The Habit-Forming Effect of Subsidies: Evidence from WIC [*]

David Frisvold[†]
Emily Leslie[‡]
Joseph Price[§]

We examine whether programs that provide vouchers to households can continue to influence behavior even after the household leaves the program. Using detailed scanner data, we test whether benefit vouchers received through the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) change household purchasing decisions and whether these changes continue to persist even after households are no longer eligible to participate in the program. In 2009, the package of goods available through WIC vouchers changed to include additional items and place nutritional restrictions on other items. Examining variation due to this package change, we show that the WIC vouchers change purchasing decisions consistent with the nutritional guidelines of the program. However, we find that households exposed longer to the revised package are generally not more likely to continue to purchase these items after eligibility ends.

JEL Codes: I38, I18, J13

---

[*] The authors are grateful for research assistance provided by Michael Gmeiner, Chelsea Hunter, Nathalia Myrrha, Adam Shumway, and Jacob Walley. The authors thank Laura Argys, Kevin Gee, Adriana Lleras-Muney, David Johnson, Daniel Tannenbaum, Nathan Tefft, seminar participants at Georgia State University, UC Davis, UC Merced, and University of Illinois, and participants at the American Society of Health Economists, Association for Public Policy Analysis and Management, Southern Economic Association, Western Social Science Association, and Western Economic Association conferences for helpful comments. Funding for this project was made possible in part by grant number 1H79AE000100-1 to the UC Davis Center for Poverty Research from the U.S. Department of Health and Human Services, Office of the Assistant Secretary for Planning and Analysis (ASPE), which was awarded by the Substance Abuse and Mental Health Services Administration (SAMHSA). The views expressed are those of the authors and do not necessarily reflect the official policies of the Department of Health and Human Services. This paper uses data from The Nielsen Company (US), LLC and marketing databases provided by the Kilts Center for Marketing Data Center at The University of Chicago Booth School of Business. Information on availability and access to the data is available at http://research.chicagobooth.edu/nielsen.
[†] Department of Economics, University of Iowa and NBER, (319) 335-0957, david-frisvold@uiowa.edu
[‡] Department of Economics, University of Iowa, emily-leslie@uiowa.edu
[§] Department of Economics, Brigham Young University and NBER, joseph_price@byu.edu

Public assistance to poor households through cash transfers allows recipients to select their own utility maximizing bundles without excessive constraints and provides relatively low administrative costs. However, the welfare system in the United States includes a broad set of vouchers that can only be used for specific goods and services. Vouchers that apply to a broad class of items, such as through the Supplemental Nutrition Assistance Program (SNAP), are effectively equivalent to a cash transfer for most households (Hoynes and Schanzenbach, 2009). In contrast, the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) provides recipients a set of vouchers for specific food items. In this paper, we examine whether programs that provide highly targeted vouchers for a sustained period continue to influence behavior after the program ends.

The process of consumption patterns in one period positively influencing consumption patterns in future periods is a form of habit formation (Rabin 2013). Habit formation can occur through at least two mechanisms, both of which are possible with WIC vouchers. First, 'classic' habit formation occurs when individuals become used to eating particular foods, and this becomes an automatic pattern of behavior. Second, consuming certain foods may influence an individual's food preferences through repeated exposure (Birch & Marlin 1982).

Several recent studies provide evidence that short-run programs that influence food choices in schools can continue to affect behavior once the program ends through habit formation (Belot, James, and Nolen 2013; List and Samek 2014; Loewenstein, Price, and Volpp 2014).[1] Our paper extends this work in several ways. First, we analyze the effects of several years of exposure to incentives, while previous studies measure effects for programs that last

[1] Another branch of the literature studies persistence in response to exercise programs, finding evidence that short-term financial incentives continue to influence behavior for several weeks after incentives are removed (Charness and Gneezy, 2009; Royer, Stehr, and Sydnor, 2015).

only a few weeks. Second, we test for habit formation throughout a longer follow-up period than most existing studies. Third, we test for habit formation in a context where parents are the decision makers, rather than children. Finally, we examine habit formation as a result of a national public program, in contrast to a local field experiment. Thus, we also contribute to the literature on food assistance programs and antipoverty programs more generally by examining whether targeted public vouchers continue to influence behavior after eligibility ends.

To test for habit formation through WIC vouchers, we use detailed scanner data from the Nielsen Consumer Panel. These data allow us to examine changes in household purchases of WIC-eligible and WIC-ineligible products that occur during program participation and whether these changes persist after children in the household age out of eligibility. To identify the effects of WIC vouchers, we take advantage of the changes in the specific items covered by WIC that occurred in 2009, particularly the introduction of whole grains and produce to the package of goods offered to children. We begin by verifying that the package revision affected what households purchased while the youngest member of the household was eligible for WIC. We find that income-eligible households with at least one age-eligible child increase purchases of whole grain products by 15 percent after the WIC package change. We also find that the package change does not significantly influence produce purchases, which is perhaps due to the size of the voucher relative to the amount of produce that WIC-eligible households were purchasing prior to the package change. Increasing the confidence that the results are due to the WIC package change, we do not find corresponding changes in whole grains or produce purchases at the time of the package change among households in which the youngest child is older than the age threshold for WIC eligibility.

