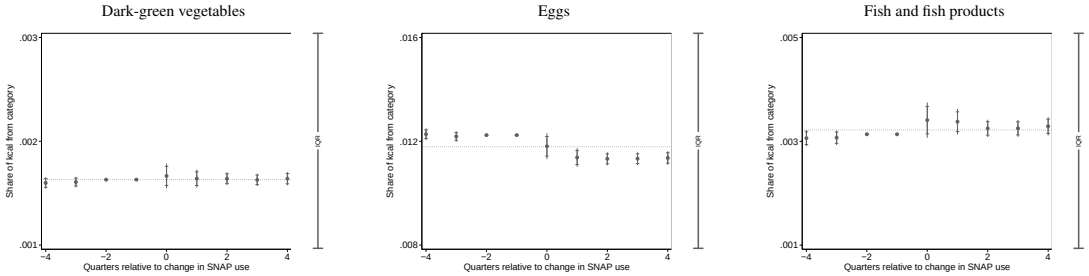
Panel B: Quarterly frequency with in-state earning dynamics



Panel C: Two stage least squares estimator

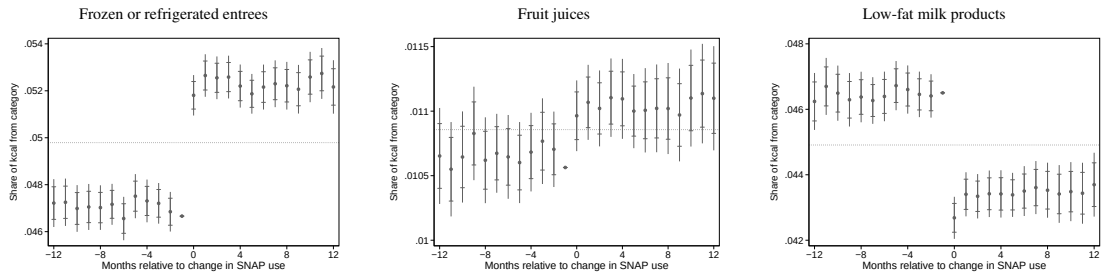


Panel D: Two stage least squares estimator relative to the IQR

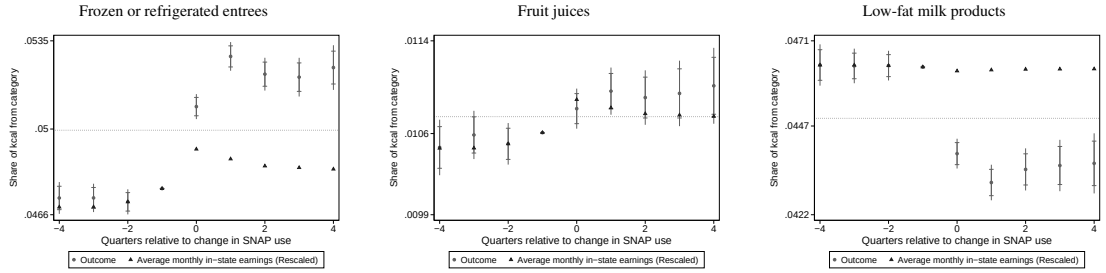


Online Appendix Figure 5: Dynamics of TFP kilocalorie shares before and after entry into SNAP (continued)

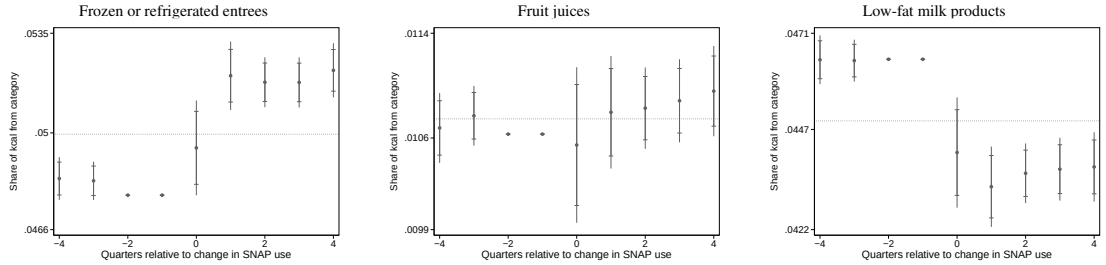
Panel A: Monthly frequency



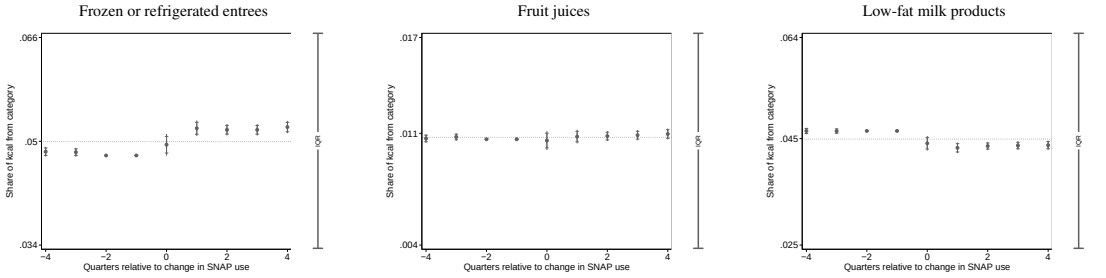
Panel B: Quarterly frequency with in-state earning dynamics



Panel C: Two stage least squares estimator

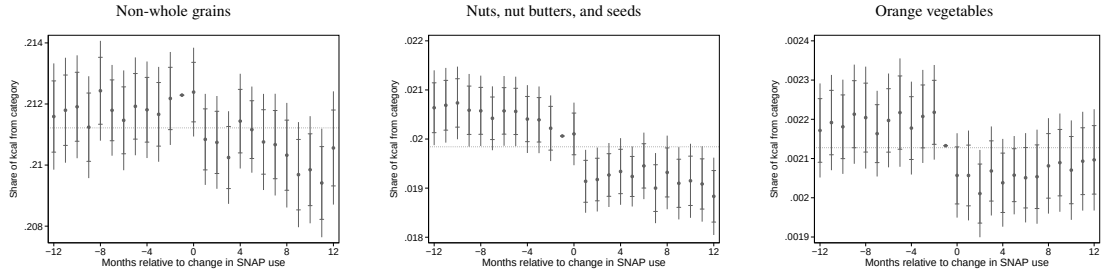


Panel D: Two stage least squares estimator relative to the IQR

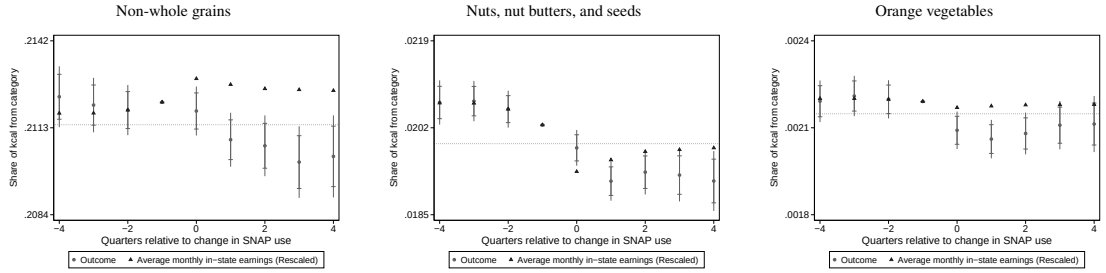


Online Appendix Figure 5: Dynamics of TFP kilocalorie shares before and after entry into SNAP (continued)

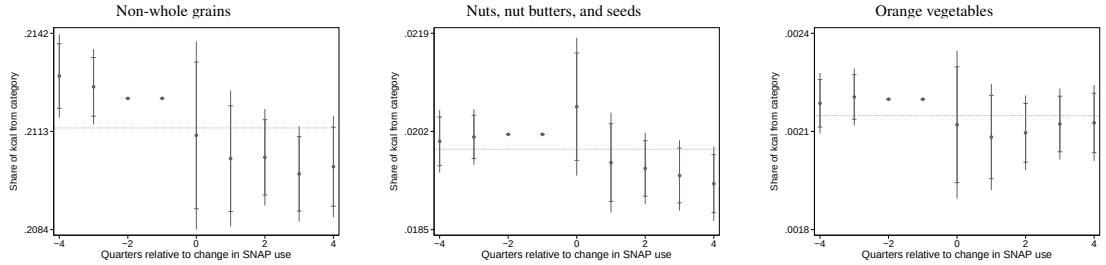
Panel A: Monthly frequency



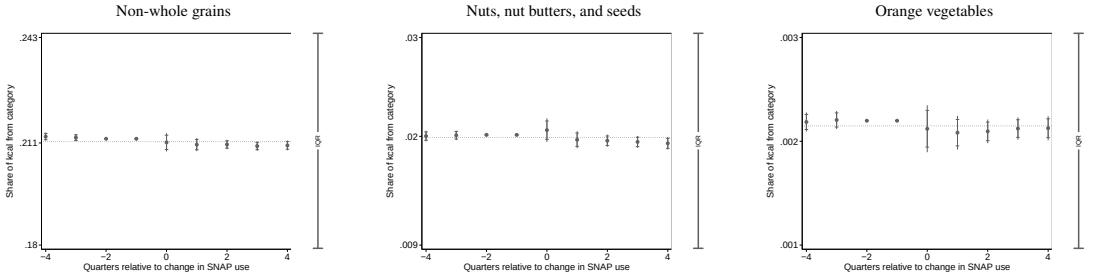
Panel B: Quarterly frequency with in-state earning dynamics



Panel C: Two stage least squares estimator

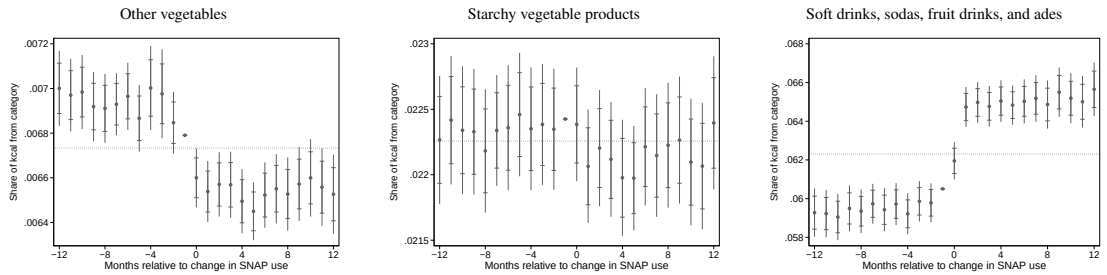


Panel D: Two stage least squares estimator relative to the IQR

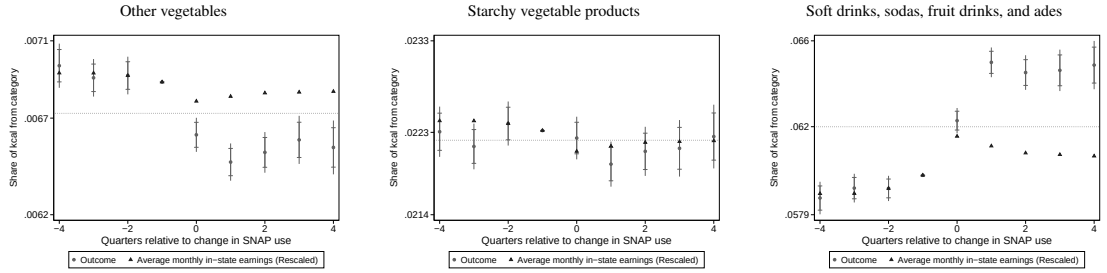


Online Appendix Figure 5: Dynamics of TFP kilocalorie shares before and after entry into SNAP (continued)

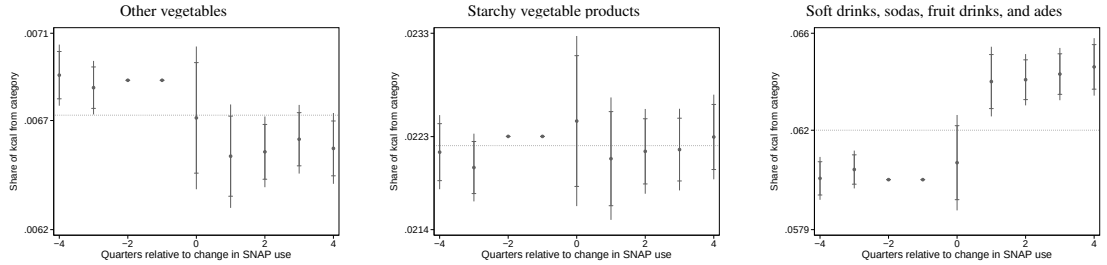
Panel A: Monthly frequency



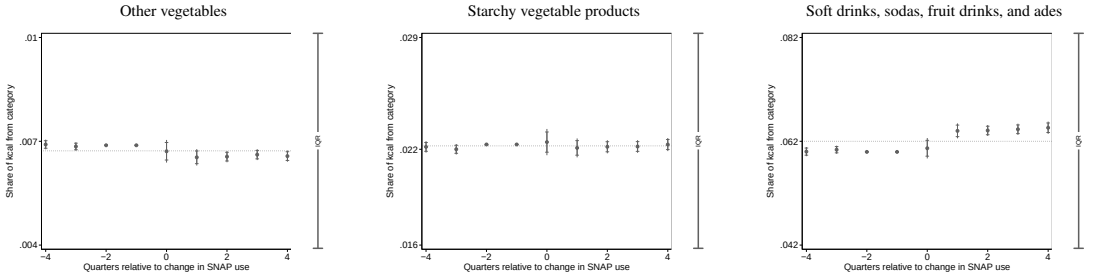
Panel B: Quarterly frequency with in-state earning dynamics



Panel C: Two stage least squares estimator

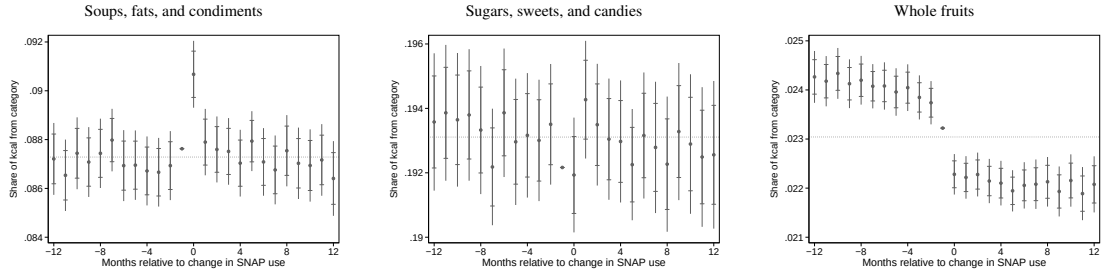


Panel D: Two stage least squares estimator relative to the IQR

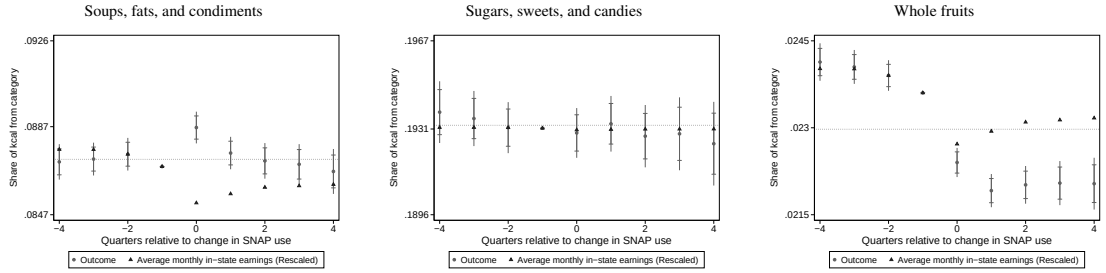


Online Appendix Figure 5: Dynamics of TFP kilocalorie shares before and after entry into SNAP (continued)

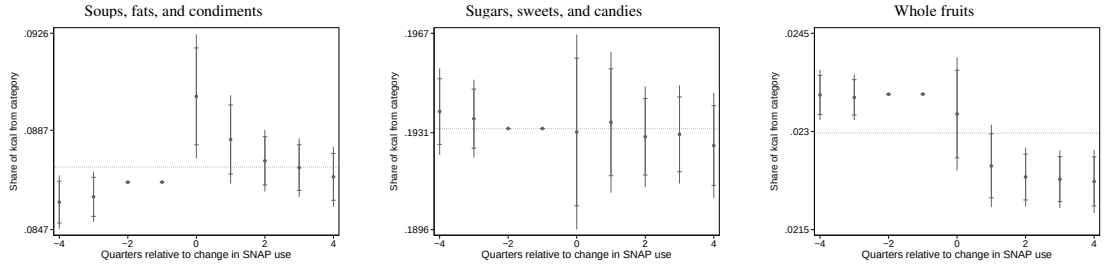
Panel A: Monthly frequency



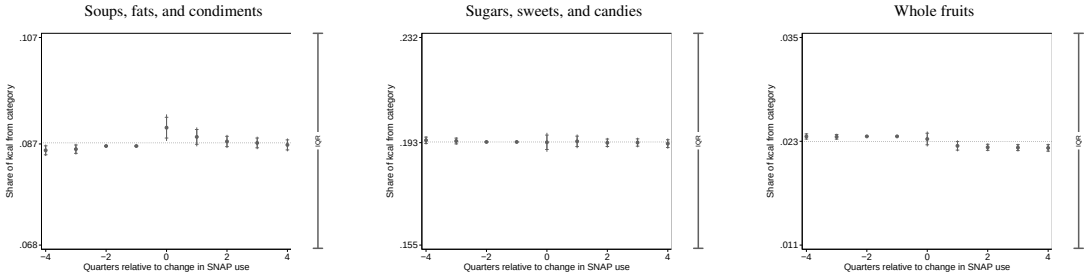
Panel B: Quarterly frequency with in-state earning dynamics



Panel C: Two stage least squares estimator

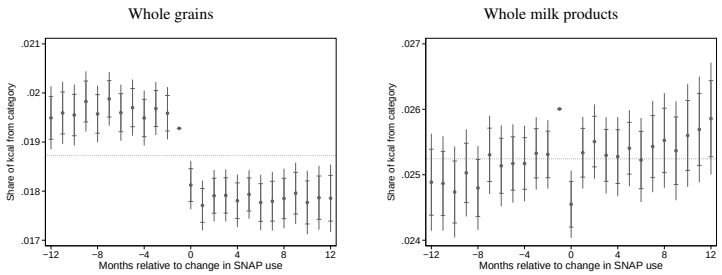


Panel D: Two stage least squares estimator relative to the IQR

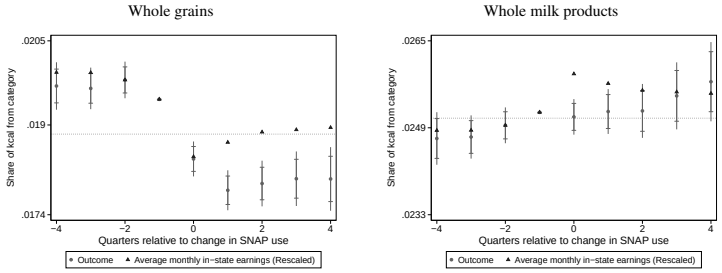


Online Appendix Figure 5: Dynamics of TFP kilocalorie shares before and after entry into SNAP (continued)

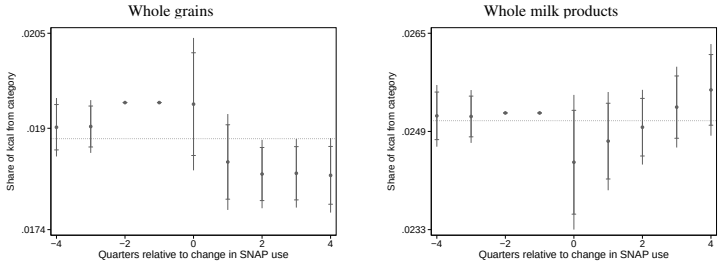
Panel A: Monthly frequency



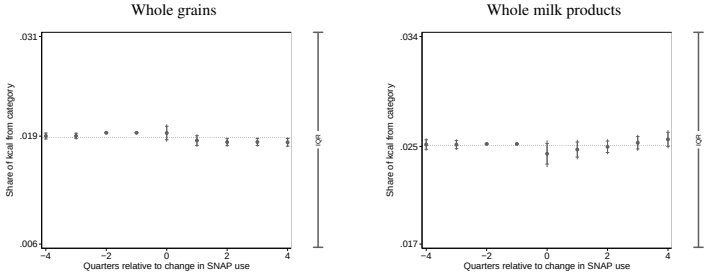
Panel B: Quarterly frequency with in-state earning dynamics



Panel C: Two stage least squares estimator



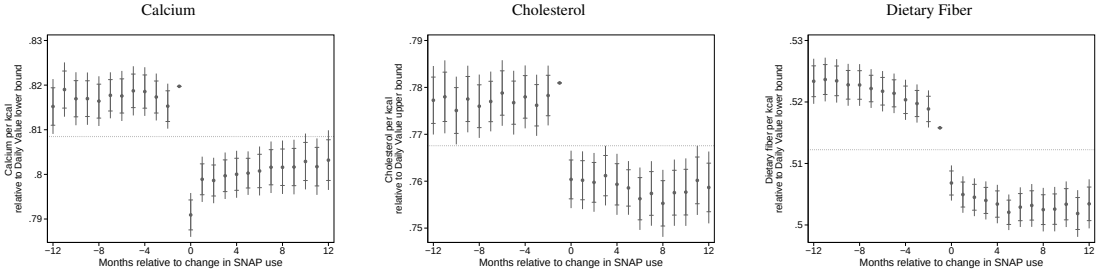
Panel D: Two stage least squares estimator relative to the IQR



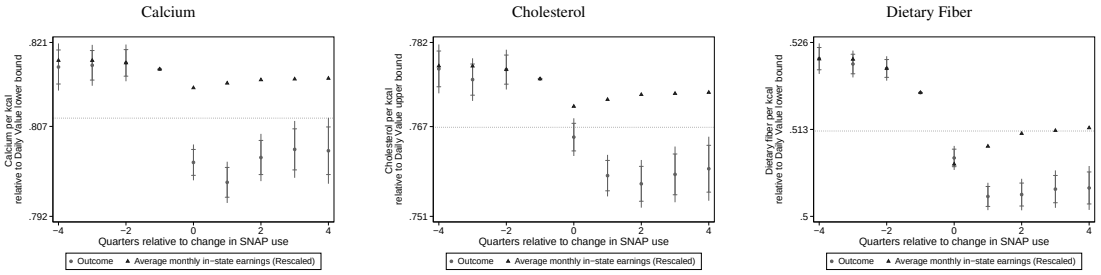
Notes: Each figure plots coefficient estimates from a two-stage least squares regression of a measure of healthfulness on a vector of leads and lags of the contemporaneous change in SNAP use. The sample is the set of SNAP adopters. The unit of observation is the household-time period. Each regression includes controls for the sum of the change in SNAP use before the start of the plot window and after the end of the plot window, with the number of SNAP adoption periods before the start of the plot window and after the end of the plot window as excluded instruments. The change in SNAP use and the SNAP adoption indicator are treated as zero outside of the sample period. Each regression includes household and time period fixed effects. The coefficient estimates are shifted by a constant such that the mean of the coefficient estimates is equal to the mean of the outcome in the estimation sample. This mean is marked by a dotted line within each plot. The inner error bars represent 95 percent pointwise confidence intervals based on asymptotic standard errors clustered by household. The outer error bars represent 95 percent uniform sup-t confidence intervals computed as outlined in Montiel Olea and Plagborg-Møller (2019) based on an asymptotic variance-covariance matrix clustered by household. In panel A, the time period is a calendar month. In panels B-D, the time period is a calendar quarter. In panel A and panel B, the endogenous variables are a vector of leads and lags of the contemporaneous change in SNAP use, with leads and lags of a contemporaneous indicator for whether the current time period (i.e., month or quarter) is a SNAP adoption period as excluded instruments. The coefficient on the first lead of the contemporaneous change in SNAP use is normalized to zero. In panel B, in addition to the dynamics of the outcomes, the plots show the dynamics of in-state earnings (from figure 2) rescaled such that the change in in-state earnings matches the change in the outcome between two and one periods prior to the change in SNAP use. In panel C and panel D, the estimates are based on the research design described in section 3.1. The model is estimated in two samples using the TS2SLS estimator defined in Inoue and Solon (2010). Standard errors are calculated as outlined in appendix B. The endogenous variables are a vector of leads and lags of the contemporaneous change in SNAP use and average monthly in-state earnings, with leads and lags of a contemporaneous indicator for whether the current quarter is a SNAP adoption quarter as excluded instruments. The first stage for in-state earnings is estimated on the sample of SNAP adopters in the Rhode Island administrative data described in section 2.7. The first stage for the leads and lags of the contemporaneous change in SNAP use and the second stage are estimated in the retail panel. The coefficients on the first and second leads of the contemporaneous change in SNAP use are normalized to zero. In panel D, we repeat the plots in panel C, setting the y-axis range to be the interquartile range of the average of the outcome across all retailer households. Each outcome is the share of kilocalories from a given product category underlying the Thrifty Food Plan, as described in section 2.4.1.