Next, we examine whether aging out of WIC eligibility influences household purchases. We find that income-eligible households decrease whole grain purchases after the youngest member of the household turns 5 years old and is no longer eligible to receive WIC. Within six months of aging out of the household, the magnitude of the decrease in whole grain purchases is similar to the magnitude of the increase in whole grain purchases from the introduction of whole grain products to the WIC package.

The sharp change in the WIC package means that some households aged out of WIC eligibility just before the package change while other households were exposed to the new WIC items for varying amounts of time. We use the variation in the length of program eligibility after the package changes to determine the persistent impact of the vouchers on household purchases. We do not find that households exposed to whole grain and produce vouchers for longer are more likely to purchase these products after the youngest member of the household ages out of eligibility.

Overall, the results indicate that the WIC package revision increased purchases of whole grain products. However, we do not find consistent evidence that these changes in purchases of WIC items continue for the long-term after households are no longer eligible for WIC.

I. Background

The objective of WIC is to supplement nutrient intake for pregnant and postpartum women and young children. WIC is a federal program that was permanently authorized in 1974 and operates through state and local agencies. In 2014, 8.3 million people received WIC benefits every month; more than half of the recipients were children aged two to four years (USDA, 2015a). The total costs of the program were $6.3 billion and the average monthly benefit per

participant was $43.64 in 2014 (USDA, 2015b). Eligibility for WIC is determined at the individual level, primarily based on age and household income. Women may be eligible if they are pregnant, up to six months postpartum, or 7 to 12 months postpartum and breastfeeding. Children may be eligible up to their fifth birthday. Individuals are eligible if their household income is below 185% of the poverty line, or if they are participating in the federal aid programs Temporary Assistance to Needy Families (TANF), the Supplemental Nutrition Assistance Program (SNAP), or Medicaid.[2] Since we are using data on household food purchases, we refer to households as WIC eligible if they contain at least one eligible member.

The package of foods subsidized for WIC participants can differ for women who are pregnant, postpartum, and breastfeeding, infants who are younger than 12 months, and children who are younger than 60 months. These packages remained largely unchanged between 1972 and 2009. The review of the WIC package began in 2003, and the packages were revised in 2007 to be consistent with the Dietary Guidelines for Americans. All states were required to implement the revised packages by October 1, 2009. Most states implemented these revisions on October 1. A few states implemented the revisions earlier in the summer, and New York and Delaware implemented the revisions in January.[3] Table 1 provides a comparison of the original and revised food packages for children. The revisions included the addition of whole-grain products and produce to the package. The types of milk included in the package changed to require low- or non-fat for children two and older, and the quantity was reduced. Similarly, for

[2] Children must also be deemed at nutritional risk to be eligible. WIC's definition of nutritional risk includes conditions such as being overweight, underweight, or anemic. It can also include the characteristics of the mother including age, inadequate diet, and past pregnancy complications. Bitler et al. (2003) find that, in practice, the nutritional risk criteria does not prevent otherwise eligible individuals from receiving WIC benefits.

[3] The implementation dates for states that introduced the revised WIC packages before October 1, 2009 are: January 2, 2009 for Delaware and New York; May 1 for Kentucky; June 1 for Colorado; July 1 for Utah; August 1 for Kansas, Michigan, Minnesota, Oklahoma, Oregon, and Wisconsin; August 3 for Illinois; September 1 for South Dakota; and September 28 for Alabama, Arkansas, and Indiana.

cheese, which is a dairy substitute for milk, the types allowed changed and the quantity was reduced. The types of cereal changed to emphasize products with whole grains, while the quantity included remained the same. The quantities of juice and eggs included in the package were reduced. Our analysis focuses on the specific products and quantities that are included in the WIC packages and the changes in the included products that occurred in 2009. We focus primarily on whole grains and produce, because these products were new to the WIC package in 2009, but show the results for all products in the appendix.

A number of papers have examined the influence of the 2009 WIC food package revisions on the availability of specific food items in stores, prices, purchases, and consumption. These studies compare characteristics of the supply side (availability and prices) before and after the package change or the behavior of WIC participants (purchases and consumption) before and after the package change. The results from these studies consistently show that the availability of healthier foods included in the WIC package increased in stores (e.g., Andreyeva et al., 2012; Zenk et al., 2012) with some evidence that the prices of these foods did not rise or decreased (e.g., Zenk et al., 2014). Further, these studies consistently find that the WIC package revision increased purchases and consumption of the foods included in the new package, resulting in an overall improvement in diet (e.g., Whaley et al., 2012; Andreyeva and Luedicke, 2013; Andreyeva et al., 2013).

Our paper makes two significant contributions to the literature on the influence of WIC participation on food purchases. First, we use a more credible research design to determine the impact of the WIC program by comparing purchasing patterns before and after the WIC package change in 2009 for eligible and non-eligible households and also exploiting variation in the age of the youngest child across households to incorporate the age eligibility requirements for WIC

participation. Second, we examine whether exposure to specific WIC-eligible items has a persistent influence on what WIC participants purchase even when they are no longer eligible for WIC. This contributes to the literature on habit formation by examining a targeted voucher that changes what individuals purchase for several years using data that allows us to continue to follow the purchasing patterns of the household months after leaving the program.

II. Data

The analysis in this paper is based on Nielsen Homescan Consumer Panel data for the years 2004 through 2014, which include detailed data on food items purchased for about 40,000 or more households each year. Participants in the panel are given a special scanner that they use to scan in all items purchased at any grocery store along with all of the information recorded on the store receipt. The scanner records the UPC code for each item. At the end of each week, the household transmits their data to Nielsen and receives points, which can be exchanged for merchandise in a way similar to using a credit card. This system creates a strong incentive for households to upload their purchase data each week (Harding, Leibtag, and Lovenheim, 2012).

Since data are recorded at the UPC level, they include sufficient product characteristics to determine the type of item being purchased and the exact amount purchased. We use these detailed data to look at specific items that are included as part of the WIC bundle, along with their quantities. We primarily examine whole grains (whole-wheat bread and bread substitutes) and produce (fruits and vegetables), which are the products most affected by the package revisions. In the appendix, we also examine milk, breakfast cereals, cheese, eggs, and fruit juice. Further, we show the results for fish in the appendix as a falsification exercise. Fish is included in the WIC package for fully breastfeeding women, but not for children. All products are

measured in ounces per month. In the appendix, we also report results for produce in dollars spent since, after the package change, WIC provides a voucher for $6 of produce, instead of a quantity voucher.[4]

The Nielsen data also provide socio-economic characteristics of the household, including household income, age of family members, household size, education levels, and other demographic characteristics. Two of the most important characteristics that determine whether a household member is eligible for WIC are household income and the age of the household's youngest child. Eligible households are likely to have income less than 185% of the federal poverty guidelines.[5] Until 2011, the Nielsen data reported total household income in the full calendar year that is two years prior to the data on purchases. In the fall preceding the panel year, households were asked to report their total annual income for the previous year. In 2011, Nielsen changed the question about income to ask households to report their estimated annual income at the time of the survey. Since Nielsen believed that households were reporting their current estimated annual income instead of referring to the prior year's tax returns, this change should have increased the consistency of the reporting period of income (Kilts Center for Marketing, 2014). Household income is measured as a categorical variable that has rather

[4] Our food measures include all products in each category and not just the specific brands or sizes that are included in vouchers for each state. Whole grain products include whole-wheat and whole-grain bread, buns, rolls, and noodles; corn and wheat tortillas; brown rice; bulgur; oats and oatmeal; and barley. Produce includes all canned, frozen, and fresh fruits and vegetables and dried fruits. Low-fat milk includes skim and up to 2 percent non-sweetened milk. Whole milk includes non-sweetened whole and evaporated milk. Cereal includes hot and cold cereals with separate categories for whole grain cereals and sugar cereals. Cheese includes all imported and domestic cheeses and string cheeses, but not spreads, cream cheese, or cheese dips. All eggs are included. Juice includes fresh and frozen juice and juice drinks of any size.

[5] States have the flexibility to set the income eligibility threshold between 100 and 185 percent of the federal poverty guidelines, but all states use the maximum amount of 185 percent. Also, pregnant and post-partum women, infants, and children under 60 months are categorically eligible if they also participate in SNAP, Medicaid, or TANF. However, only about two percent of WIC participants report household income above 185 percent (GAO, 2013).

narrow bands at the lower income levels.[6] Using the minimum of these income bands and the number of household members, we are able to approximate where a household stands in relation to the poverty guidelines. In the sample of households with reported income, about 20% of the households fall below 185% of the federal poverty guidelines in any given year.

Households are only eligible for WIC if they have a child under the age of five (or if the mother is pregnant). We use the birth month and year of household members to determine age eligibility for WIC. There is no information about whether women in the household are pregnant. As a result, we use information from subsequent years of the household to infer the timing of pregnancy.[7]

Beginning in 2006, the Nielsen data include variables describing whether the household is currently receiving and has ever received WIC. Kreider, Pepper, and Roy (2012) and Bitler, Currie, and Scholz (2003) document that WIC participation is generally underreported in survey data. The low levels of self-reported WIC participation in the Nielsen data are consistent with rampant underreporting. For example, WIC serves over half of all infants born in the United States (citation), but less than 10% of Nielsen households with infants report receiving WIC. Because missing responses are indistinguishable from negative responses for WIC participation in the Nielsen data, self-reported participation is likely to be even less reliable than in other surveys. Due to the low quality of the self-reported WIC information, we focus on eligibility rather than participation.

---

[6] The first few income categories are: under $5,000, 5,000-7,999, 8,000-9,999, 10,000-11,999, and 12,000-14,999. The income categories are $5,000 apart from $20,000 through $50,000 and then $10,000 apart through $70,000.

[7] Some households with infants born in their final year in the panel may be incorrectly marked as ineligible for WIC when they are eligible. However, this will just bias against finding an impact of being on WIC during the WIC-period but not influence our estimates of how long the family is on WIC when we examine post-WIC behavior.