Online Appendix Figure 6: Dynamics of nutrient density indexes before and after entry into SNAP

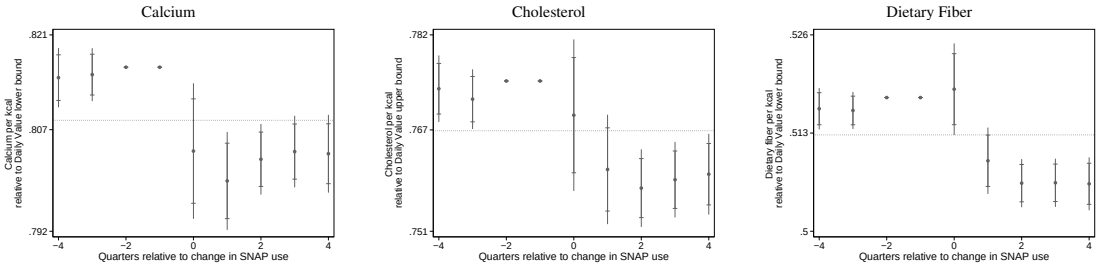
Panel A: Monthly frequency



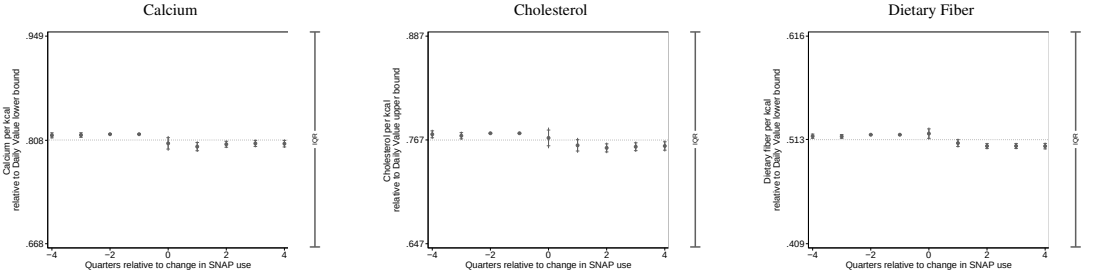
Panel B: Quarterly frequency with in-state earning dynamics



Panel C: Two stage least squares estimator

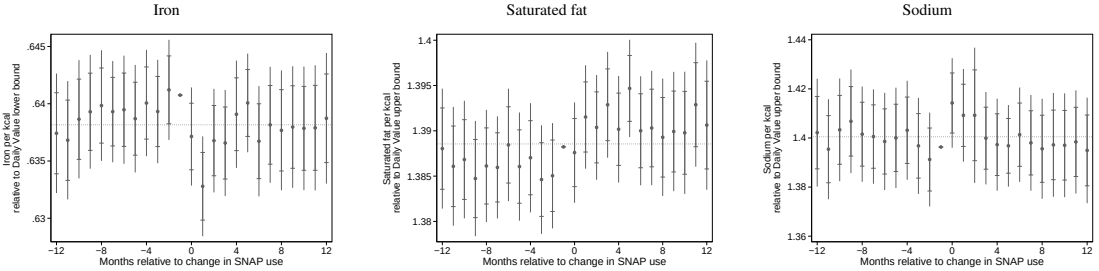


Panel D: Two stage least squares estimator relative to the IQR

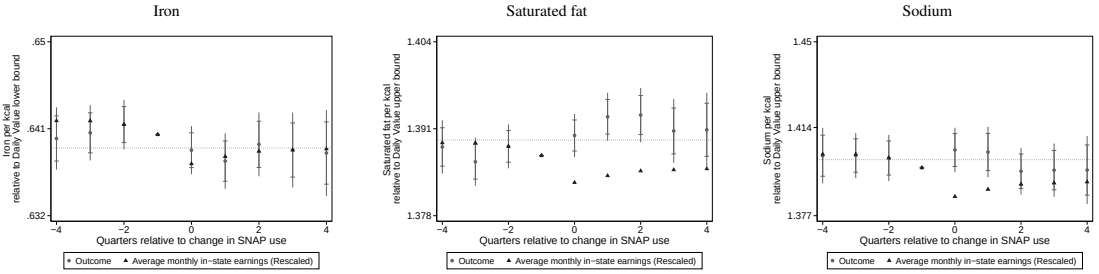


Online Appendix 6: Dynamics of nutrient density indexes before and after entry into SNAP (continued)

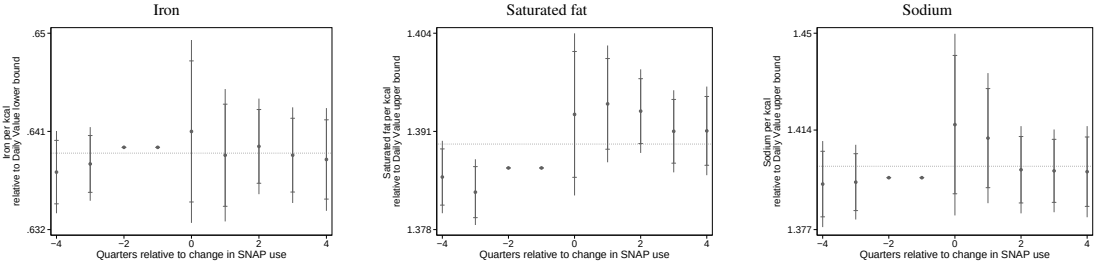
Panel A: Monthly frequency



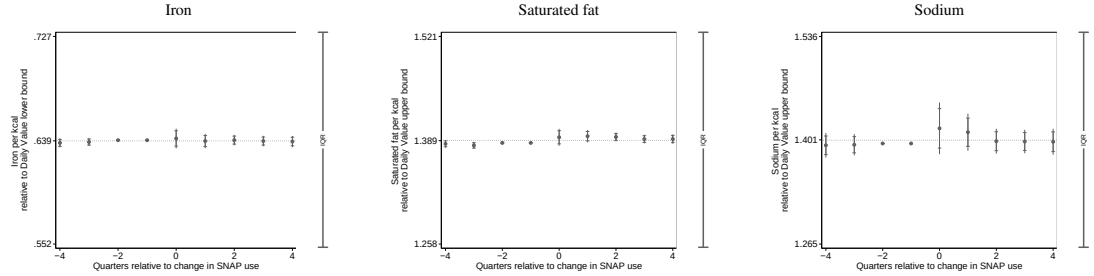
Panel B: Quarterly frequency with in-state earning dynamics



Panel C: Two stage least squares estimator

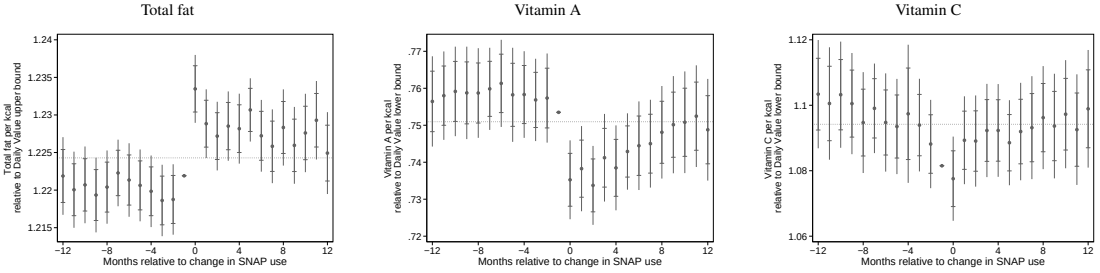


Panel D: Two stage least squares estimator relative to the IQR

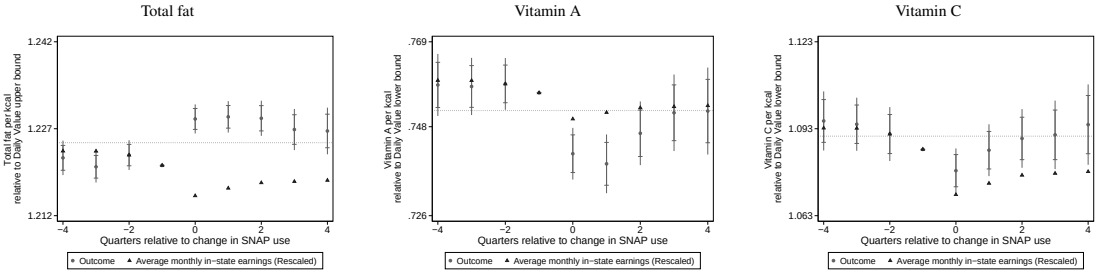


Online Appendix 6: Dynamics of nutrient density indexes before and after entry into SNAP (continued)

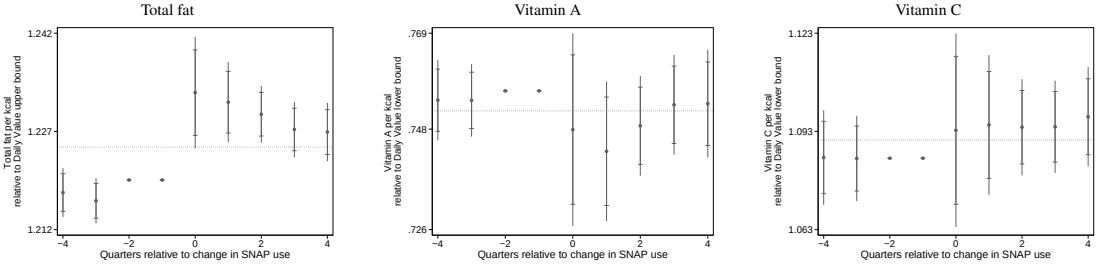
Panel A: Monthly frequency



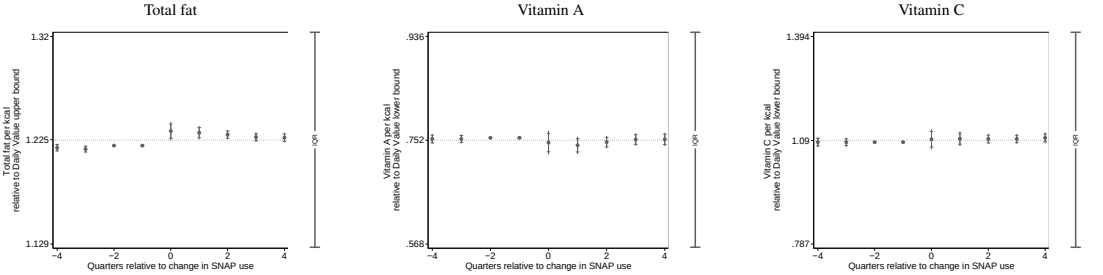
Panel B: Quarterly frequency with in-state earning dynamics