We treat a household as WIC eligible if household income is below 185% of the federal poverty guidelines and the youngest member of the household is less than 60 months old. Our analysis sample excludes households with income above 400 percent of the federal poverty guidelines in all waves of the panel and households that did not have a child under 60 months of age for at least one month of the panel. These restrictions yield 9,784 households with an average duration in the panel of 46.5 months for a total of 455,772 household-months in our analysis sample.

Table 2 provides descriptive statistics for all households, WIC-eligible households, and WIC-ineligible households. There are 93,713 observations in which the household is eligible for WIC, based on the age of the youngest member of the household being less than 60 months of age and income being less than or equal to 185 percent of the poverty guidelines. Average household income is $30,130 and the average household size is 4.89 persons. There are 372,422 household-month observations of households with income greater than 185 percent of the poverty guidelines or without an age-eligible child, which are ineligible for WIC during that month. Since the analysis sample is restricted to households with at least one age-eligible child for at least one month, these observations include households who formerly received WIC benefits. For these observations, average household income is $64,960 and the average household size is 3.89 persons.

WIC-eligible households purchase similar quantities of whole grains as WIC-ineligible households. The revised WIC package includes vouchers for 32 ounces of whole grains per eligible child. Although not shown in the table, prior to the package revision, WIC-eligible households purchased 23.5 ounces per month (with a standard deviation of 48.6). After the

revision, WIC-eligible households purchased 30.0 ounces per month (with a standard deviation of 54.4).

Although they spend $19.83 per month on average on produce, which is slightly less than ineligible households, WIC-eligible households purchase 190.1 ounces of produce per month compared to 181 ounces for ineligible households. The produce voucher in the revised WIC package is $6 per month per eligible child, which is significantly less than the average WIC-eligible household spends on produce. The average monthly expenditures for WIC-eligible households was $16.86 (with a standard deviation of $16.65) before the package change and is $23.92 (with a standard deviation of $24.49) after the package change. The produce voucher targets expenditure amounts, not quantities, and expenditures on produce were higher after the package change. In contrast, the average ounces purchased by WIC-eligible households fell from 193.5 to 189.0 ounces per month.

WIC-eligible households purchase approximately similar quantities of low-fat milk, cereal, cheese, eggs, and juice as WIC-ineligible households and purchase higher quantities of whole milk. Average food expenditures are $321.41 per month for WIC-eligible households, which includes purchases using WIC voucher, and are $313.07 per month for WIC-ineligible households.

III. Analysis

The objective of our analysis is to estimate the extent to which WIC affects household purchasing patterns and whether this change persists even after eligibility ends. Comparisons of the purchasing behavior of households with and without individuals eligible for WIC are unlikely to yield consistent estimates, since the unobserved characteristics that are related to

participation are also likely to affect purchasing decisions. Thus, our analysis consists of a series of difference-in-differences regressions that make use of the 2009 package revision and the age-eligibility criteria.

First, we estimate whether changes in the items included in the WIC packages in 2009 affected purchasing patterns for WIC-eligible households. Second, we examine changes in purchasing patterns before and after the package change when households lose eligibility because the youngest member of the household turns 5 years old. Third, we estimate whether the amount of time that WIC-eligible households are exposed to the specific items in the new package vouchers affects their purchases of these items after these households are no longer eligible for WIC, based on the age of the youngest child.

A. Changes Due to the Revision of the WIC Packages

We begin by estimating changes in household purchasing patterns that occurred in 2009 when the items included in the WIC package changed, using the implementation date for the state where the household was living. We compare the changes in the amount purchased of specific product categories before and after the package changes for WIC-eligible households to changes that occurred in households that were ineligible for WIC. Specifically, we estimate the following difference-in-differences specification:

$$Y_{ht} = \beta_0 + \beta_1 Inc_{ht} + \beta_2 After_t + \beta_3 Inc_{ht} \cdot After_t + \gamma X_{ht} + \rho_h + \delta_t + \varepsilon_{ht}, \qquad (1)$$

where Y_{ht} denotes the amount purchased of a specific product for household *h* in month *t*, between January 2004 and December 2013. *Inc* denotes whether the household is income-

eligible for WIC. We initially restrict the sample to households with at least one age-eligible child. As a result, *Inc* is equivalent to WIC eligibility. *After* is a dummy variable for whether the purchase occurs after the package change based on the date of the package changes in the state of residence of the household. ρ represents household fixed effects. δ represents time (month and year) fixed effects, which control for any annual trends in purchasing patterns, seasonality of purchasing patterns within the year, and any changes in the reporting patterns of household purchases in the survey. X is a vector of household characteristics including age of the youngest person in the household, income, household size, race/ethnicity, marital status, and educational attainment. β and γ represent parameters to be estimated. β_3 is the parameter of interest; it measures the change in purchases after the package revision for WIC-eligible households compared to income-ineligible households with an age-eligible child.

Table 3 displays the estimates of equation (1) for whole grains and produce purchases, which are the two categories added under the new guidelines.[8] The top panel displays results for households with at least one age-eligible child who is at least 12 months old, which includes 9,342 households and 180,796 household-month observations.[9] We find that, after the package change, WIC-eligible households increased purchases of whole-wheat products by 3.5 ounces, which is a 14.8% increase relative to the mean of 23.5 ounces of income-eligible households prior to the package change. This suggests that the addition of the whole-grain category to the

[8] The results for additional outcomes are shown in Appendix Table A1. The package revision did not change the maximum allowances or product types for these products as significantly as the products featured in Table 3. The estimates are mostly small and statistically insignificant for WIC-eligible households, with the exception of juice, which increased by 11.8 ounces or 3.7 percent. The revised package decreased the amount of juice and changed the allowed types to exclude juice drinks. In results not shown, purchases of juice products included in the revised WIC package decreased after the package revision, consistent with the smaller allowance in the package, but purchases of juice drinks increased after the package revision. Fish is included as a falsification exercise since fish is included in the revised package for post-partum breastfeeding mothers, but not children.

[9] The results are similar when we restrict the sample further to include the 4,466 households that are in the sample for at least one month before and after the WIC package change, which includes 108,281 household-month observations.

WIC package had a significant positive effect on purchases of whole grain items.[10] The coefficients for produce purchased and the amount of money spent on food are both positive, but imprecisely estimated and small in magnitude. The coefficient on produce represents a 0.5 percent increase relative to the mean prior to the package revision for WIC-eligible households and the coefficient on food expenditures represents a 3.2 percent increase. Since WIC-eligible households already purchased more than $6 of produce each month, the estimates for produce are consistent with the possibility that these households were able to substitute the value of this voucher to purchase other products. Although produce was included in the revised package, the voucher for $6 was well below the pre-revision mean of $16.86 spent on produce, and over 70 percent of household-month observations were above $6 for WIC-eligible households prior to the package revision. In contrast, the quantities of whole grains allowed in the revised package (32 ounces) were above the pre-revision mean for WIC-eligible households (23.5 ounces).

The identifying assumption for equation (1) is that the changes over time in food purchases of income-ineligible households with an age-eligible child would be similar to the changes for WIC-eligible households in the absence of the WIC package revision. To assess the credibility of this assumption, we examine the monthly food purchasing trends of these two groups of households before and after the package revision. As shown in Figure 1, the differences in whole grain purchases for eligible and ineligible households are similar prior to the package change. In the bottom panel of Table 3, we estimate the effect of the package change for households without any age-eligible children as a falsification test. These households aged out

[10] The results are not sensitive to whether we control for household characteristics. Appendix Table 2 displays the results from equation (1) that do not control for household characteristics and additional regressions that use each household characteristic as an outcome variable. The point estimates for all outcomes are small in magnitude relative to the sample means for income-eligible households prior to the package change and are not statistically significant, except for parents' marital status.

of WIC eligibility prior to the package revision and would not have been exposed to whole grain or produce vouchers. We do not find statistically significant impacts on whole grains, produce, or food expenditures from the WIC package revision for this sample. Further, the point estimate for whole grains is much smaller for this sample at 1.97 ounces.

Overall, our estimates show that the package revision changed household purchasing patterns for whole grain products, suggesting that the specific products included in the WIC vouchers can be in important policy tool for influencing the types of foods low-income families with children purchase. At the same time, they confirm that providing vouchers that are inframarginal to pre-program spending may be ineffective in changing behavior (beyond the effects associated with a cash transfer). Our results also demonstrate that the WIC package change is a useful context for studying habit formation, because behavior changed while the incentives were in place.

B. Persistence of Effects after Losing Age Eligibility

Next, we estimate the changes in household purchasing patterns when income-eligible households lose eligibility after the youngest child reaches 60 months of age. Specifically, we estimate:

$$Y_{ht} = \alpha_0 + \alpha_1 Inc_{ht} + \alpha_2 \cdot 1[Age \geq 60]_{ht} + \alpha_3 Inc_{ht} \cdot 1[Age \geq 60]_{ht} + \theta X_{ht} + \rho_h + \delta_t + \epsilon_{ht}, \quad (2)$$

where 1[·] is an indicator function and 1[Age ≥ 60] denotes that the youngest member of the household is not age-eligible for WIC (at least 60 months old). All other parameters and

coefficients are defined analogously to those in equation (1). α_3 is the coefficient of interest, which represents the change in purchases upon losing WIC eligibility for income-eligible households compared to income-ineligible households.

To examine whether there is a persistent impact of WIC vouchers and how long the impact persists, we estimate equation (2) with periods of different lengths after aging out of WIC eligibility. These results are shown in Table 4. The first column estimates effects before the package change. Households that lost eligibility for WIC before whole grains and produce were added to the package did not receive incentives to purchase these items specifically. Upon aging out of eligibility, these households experienced an income effect equivalent to the decrease in the implied value of the WIC package. As a result, any decrease in purchases is likely to reflect an income effect, in contrast to the estimates after the package change, which reflect an income effect and the removal of the product-specific voucher. The coefficient for whole grains is small and not statistically significant, suggesting that there is little income effect on whole grain purchases prior to the package change. In contrast, there is a reduction in produce purchases of 8.1 ounces as income-eligible households age out of WIC eligibility, which suggests that the income effect associated with losing the implied value of the WIC package reduces produce purchases.