Panel C: Two stage least squares estimator



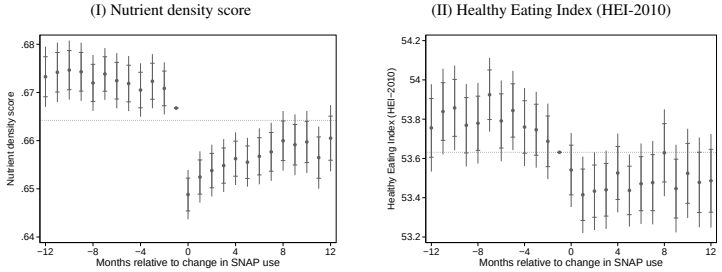
Panel D: Two stage least squares estimator relative to the IQR



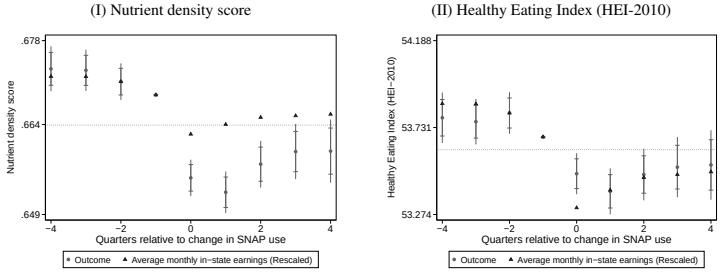
Notes: Each figure plots coefficient estimates from a two-stage least squares regression of a measure of healthfulness on a vector of leads and lags of the contemporaneous change in SNAP use. The sample is the set of SNAP adopters. The unit of observation is the household-time period. Each regression includes controls for the sum of the change in SNAP use before the start of the plot window and after the end of the plot window, with the number of SNAP adoption periods before the start of the plot window and after the end of the plot window as excluded instruments. The change in SNAP use and the SNAP adoption indicator are treated as zero outside of the sample period. Each regression includes household and time period fixed effects. The coefficient estimates are shifted by a constant such that the mean of the coefficient estimates is equal to the mean of the outcome in the estimation sample. This mean is marked by a dotted line within each plot. The inner error bars represent 95 percent pointwise confidence intervals based on asymptotic standard errors clustered by household. The outer error bars represent 95 percent uniform sup-t confidence intervals computed as outlined in Montiel Olea and Plagborg-Møller (2019) based on an asymptotic variance-covariance matrix clustered by household. In panel A, the time period is a calendar month. In panels B-D, the time period is a calendar quarter. In panel A and panel B, the endogenous variables are a vector of leads and lags of the contemporaneous change in SNAP use, with leads and lags of a contemporaneous indicator for whether the current time period (i.e., month or quarter) is a SNAP adoption period as excluded instruments. The coefficient on the first lead of the contemporaneous change in SNAP use is normalized to zero. In panel B, in addition to the dynamics of the outcomes, the plots show the dynamics of in-state earnings (from figure 2) rescaled such that the change in in-state earnings matches the change in the outcome between two and one periods prior to the change in SNAP use. In panel C and panel D, the estimates are based on the research design described in section 3.1. The model is estimated in two samples using the TS2SLS estimator defined in Inoue and Solon (2010). Standard errors are calculated as outlined in appendix B. The endogenous variables are a vector of leads and lags of the contemporaneous change in SNAP use and average monthly in-state earnings, with leads and lags of a contemporaneous indicator for whether the current quarter is a SNAP adoption quarter as excluded instruments. The first stage for in-state earnings is estimated on the sample of SNAP adopters in the Rhode Island administrative data described in section 2.7. The first stage for the leads and lags of the contemporaneous change in SNAP use and the second stage are estimated in the retail panel. The coefficients on the first and second leads of the contemporaneous change in SNAP use are normalized to zero. In panel D, we repeat the plots in panel C, setting the y-axis range to be the interquartile range of the average of the outcome across all retailer households. Each outcome is the amount of a given nutrient purchased per kilocalorie divided by the corresponding nutrient density implied by the Food and Drug Administration (FDA) Daily Value (DV) bounds, as described in section 2.4.2.

Online Appendix Figure 7: Dynamics of summary measures of food healthfulness before and after entry into SNAP

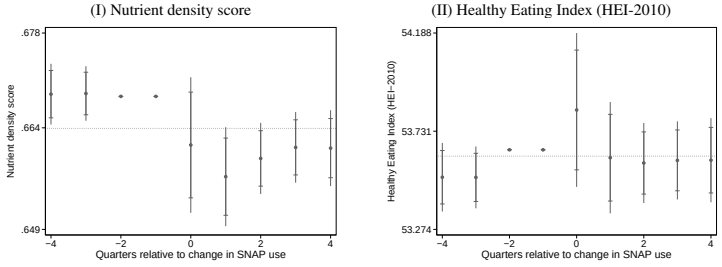
Panel A: Monthly frequency



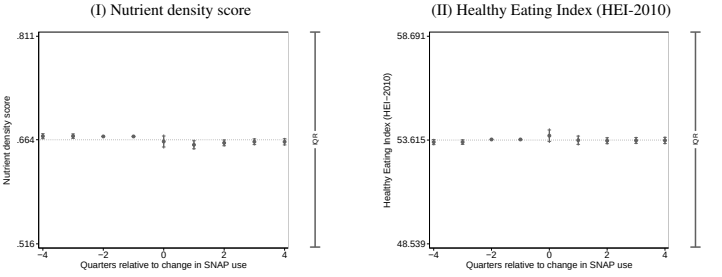
Panel B: Quarterly frequency with in-state earning dynamics



Panel C: Two stage least squares estimator



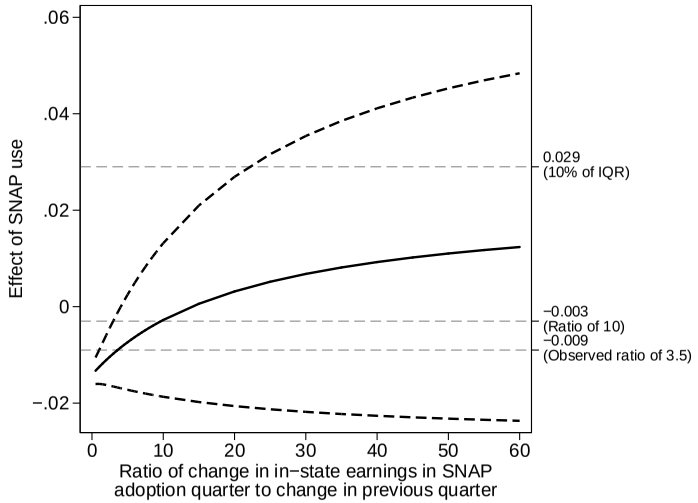
Panel D: Two stage least squares estimator relative to the IQR



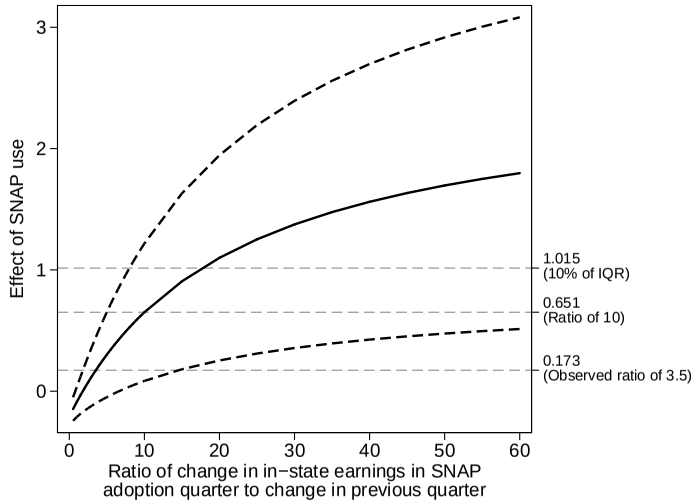
Notes: Each figure plots coefficient estimates from a two-stage least squares regression of a measure of healthfulness on a vector of leads and lags of the contemporaneous change in SNAP use. The sample is the set of SNAP adopters. The unit of observation is the household-time period. Each regression includes controls for the sum of the change in SNAP use before the start of the plot window and after the end of the plot window, with the number of SNAP adoption periods before the start of the plot window and after the end of the plot window as excluded instruments. The change in SNAP use and the SNAP adoption indicator are treated as zero outside of the sample period. Each regression includes household and time period fixed effects. The coefficient estimates are shifted by a constant such that the mean of the coefficient estimates is equal to the mean of the outcome in the estimation sample. This mean is marked by a dotted line within each plot. The inner error bars represent 95 percent pointwise confidence intervals based on asymptotic standard errors clustered by household. The outer error bars represent 95 percent uniform sup-t confidence intervals computed as outlined in Montiel Olea and Plagborg-Møller (2019) based on an asymptotic variance-covariance matrix clustered by household. In panel A, the time period is a calendar month. In panels B-D, the time period is a calendar quarter. In panel A and panel B, the endogenous variables are a vector of leads and lags of the contemporaneous change in SNAP use, with leads and lags of a contemporaneous indicator for whether the current time period (i.e., month or quarter) is a SNAP adoption period as excluded instruments. The coefficient on the first lead of the contemporaneous change in SNAP use is normalized to zero. In panel B, in addition to the dynamics of the outcomes, the plots show the dynamics of in-state earnings (from figure 2) rescaled such that the change in in-state earnings matches the change in the outcome between two and one periods prior to the change in SNAP use. In panel C and panel D, the estimates are based on the research design described in section 3.1. The model is estimated in two samples using the TS2SLS estimator defined in Inoue and Solon (2010). Standard errors are calculated as outlined in appendix B. The endogenous variables are a vector of leads and lags of the contemporaneous change in SNAP use and average monthly in-state earnings, with leads and lags of a contemporaneous indicator for whether the current quarter is a SNAP adoption quarter as excluded instruments. The first stage for in-state earnings is estimated on the sample of SNAP adopters in the Rhode Island administrative data described in section 2.7. The first stage for the leads and lags of the contemporaneous change in SNAP use and the second stage are estimated in the retail panel. The coefficients on the first and second leads of the contemporaneous change in SNAP use are normalized to zero. In panel D, we repeat the plots in panel C, setting the y-axis range to be the interquartile range of the average of the outcome across all retailer households. In the first column, the measure of healthfulness is the nutrient density score, described in section 2.4.2 In the second column, the measure of healthfulness is the Healthy Eating Index (HEI-2010), described in section 2.4.3.