The rest of Table 4 restricts attention to households whose youngest child turned five after the package change, meaning that income-eligible households had some potential exposure to the revised set of vouchers. In the second column, we define the post-treatment period to include all months within four years after the youngest turns five. We find that after income-eligible households age out of WIC eligibility, their whole grain purchases decrease by about four ounces per month. This completely undoes the effect of the package change during

eligibility as estimated in Table 3. However, it also obscures the post-eligibility transition pattern over time. In the third column, we use only the first three months after losing age eligibility as the post-treatment period. The resulting whole grains coefficient suggests a drop of only 2.6 ounces per month. Effects within the first 6, 9, 12, and 24 months are close to the effect for the entire four years after losing eligibility (ranging from 3.5 to 4.0 ounces less in whole grain products purchased per month). Taken together, the estimates in Table 4 suggest that receiving the voucher for whole grain products has a persistent effect on household purchasing patterns. The vouchers increase whole grain purchases by about 3.5 ounces per month during eligibility, and three quarters of this effect is reversed within three months after losing eligibility. The rest is undone within six months of losing eligibility.

C. Effects by Length of Exposure to the New WIC Packages

Finally, we examine whether length of exposure to the new package influences persistence in purchasing patterns after losing eligibility. We use the exact timing of when the new guidelines were implemented in each state to identify the length of time that each household was potentially exposed to these new items before aging out of the WIC program. If strength of habit formation is strictly increasing in length of exposure to incentives, households with longer exposure to the new package would be expected to buy more of the items in the new package for longer after leaving the program.

We restrict attention to households with an age-eligible member within the six months prior to the package change. The identifying variation that we exploit is the timing of when the WIC package was revised relative to the age of the youngest member of the household. For income-eligible households, age of youngest child at the time of the package change determines

how long the household was eligible to receive the revised set of vouchers. We compare purchasing patterns after the youngest turns five by length of age eligibility for the new package and income eligibility. Specifically, we estimate the following specification:

$$Y_{ht} = \beta_0 + \beta_1 Exposure_h + \beta_2 IncEligible_h + \beta_3 Exposure_h \cdot IncEligible_h + \gamma X_{ht} + \delta_t + \varepsilon_{ht}$$

where $Exposure_h$ measures the number of months that the youngest member of the household was less than 60 months old after the package change, and $IncEligible_h$ indicates whether the household was income eligible within the six months prior to the package change. Y_{ht} is the amount of whole grains or produce, or total food spending, for the household that month. We cannot include household fixed effects, because they would be collinear with the measures of exposure length and income eligibility.

The results are shown in Table 5. The sample for the first column includes all households with an age-eligible member within the six months leading up to the package change. Some of the youngest children in these households reached 60 months before the revisions were implemented and so had zero months of exposure to the new vouchers. The point estimates suggest a positive relationship between months of exposure to the new package and whole-wheat purchases and total food spending and a negative relationship with produce purchases. However, none of these coefficients is precisely estimated. In columns two through four, we restrict attention to the first three months, six months, and 12 months after the youngest turned five. The pattern is similar for these subsamples, although the coefficient for whole grains is negative (and smaller) for the six- and 12-month windows. Restricting attention to households with at least one month of age eligibility after the package change produces similar results (see column five).

All together, the results do not suggest a strong relationship between length of exposure and persistence in purchasing patterns.

V. Conclusion

This paper examines whether changing the items included in the WIC bundle impacts what households purchase and whether exposure to these different items results in households continuing to purchase them even after losing WIC eligibility. We exploit two sources of variation to answer these questions. First, we exploit variation in the timing of when the WIC package was implemented in 2009. We use detailed high frequency data on the items that households purchase to compare purchases of specific items before and after the change in the guidelines. Consistent with the goals of the new guidelines we find that households with at least one child eligible for WIC (based on both age and income eligibility) purchased more whole grains after the implementation of the new WIC package. The introduction of the produce voucher did not have a significant effect on produce purchases, consistent with the value of the voucher being inframarginal to household produce budgets.

Second, we exploit variation in the age of the youngest child in the households that are income eligible for WIC at the time of WIC package revision. Some households aged out of WIC just before 2009 and hence had no WIC-induced increase in their exposure to these items. Other households had their youngest child age out in 2010, 2011, etc. thus creating differences across households in the number of years they were exposed to the WIC-induced changes in their purchasing patterns. This creates variation in time exposed to a specific set of items and creates an ideal test of habit formation in purchasing patterns created by a government subsidy. We find limited evidence of a persistent impact on purchases after aging out of eligibility. The

persistence in whole-wheat purchases is partial and short-lived, vanishing within six months of losing eligibility. Longer exposure to incentives does not appear to have a substantial effect on strength or length of persistence. This is consistent with the possibility that the relationship between length of exposure and strength of persistence levels off.

Our findings suggest that, for adults, using incentives or vouchers for specific items can be successful in raising consumption of those items while the incentives are in place. However, their efficacy in instilling habits that will outlive program participation is limited.

References

Andreyeva, T., & Luedicke, J. (2013). Federal Food Package Revisions: Effects on Purchases of Whole-Grain Products. *American Journal of Preventive Medicine*, 45(4), 422-429.

Belot, M., James J. and Nolen P. 2013. Changing Eating Habits- A Field Experiment in Primary Schools. Working paper, University of Edinburgh

Birch, Leann L. (1999). Development of Food Preferences. *Annual Review of Nutrition*, 19, 41-62.

Birch L.L. and Marlin D.W. 1982. I don't like it; I never tried it: Effects of exposure on two-year-old children's food preferences. *Appetite*, 3(4): 353-360.

Bitler, M., & Currie, J. (2004). Does WIC Work? The Effects of WIC on Pregnancy and Birth Outcomes. *Journal of Policy Analysis and Management, 24*(1), 73-91.

Bitler, M., Currie, J., and Scholz, J., K (2003). WIC Eligibility and Participation. *Journal of Human Resources*, 38(5): 1139–1179.

Charness, G., & Gneezy, U. (2009). Incentives to exercise. *Econometrica*, *77*(3), 909-931.

Cole, N., Jacobson, J., Nichols-Barrer, I., & Fox, M. K. (2011). *WIC food packages policy options study*. Mathematica Policy Research.

Deci, E., Koestner, R., & Ryan, R. (2001). Extrinsic Rewards and Intrinsic Motivation in Education: Reconsidered Once Again. *Review of Educational Research*, 1-27.

Figlio, D., Hamersma, S., & Roth, J. (2009). Does prenatal WIC participation improve birth outcomes? New evidence from Florida. *Journal of Public Economics, 93*(1-2), 235-245.

Fox, Mary Kay, Hamilton, William, & Lin, Biing-Hwan. 2004. Effects of food assistance and nutrition programs on nutrition and health. Food Assistance and Nutrition Research Report.

Frey, B., & Jegen, R. (2001). Motivation Crowding Theory. *Journal of Economic Surveys*, 589-611.

Government Accountability Office. (2013). *WIC Program: Improved Oversight of Income Eligibility Determination Needed* (GAO-13-290).

Gundersen, C. (2005). A dynamic analysis of the well-being of WIC recipients and eligible non-recipients. *Children and Youth Services Review*, 27(1), 99-114. doi:10.1016/j.childyouth.2004.08.014

Harding, M, Leibtag, E., & Lovenheim, M. (2012). The Heterogeneous Geographic and Socioeconomic Incidence of Cigarette Taxes: Evidence from Nielsen Homescan Data. *American Economic Journal: Economic Policy*, 4(4), 169-198.

Hoynes, H., Page, M., & Stevens, A. (2011). Can targeted transfers improve birth outcomes?: Evidence from the introduction of the WIC program. *Journal of Public Economics, 95*(7-8), 813-827.

Hoynes, H., & Schanzenbach, D. (2009). Consumption Responses to In-Kind Transfers: Evidence from the Introduction of the Food Stamp Program. *American Economic Journal: Applied Economics, 1*(4), 109-139.

Joyce, T., Gibson, D., & Colman, S. (2005). The Changing Association Between Prenatal Participation In WIC And Birth Outcomes In New York City. *Journal of Policy Analysis and Management*, 661-685.

Joyce, T., Racine, A., & Yunzal-Butler, C. (2008). Reassessing The WIC Effect: Evidence From The Pregnancy Nutrition Surveillance System. *Journal of Policy Analysis and Management, 27*(2), 277-303.

Kilts Center for Marketing. (2014). Nielsen Consumer Panel Dataset Manual.

Kreider, P., Pepper, J., & Roy, M. Identifying the Effect of WIC on Very Low Food Security among Infants and Children. University of Kentucky Center for Poverty Research Discussion Paper Series, DP 2012-11.

List, J.A. & Samek, S. 2015. The Behavioralist as Nutritionist: Leveraging Behavioral Economics to Improve Child Food Choice and Consumption. *Journal of Health Economics*, 39, 135-146..

Loewenstein, G., Price J. and Volpp K. 2017. Habit formation in Children: Evidence from Incentives for Healthy Eating. *Journal of Health Economics*, forthcoming.

Ponza, M., Devaney, B., Ziegler, P., Reidy, K., & Squatrito, C. (2004). Nutrient Intakes And Food Choices Of Infants And Toddlers Participating In WIC. *Journal of the American Dietetic Association, 104*(1), 71-79.

Royer, H., Stehr, M., & Sydnor, J. (2015). Incentives, commitments, and habit formation in exercise: evidence from a field experiment with workers at a fortune-500 company. *American Economic Journal: Applied Economics, 7*(3), 51-84.

United States Census Bureau. (2007). Population Estimates. Retrieved November 5, 2015, from http://www.census.gov/popest/data/historical/2000s/vintage_2007/

US Department of Agriculture (2011). WIC Food Packages Policy Options Study, Final Report. Report No. WIC-11-FOOD.