Online Appendix Figure 8: Sensitivity of program adoption research design to alternative income dynamics

Panel A: Nutrient density score

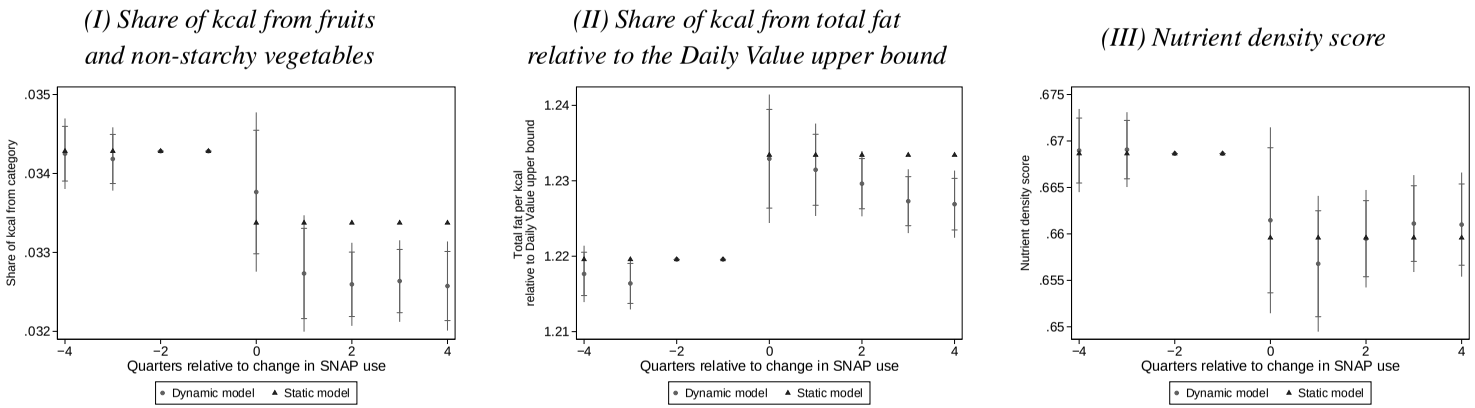


Panel B: Healthy Eating Index (HEI-2010)



Notes: The figures show the estimated effect of SNAP use on the given outcome as a function of the ratio α of the change in in-state earnings in the quarter of SNAP adoption to the change in the quarter before. The sample is the set of SNAP adopters. The unit of observation is the household-quarter. For each α, the estimated effect of SNAP use is obtained via a 2SLS regression of the change in the given measure of healthfulness Δh_{it} on the change in an indicator for whether the current quarter is a SNAP quarter Δs_{it}, with an indicator for whether the current quarter is a SNAP adoption quarter z_{it} as the excluded instrument and the change in counterfactual in-state earnings Δx_{it}^{α} and calendar quarter fixed effects ψ_t as exogenous controls. Counterfactual in-state earnings are defined in the retail panel as $\Delta x_{it}^{\alpha} = -\alpha z_{it} - 1 \cdot z_{it+1} + \hat{\phi}_t$, with the calendar quarter fixed effects $\hat{\phi}_t$ coming from the first stage underlying figure 4 and estimated using the Rhode Island administrative data described in section 2.7. The solid black line represents estimates of the effect of SNAP use on the given outcome. The dashed black lines represent 95 percent confidence intervals based on asymptotic standard errors clustered by household. In panel A, the outcome is the nutrient density score (NDS), described in section 2.4.2. In panel B, the outcome is the Healthy Eating Index (HEI-2010), described in section 2.4.3. The dashed horizontal lines mark 10 percent of the interquartile range (IQR) of the average of the outcome across all retail households, the estimated effect of SNAP at $\alpha = 10$, and the estimated effect of SNAP at the observed α. The observed α corresponds to the ratio of the coefficient on the lead of SNAP adoption to the coefficient on SNAP adoption in the first stage underlying figure 4 and is estimated using the Rhode Island administrative data described in section 2.7.

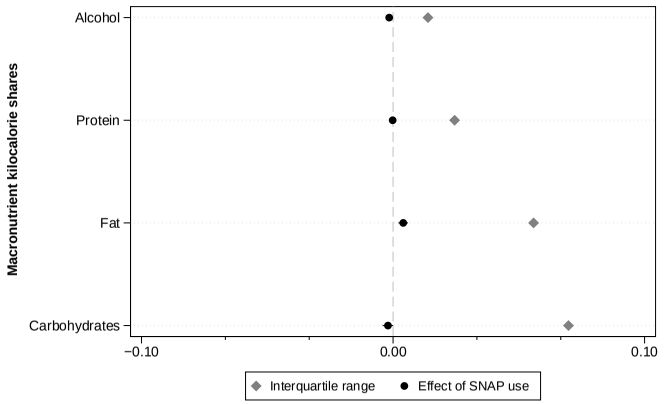
Online Appendix Figure 9: Dynamics of select outcomes before and after entry into SNAP, with predictions of static model



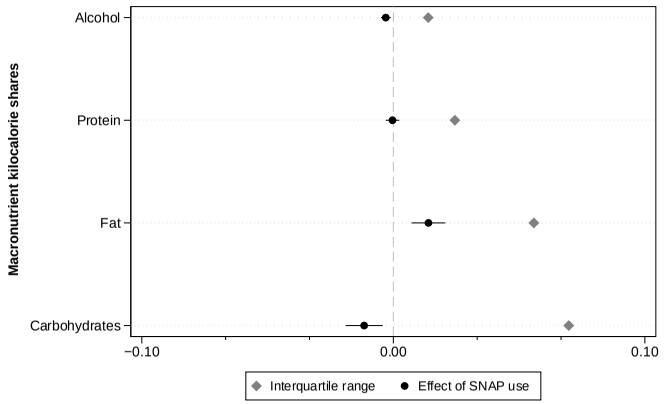
Notes: Each panel plots coefficients estimated using the models underlying figure 3 and figure 4. The sample is the set of SNAP adopters. The unit of observation is the household-quarter. The "Dynamic model" series plots coefficient estimates from a two-stage least squares regression of a measure of healthfulness on a vector of leads and lags of the contemporaneous change in SNAP use. The model is estimated in two samples using the TS2SLS estimator defined in Inoue and Solon (2010). Standard errors are calculated as outlined in appendix B. The endogenous variables are a vector of leads and lags of the contemporaneous change in SNAP use and average monthly in-state earnings, with leads and lags of a contemporaneous indicator for whether the current quarter is a SNAP adoption quarter as excluded instruments. The first stage for in-state earnings is estimated on the sample of SNAP adopters in the Rhode Island administrative data described in section 2.7. The first stage for the leads and lags of the contemporaneous change in SNAP use and the second stage are estimated in the retail panel. The coefficients on the first and second leads of the contemporaneous change in SNAP use are normalized to zero. Each regression includes controls for the sum of the change in SNAP use before the start of the plot window and after the end of the plot window, with the number of SNAP adoption quarters before the start of the plot window and after the end of the plot window as excluded instruments. The change in SNAP use and the SNAP adoption indicator are treated as zero outside of the sample period. Each regression includes household and calendar quarter fixed effects. The "Static model" series is set to zero in all quarters prior to change in SNAP use and the estimated causal effect of SNAP use (depicted in figure 4) in all quarters following change in SNAP use. For the dynamic model series, the coefficient estimates are shifted by a constant such that the mean of the coefficient estimates is equal to the mean of the outcome in the estimation sample. For the static model series, the coefficients are shifted by a constant such that the static mdoel series coincides with the dynamic model series in the two periods immediately preceding the change in SNAP use. The inner error bars represent 95 percent pointwise confidence intervals based on asymptotic standard errors clustered by household. The outer error bars represent 95 percent uniform sup-t confidence intervals computed as outlined in Montiel Olea and Plagborg-Møller (2019) based on an asymptotic variance-covariance matrix clustered by household. In the first column, the measure of healthfulness is the share of kilocalories from fruits and non-starchy vegetables, described in section 2.4.1. In the second column, the measure of healthfulness is the share of kilocalories from total fat relative to the Daily Value upper bound, described in section 2.4.2. In the third column, the measure of healthfulness is the nutrient density score, described in section 2.4.2.

Online Appendix Figure 10: Effect of SNAP use on macronutrient kilocalorie shares

Panel A: Program adoption research design



Panel B: Program exit research design

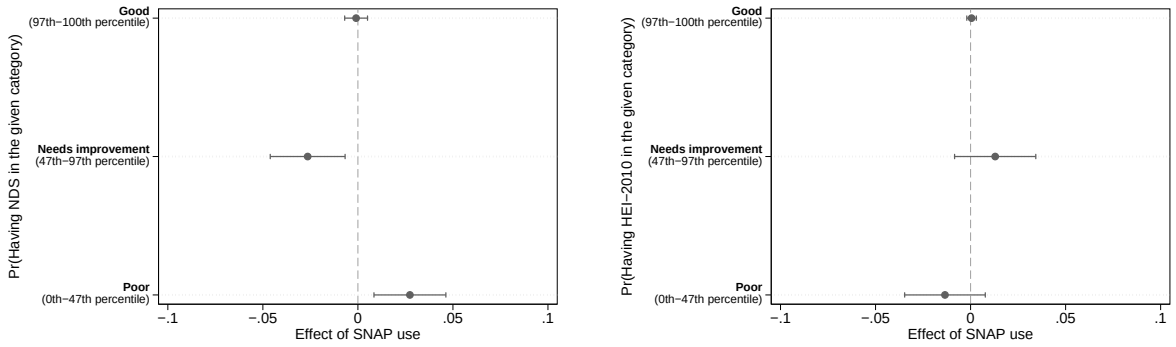


Notes: The plot presents the IQR of and the estimated effect of SNAP use on the given outcomes. For the IQR series, the sample is all retailer households and the unit of observation is the household. For the estimated effect of SNAP use, the sample is the set of SNAP adopters and the unit of observation is the household-time period. In panel A, the time period is a calendar quarter. For each outcome, the effect of SNAP use is estimated via a two-sample two-stage least squares regression (Inoue and Solon 2010) of the change in the outcome on the change in an indicator for whether the current quarter is a SNAP quarter and the change in average monthly in-state earnings, with an indicator for whether the current quarter is a SNAP adoption quarter and its first lead as excluded instruments and calendar quarter fixed effects as exogenous controls. The first stage for the change in in-state earnings is estimated on the sample of SNAP adopters in the Rhode Island administrative data described in section 2.7. The first stage for the change in an indicator for whether the current quarter is a SNAP quarter and the second stage are estimated in the retail panel. Standard errors are calculated as outlined in appendix B. In panel B, the time period is a calendar month. For each outcome, the effect of SNAP use is estimated via a two-stage least squares regression of the change in the outcome on the change in an indicator for whether the current month is a SNAP month, with an indicator equal to one in the first month of a six-month clock that begins in the most recent adoption month as the excluded instrument and calendar month fixed effects as exogenous controls. The clock indicator is set to zero in the first six months (inclusive of the adoption month) following the most recent adoption, in any month after the first 24 months (inclusive of the adoption month) following the recent adoption, and in any month for which there is no preceding adoption. Error bars represent 95 percent confidence intervals based on asymptotic standard errors clustered by household. Each outcome is the share of kilocalories from a given macronutrient.

Online Appendix Figure 11: Effect of SNAP use on the distribution of food healthfulness

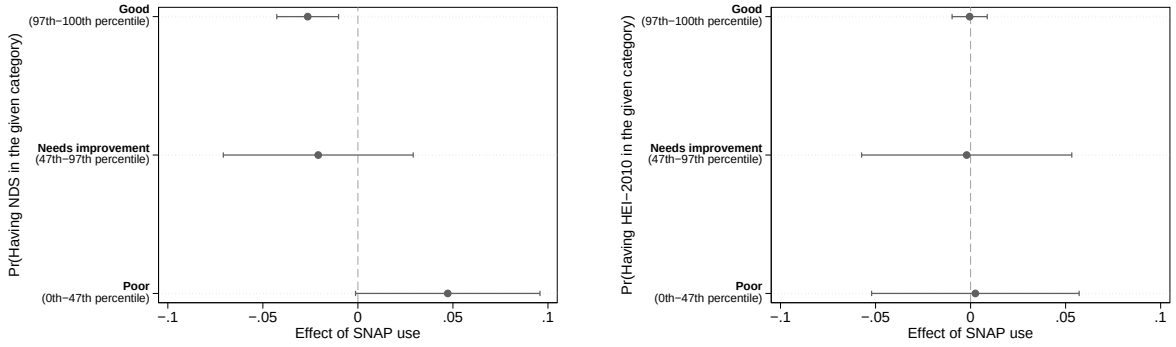
Panel A: Program adoption research design

(I) Nutrient density score (NDS) (II) Healthy Eating Index (HEI-2010)



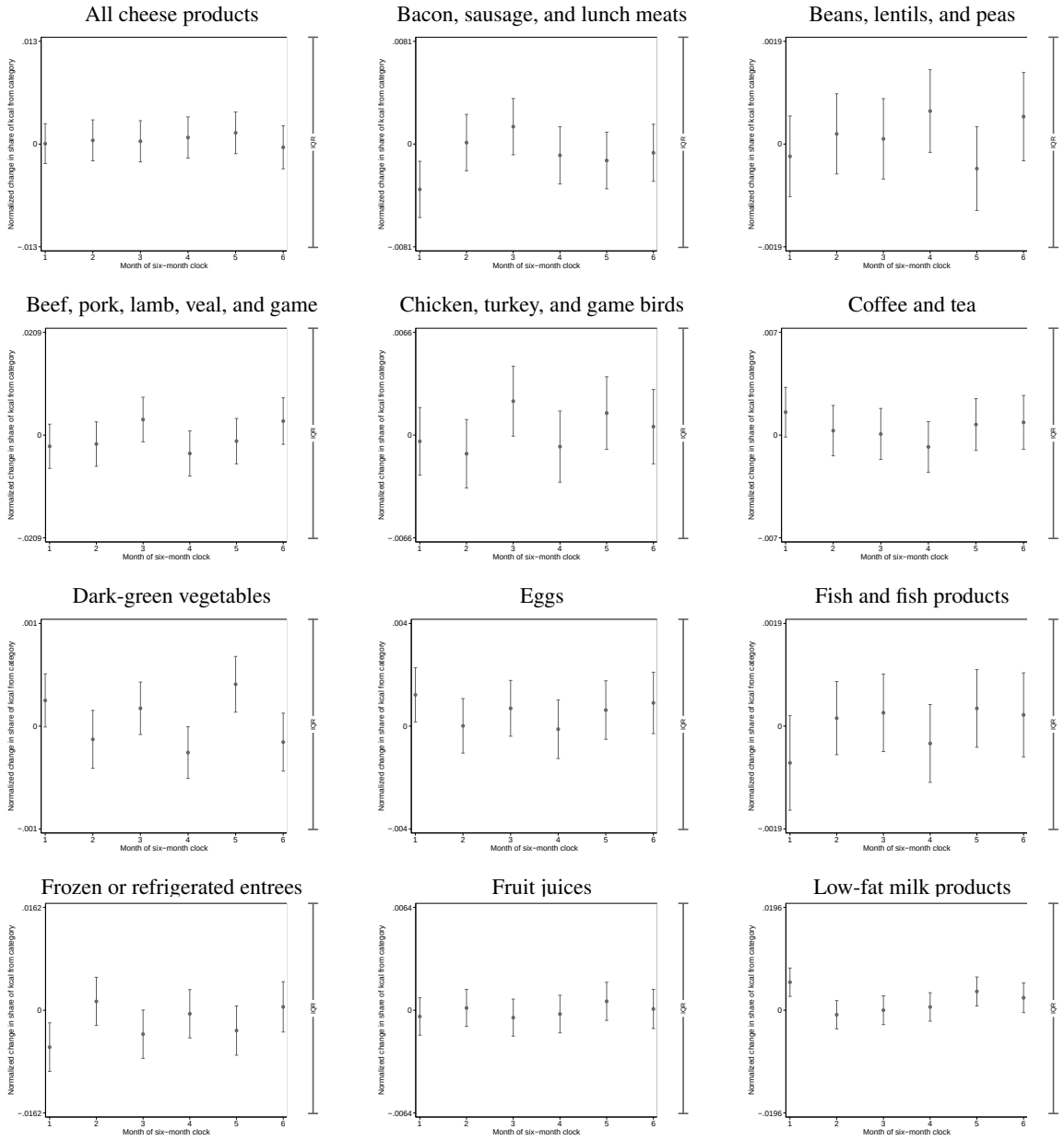
Panel B: Program exit research design

(I) Nutrient density score (NDS) (II) Healthy Eating Index (HEI-2010)

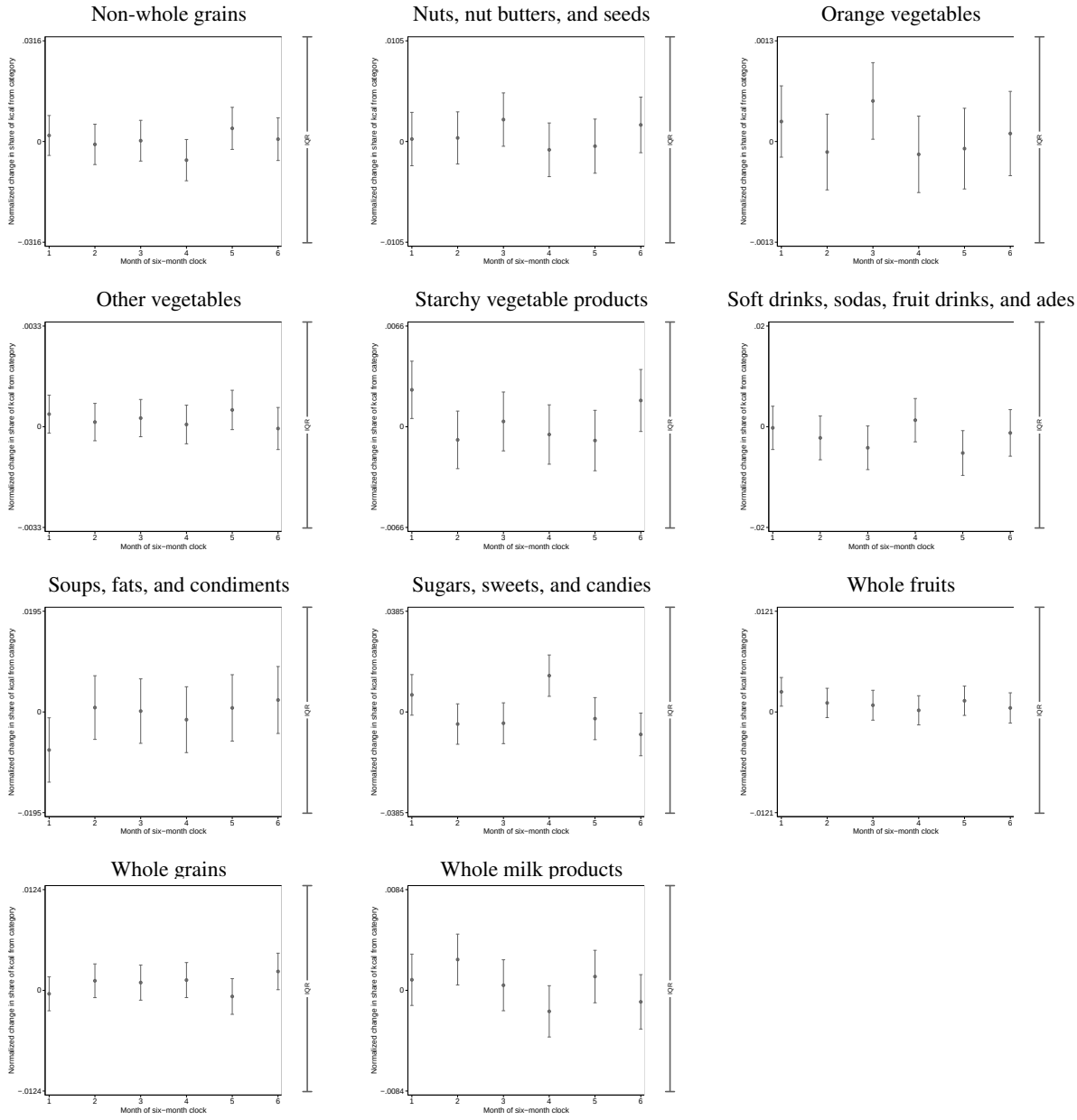


Notes: Each figure plots estimates of the effect of SNAP use on the probability of having a "good", "needs improvement", or "poor" level of healthfulness. In the left column, the outcome is the nutrient density score (NDS), described in section 2.4.2. In the right column, the outcome is the Healthy Eating Index (HEI-2010), described in section 2.4.3. For the HEI-2010, "good", "needs improvement", and "poor" levels of healthfulness are defined by score cutoffs established by the USDA for "good", "needs improvement", and "poor" levels of the original Healthy Eating Index (HEI) (USDA 1995). See Drenowatz et al. (2014), Gubur and Demir (2017), and Yosaee et al. (2017) for examples of prior work applying the original HEI cutoffs to the HEI-2010. For the NDS, "good", "needs improvement" and "poor" score cutoffs are computed as follows. First, we compute the percentiles of the original HEI score cutoffs in the distribution of the HEI-2010 using the FoodAPS data. Each FoodAPS household is weighted according to the FoodAPS household weights such that the overall sample is nationally representative. These are the percentiles reported in parentheses in the plots. Second, we compute the value of the NDS at each of the estimated percentiles in the sample of all retailer households, where the NDS of each household is the average NDS across all household-months. In panel A, the sample is the set of SNAP adopters and the unit of observation is a household-quarter. For each outcome, the effect of SNAP use is estimated via a two-sample two-stage least squares regression (Inoue and Solon 2010) of the change in the outcome on the change in an indicator for whether the current quarter is a SNAP quarter and the change in average monthly in-state earnings, with an indicator for whether the current quarter is a SNAP adoption quarter and its first lead as excluded instruments and calendar quarter fixed effects as exogenous controls. The first stage for the change in in-state earnings is estimated on the sample of SNAP adopters in the Rhode Island administrative data described in section 2.7. The first stage for the change in an indicator for whether the current quarter is a SNAP quarter and the second stage are estimated in the retail panel. Standard errors are calculated as outlined in appendix B. In panel B, the sample is the set of SNAP adopters and the unit of observation is a household-month. For each outcome, the effect of SNAP use is estimated via a two-stage least squares regression of the change in the outcome on the change in an indicator for whether the current month is a SNAP month, with an indicator equal to one in the first month of a six-month clock that begins in the most recent adoption month as the excluded instrument and calendar month fixed effects as exogenous controls. The clock indicator is set to zero in the first six months (inclusive of the adoption month) following the most recent adoption, in any month after the first 24 months (inclusive of the adoption month) following the recent adoption, and in any month for which there is no preceding adoption. Error bars represent 95 percent confidence intervals based on asymptotic standard errors clustered by household.

Online Appendix Figure 12: Dynamics of TFP kilocalorie shares over the six-month SNAP clock

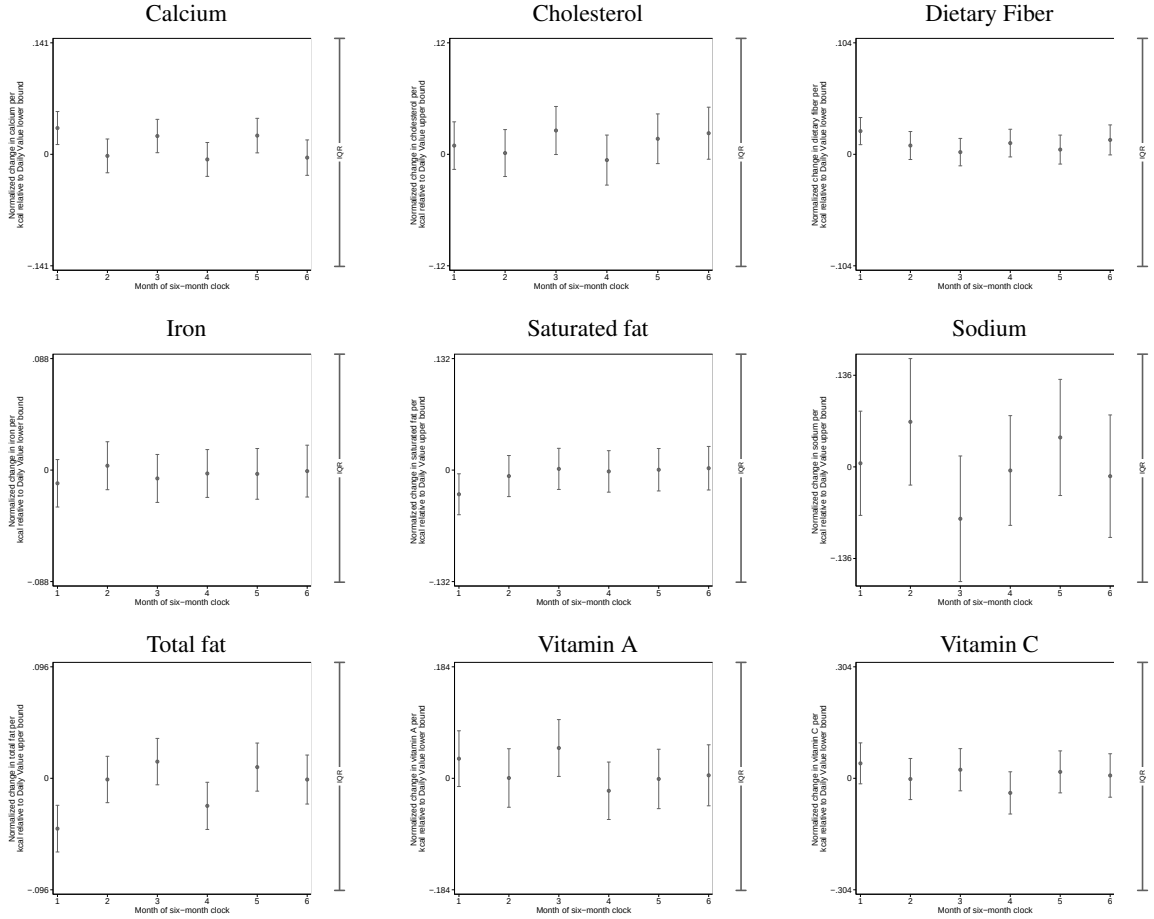


Online Appendix Figure 12: Dynamics of TFP kilocalorie shares over the six-month SNAP clock (continued)



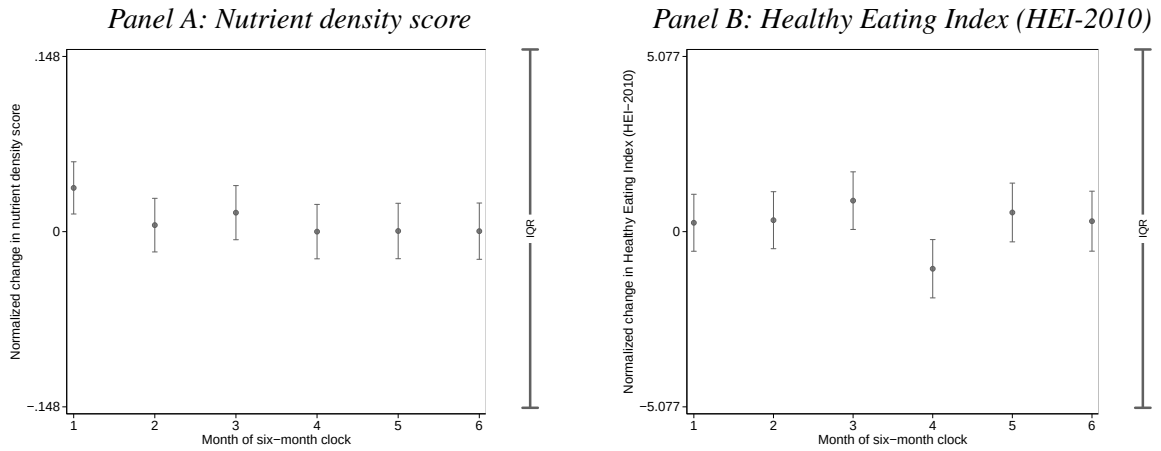
Notes: Each figure plots coefficients from a regression of a normalized measure of food healthfulness on a vector of indicators for the position of the current month in a monthly clock that begins in the most recent adoption month and resets every six months or at the next SNAP adoption, whichever comes first. So, for example, the first month of the clock corresponds to months 7, 13, 19, etc. following SNAP adoption. The sample is the set of SNAP adopters. The unit of observation for each regression is the household-month. Each regression includes calendar month fixed effects. The omitted category consists of the first six months (inclusive of the adoption month) after the household's most recent SNAP adoption, all months after the first 24 months (inclusive of the adoption month) following the household's most recent adoption, and all months for which there is no preceding adoption. Error bars represent 95 percent confidence intervals based on asymptotic standard errors clustered by household. For each outcome, we first divide the change in the outcome by the absolute value of the coefficient on clock month 1 in the regression from panel A of figure 5. We then use this normalized change as the dependent variable. Each outcome is the share of kilocalories from a given product category underlying the Thrifty Food Plan, as described in section 2.4.1. In all plots, the range of the y-axis is the interquartile range of the average of the outcome across all retailer households.

Online Appendix Figure 13: Dynamics of nutrient density indexes over the six-month SNAP clock



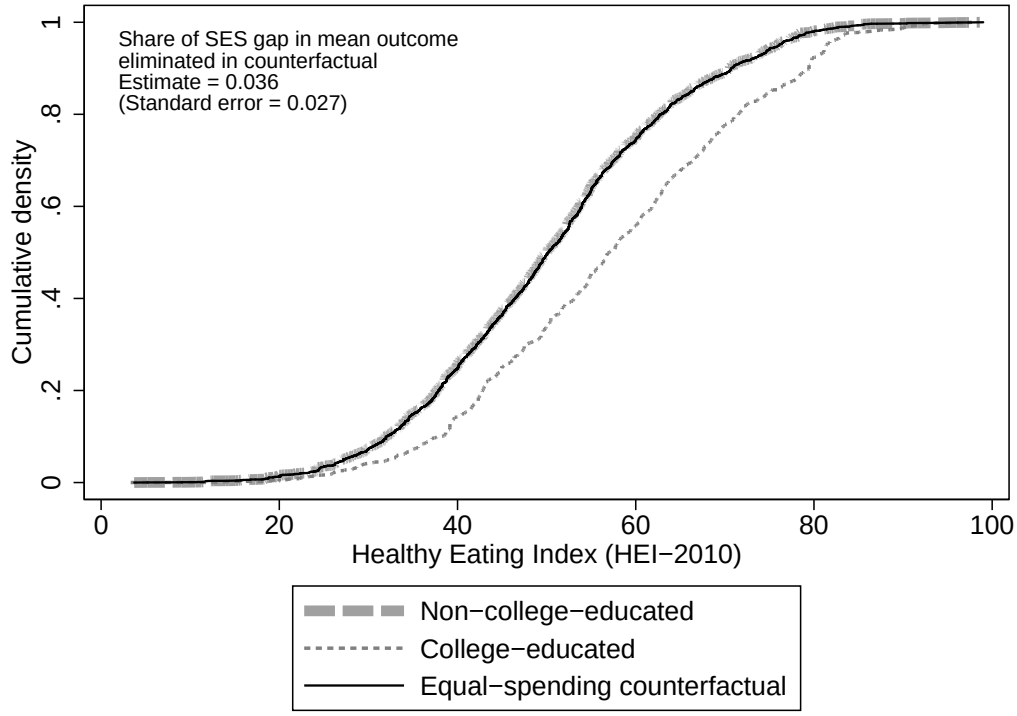
Notes: Each figure plots coefficients from a regression of a normalized measure of food healthfulness on a vector of indicators for the position of the current month in a monthly clock that begins in the most recent adoption month and resets every six months or at the next SNAP adoption, whichever comes first. So, for example, the first month of the clock corresponds to months 7, 13, 19, etc. following SNAP adoption. The sample is the set of SNAP adopters. The unit of observation for each regression is the household-month. Each regression includes calendar month fixed effects. The omitted category consists of the first six months (inclusive of the adoption month) after the household's most recent SNAP adoption, all months after the first 24 months (inclusive of the adoption month) following the household's most recent adoption, and all months for which there is no preceding adoption. Error bars represent 95 percent confidence intervals based on asymptotic standard errors clustered by household. For each outcome, we first divide the change in the outcome by the absolute value of the coefficient on clock month 1 in the regression from panel A of figure 5. We then use this normalized change as the dependent variable. Each outcome is a nutrient density index defined as the amount of a given nutrient purchased per kilocalorie divided by the corresponding nutrient density implied by the Food and Drug Administration (FDA) Daily Value (DV) bounds, as described in section 2.4.2. In all plots, the range of the y-axis is the interquartile range of the average of the outcome across all retailer households.

Online Appendix Figure 14: Dynamics of summary measures of food healthfulness over the six-month SNAP clock



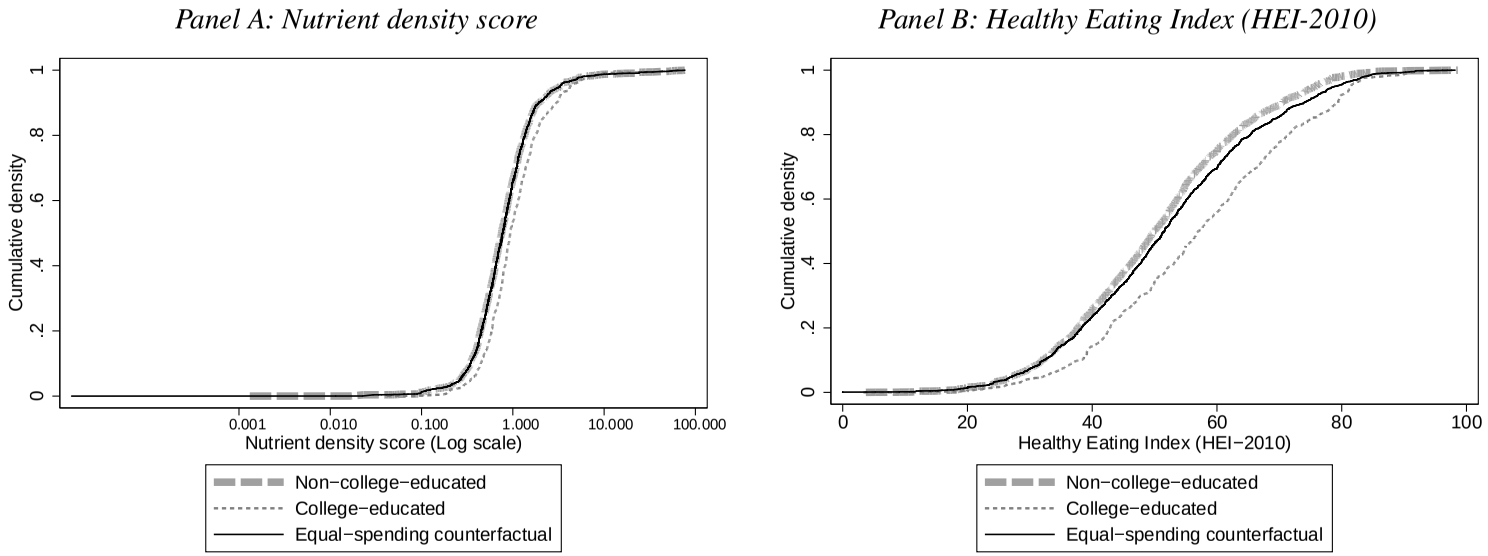
Notes: Each figure plots coefficients from a regression of a normalized measure of food healthfulness on a vector of indicators for the position of the current month in a monthly clock that begins in the most recent adoption month and resets every six months or at the next SNAP adoption, whichever comes first. So, for example, the first month of the clock corresponds to months 7, 13, 19, etc. following SNAP adoption. The sample is the set of SNAP adopters. The unit of observation for each regression is the household-month. Each regression includes calendar month fixed effects. The omitted category consists of the first six months (inclusive of the adoption month) after the household's most recent SNAP adoption, all months after the first 24 months (inclusive of the adoption month) following the household's most recent adoption, and all months for which there is no preceding adoption. Error bars represent 95 percent confidence intervals based on asymptotic standard errors clustered by household. For each outcome, we first divide the change in the outcome by the absolute value of the coefficient on clock month 1 in the regression from panel A of figure 5. We then use this normalized change as the dependent variable. In panel A, the outcome is the nutrient density score (NDS), described in section 2.4.2. In panel B, the outcome is the Healthy Eating Index (HEI-2010), described in section 2.4.3. In both panels, the range of the y-axis is the interquartile range of the average of the outcome across all retailer households.

Online Appendix Figure 15: Role of food-at-home spending in socioeconomic disparities in the Healthy Eating Index (HEI-2010)



Notes: The figure plots cumulative distribution functions of the Healthy Eating Index (HEI-2010), described in section 2.4.3, over a subset of households surveyed in the FoodAPS data, described in section 2.5. The HEI-2010 is calculated from all food-at-home acquisitions during the survey week. Each FoodAPS household is weighted according to the FoodAPS household weights such that the overall sample is nationally representative. For the line labeled "Non-college-educated," the sample is the set of FoodAPS households whose main food shopper or meal planner does not report having a bachelor's degree or higher. For the line labeled "College-educated," the sample is the set of FoodAPS households whose main food shopper or meal planner reports having a bachelor's degree or higher. For the line labeled "Equal-spending counterfactual," the sample is the set of FoodAPS households whose main food shopper or meal planner does not report having a bachelor's degree or higher. The "Equal-spending counterfactual" series is constructed as follows. First, among non-college-educated and college-educated households, we compute percentiles of each household by total food spending. Second, we assign to each non-college educated household the food spending of the college-educated household at the closest percentile, breaking ties at random. We then use the estimates of the effect of food spending on the HEI-2010 from panel A of column (5) of appendix table 1 to compute counterfactual food healthfulness at the given counterfactual level of food spending. The "Share of SES gap in mean outcome eliminated in counterfactual" is the share of the difference in average HEI-2010 across college-educated and non-college-educated households that would be eliminated if college-educated and non-college-educated households had the same average food spending. The share is estimated as the effect of food spending on the HEI-2010 (from panel A of column (5) of appendix table 1) times the difference in average food spending between college-educated and non-college-educated households divided by the difference in the average HEI-2010 between college-educated and non-college-educated households. The standard error associated with the estimated share is calculated via the delta method under the assumption that the estimate of the effect of food spending on the HEI-2010 is statistically independent from the estimated sample means.

Online Appendix Figure 16: Role of food-at-home spending in socioeconomic disparities in summary measures of food healthfulness, allowing for heterogeneity in the effect of food-at-home spending



Notes: The figures plot cumulative distribution functions of a measure of food healthfulness over a subset of households surveyed in the FoodAPS data, described in section 2.5. The measure of food healthfulness is calculated from all food-at-home (FAH) acquisitions during the survey week. Each FoodAPS household is weighted according to the FoodAPS household weights such that the overall sample is nationally representative. For the line labeled "Non-college-educated," the sample is the set of FoodAPS households whose main food shopper or meal planner does not report having a bachelor's degree or higher. For the line labeled "College-educated," the sample is the set of FoodAPS households whose main food shopper or meal planner reports having a bachelor's degree or higher. For the line labeled "Equal-spending counterfactual," the sample is the set of FoodAPS households whose main food shopper or meal planner does not report having a bachelor's degree or higher. The "Equal-spending counterfactual" series is constructed as follows. First, among non-college-educated and college-educated households, we compute percentiles of each household by total FAH spending. Second, we assign to each non-college-educated household the FAH spending of the college-educated household at the closest percentile, breaking ties at random. We then estimate the effect of FAH spending on diet healthfulness separately by quintile of food spending at the retailer in the six months prior to SNAP adoption. We then assign these estimates to non-college-educated households in the corresponding quintile of the FAH spending distribution and use them to compute counterfactual food healthfulness at the given counterfactual level of FAH spending. In panel A, the measure of food healthfulness is the nutrient density score, described in section 2.4.2. The nutrient density score is shown on a log scale. In panel B, the measure of food healthfulness is the Healthy Eating Index (HEI-2010), described in section 2.4.3.

Online Appendix Table 1: Effect of SNAP and in-state earnings on food healthfulness, program adoption research design

	(I) Nutrient density score	(II) Healthy Eating Index (HEI-2010)
Effect of SNAP use	-0.0091	0.1734
	(0.0039)	(0.1400)
Effect of in-state earnings (in hundreds of dollars)	0.0036	0.2755
	(0.0025)	(0.0885)
Simulated size distortion cutoff (percent)	1.0	1.0
Number of household-quarters	611297	611363
Number of households	24456	24456
Ratio of the effect of in-state earnings (in hundreds of dollars) to the effect of SNAP use	-0.4011	1.5893
	(0.4429)	(0.8048)

Notes: The sample is the set of SNAP adopters. The unit of observation is the household-quarter. For each outcome, the effect of SNAP use and of in-state earnings is estimated in two samples using the TS2SLS estimator defined in Inoue and Solon (2010) in a model that includes calendar quarter fixed effects. The endogenous variables are change in an indicator for whether the current quarter is a SNAP quarter and change in average monthly in-state earnings (in hundreds of dollars). The excluded instruments are an indicator for whether the current quarter is a SNAP adoption quarter and its first lead. The first stage for the change in in-state earnings is estimated on the sample of SNAP adopters in the Rhode Island administrative data described in section 2.7. The first stage for the change in an indicator for whether the current quarter is a SNAP quarter and the second stage are estimated in the retail panel. Standard errors are calculated as outlined in appendix B. Standard errors on the ratio of the effect of in-state earnings (in hundreds of dollars) to the effect of SNAP use are calculated via the delta method. The "simulated size distortion cutoff (percent)" row presents estimates of the size distortion cutoff underlying the two-step, identification-robust confidence sets proposed by Andrews (2018). The estimated size distortion cutoff is a measure of identification strength, indicating the size distortion one must tolerate to conduct inference based on conventional confidence intervals. The size distortion cutoff is estimated using a simulated measure of the change in in-state earnings, a 100 point grid, and a minimum size distortion cutoff of 1 percent, following the implementation in Sun (2018). The simulated measure of the change in in-state earnings is constructed as the sum of the predicted change in in-state earnings (from the fist stage regression) and the change in a Gaussian AR(1) random variable drawn independently of the predicted change. We choose the parameters of the Gaussian AR(1) to minimize the Euclidean distance between the variance-covariance matrix of the first stage coefficients on the excluded instruments estimated using the simulated change in in-state earnings and the analogous variance-covariance matrix estimated using the actual change in in-state earnings. In column (I), the outcome is the nutrient density score, described in section 2.4.2. Missing values arise from the trimming of extreme values as described in section 2.4.2. In column (II), the outcome is the Healthy Eating Index (HEI-2010), described in section 2.4.3.

Online Appendix Table 2: Effect of SNAP on food healthfulness, program exit research design

	(I) Nutrient density score	(II) Healthy Eating Index (HEI-2010)
Effect of SNAP use	-0.0396	-0.2320
	(0.0129)	(0.4814)
Size distortion cutoff (percent)	1.0	1.0
Number of household-quarters	2002182	2003811
Number of households	24456	24456

Notes: The sample is the set of SNAP adopters. The unit of observation is the household-month. For each outcome, the effect of SNAP use is estimated via a 2SLS regression of the change in the outcome on the change in an indicator for whether the current month is a SNAP month, with an indicator equal to one in the first month of a six-month SNAP clock that begins in the most recent adoption month as the excluded instrument. The indicator is set to zero in the first six months (inclusive of the adoption month) following the most recent adoption, in any month after the first 24 months (inclusive of the adoption month) following the most recent adoption, and in any month for which there is no preceding adoption. So, the first month of the clock corresponds to months 7, 13, 19, etc. following SNAP adoption. Each regression includes calendar month fixed effects. Standard errors reported in parentheses are clustered by household. The "size distortion cutoff (percent)" row presents estimates of the size distortion cutoff underlying the two-step, identification-robust confidence sets proposed by Andrews (2018). The estimated size distortion cutoff is a measure of identification strength, indicating the size distortion one must tolerate to conduct inference based on conventional confidence intervals. The size distortion cutoff is estimated using a 100 point grid and a minimum size distortion cutoff of 1 percent, following the implementation in Sun (2018). In column (I), the outcome is the nutrient density score, described in section 2.4.2. Missing values arise from the trimming of extreme values as described in section 2.4.2. In column (II), the outcome is the Healthy Eating Index (HEI-2010), described in section 2.4.3.

Online Appendix Table 3: Overidentification tests for the effect of food-at-home spending on food healthfulness, program adoption research design

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Outcome: Nutrient density score				Outcome: Healthy Eating Index (HEI-2010)			
	Panel A: Program adoption research design, baseline model							
Effect of $100 increase in FAH spending	-0.0167	-0.0137	-0.0140	-0.0165	0.3198	0.2623	0.2674	0.3160
	(0.0072)	(0.0059)	(0.0060)	(0.0071)	(0.2584)	(0.2119)	(0.2160)	(0.2554)
Number of household-quarters	611297	611297	611297	611297	611363	611363	611363	611363
Number of households	24456	24456	24456	24456	24456	24456	24456	24456
	Panel B: Program adoption research design, restricted model							
Effect of $100 increase in FAH spending	-0.0213	-0.0175	-0.0178	-0.0203	-0.3098	-0.2540	-0.2582	-0.2962
	(0.0017)	(0.0014)	(0.0015)	(0.0017)	(0.0617)	(0.0506)	(0.0514)	(0.0585)
Number of household-quarters	611297	611297	611297	611297	611363	611363	611363	611363
Number of households	24456	24456	24456	24456	24456	24456	24456	24456
$p-$value for overidentification test	0.468	0.468	0.476	0.550	0.006	0.006	0.006	0.007
Assumed retailer share of FAH spending when household is:								
Not on SNAP	1.000	0.820	0.818	0.800	1.000	0.820	0.818	0.800
On SNAP	1.000	0.820	0.820	0.820	1.000	0.820	0.820	0.820
Basis for assumed effect of SNAP on retailer share of FAH spending	No effect	No effect	Homescan lower bound	Homescan upper bound	No effect	No effect	Homescan lower bound	Homescan upper bound

Notes: The sample is the set of SNAP adopters. The unit of observation is the household-quarter. Each column within panels A and B reports coefficient estimates from an instrumental variables regression, with standard errors in parentheses clustered by household. All models are estimated in first differences and include calendar quarter fixed effects. In panel A, the model is estimated in two samples using the TS2SLS estimator defined in Inoue and Solon (2010). Standard errors are calculated as outlined in appendix B. In each column, the endogenous variables are food-at-home (FAH) spending (in hundreds of dollars), computed by dividing food spending at the retailer by the "On SNAP" share in SNAP months and the "Not on SNAP" share in non-SNAP months, and average monthly in-state earnings. The excluded instruments are the number of SNAP adoptions the household has experienced as of the given calendar quarter and its first lead. The first stage for in-state earnings is estimated on the sample of SNAP adopters in the Rhode Island administrative data described in section 2.7. The first stage for FAH spending and the second stage are estimated in the retail panel. In panel B, the model is estimated in the retail panel. In each column, the endogenous variable is FAH spending (in hundreds of dollars), computed by dividing food spending at the retailer by the "On SNAP" share in SNAP months and the "Not on SNAP" share in non-SNAP months. The excluded instruments are the number of SNAP adoptions the household has experienced as of the given calendar quarter and its first lead. The row "$p-$value for overidentification test" presents the $p-$value from Hansen's overidentification test (Hansen 1982). In columns (1) to (4), the dependent variable is the nutrient density score, described in section 2.4.2. Missing values arise from the trimming of extreme values as described in section 2.4.2. In columns (5) to (8), the dependent variable is the Healthy Eating Index (HEI-2010), described in section 2.4.3. In columns (1) and (5), we assume that all households devote all food spending to the retailer in all months. In columns (2) and (6), we assume that all households devote a constant share of food spending to the retailer, with the share given by the ratio of average SNAP benefits between retailer and SNAP Quality Control Data, as estimated in online appendix table 7 of Hastings and Shapiro (2018). In columns (3) and (7), we assume that the share of spending in SNAP months is the same as in columns (2) and (5), and that the difference in the share of spending between SNAP months and non-SNAP months is equal to the lower bound of the 95 percent confidence interval of the effect of SNAP participation on the share of spending devoted to the primary retailer reported in column (2) of appendix table 1 in Hastings and Shapiro (2018). In columns (4) and (8), we assume that the share of spending in SNAP months is the same as in columns (2) and (5), and that the difference in the share of spending between SNAP months and non-SNAP months is equal to the upper bound of the 95 percent confidence interval of the effect of SNAP participation on the share of spending devoted to the primary retailer reported in column (2) of appendix table 1 in Hastings and Shapiro (2018).

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