United States Department of Agriculture (2015a). *"Frequently Asked Questions about WIC."*. Retrieved November 5, 2015 from www.fns.usda.gov/wic/frequently-asked-questions-about-wic

United States Department of Agriculture, 2015b, "WIC Program Participation and Costs," Retrieved November 9, 2015 from http://www.fns.usda.gov/sites/default/files/pd/wisummary.pdf

US Department of Agriculture (2016a). WIC Food Packages – Maximum Monthly Allowances: Snapshot of the WIC Food Packages. Retrieved May 18, 2016 from: http://www.fns.usda.gov/wic/wic-food-packages-maximum-monthly-allowances.

US Department of Agriculture (2016b). WIC Food Packages – Regulator Requirements for WIC-Eligible Foods. Retrieved May 18, 2016 from: http://www.fns.usda.gov/wic/wic-food-packages-regulatory-requirements-wic-eligible-foods.

Rabin, M. (2013). Healthy habits: some thoughts on the role of public policy in healthful eating and exercise under limited rationality. In A. Oliver (ed.), *Behavioural Public Policy*. Cambridge: Cambridge University Press.

Ritchie, L., Whaley, S., Spector, P., Gomez, J., & Crawford, P. (2010). Favorable Impact Of Nutrition Education On California WIC Families. *Journal of Nutrition Education and Behavior, 42*(3), S2-S10.

Siega-Riz, A., Kranz, S., Blanchette, D., Haines, P., Guilkey, D., & Popkin, B. (2004). The effect of participation in the WIC program on preschoolers' diets. *The Journal of Pediatrics, 144*(2), 229-234.

Whaley, S., Ritchie, L., Spector, P., & Gomez, J. (2012). Revised WIC Food Package Improves Diets of WIC Families. *Journal of Nutrition Education and Behavior, 44*(3), 204-209.

Wilde, P. & Ranney, C. (2000). The Monthly Food Stamp Cycle: Shoping Frequency and Food Intake Decisions in an Endogenous Switching Regression Framework. *American Journal of Agricultural Economics*. 82(1), 200-213.

Table 1**.** Revisions to the WIC Package for Children Ages 2 Through 4

	Maximum Allowance Before 2009	Maximum Allowance After 2009
Whole Grains	-	2 lbs.
Produce Voucher	-	$6
Any milk	24 qt.	-
Reduced-fat milk	-	16 qt.
Cheese	4 lbs.	1 lb.
Juice	288 oz.	128 oz.
Cereal	36 oz.	36 oz.
Eggs	30	12
Dried beans	1 lb.	1 lb.
Canned beans	-	64 oz.
Peanut butter	18 oz.	18 oz.

Notes: The WIC package for one-year-old children is the same as the package described in this table, except for the milk allowance. The produce voucher was increased to $8/month in 2014. Before 2009, up to 4 lbs. of cheese could be substituted for milk at a rate of 1 lb. cheese per 3 quarts milk. After 2009, up to 1 lb. of domestic cheese with reduced sodium, fat, or cholesterol may be substituted for milk at a rate of 1 lb. cheese per 3 quarts milk. After 2009, half of the cereals on each state's authorized list must have whole grain as the primary ingredient by weight). After 2009, canned beans are allowed as a substitute for dried beans. Peanut butter is a substitute for dried beans.
Sources: USDA (2011, 2016a,b)

Table 2: Descriptive Statistics

Food purchases (oz.):	All		WIC-Eligible		WIC-Ineligible	
Whole Grains	26.08	(47.79)	25.59	(49.92)	26.19	(47.29)
Low-Fat Milk	382.10	(474.39)	374.84	(493.17)	383.73	(470.07)
Whole Milk	121.60	(266.22)	155.89	(309.54)	113.92	(254.89)
Total Milk	503.70	(520.09)	530.73	(558.83)	497.65	(510.82)
Produce	182.68	(195.10)	190.12	(209.66)	181.02	(191.65)
Cereal	58.08	(75.22)	61.20	(76.77)	57.38	(74.85)
Whole-Grain Cereal	15.62	(33.48)	16.47	(32.07)	15.43	(33.79)
Sugar Cereal	29.51	(47.08)	31.52	(49.96)	29.06	(46.40)
Cheese	47.07	(53.22)	49.48	(56.82)	46.53	(52.37)
Eggs	47.51	(64.44)	50.03	(67.10)	46.94	(63.81)
Juice	296.76	(377.02)	301.36	(386.98)	295.73	(374.74)
Expenditures ($):						
Food Expenditures	314.60	(229.03)	321.41	(249.15)	313.07	(224.26)
Produce Expenditures	21.43	(22.31)	19.83	(20.77)	21.78	(22.63)
Characteristics:						
Household Income ($1000)	58.59	(30.22)	30.13	(12.87)	64.96	(29.31)
Household Size	4.07	(1.52)	4.89	(1.59)	3.89	(1.44)
Age of the Youngest (Yrs.)	10.16	(15.96)	2.18	(1.58)	11.95	(17.14)
White	0.72	(0.45)	0.72	(0.45)	0.72	(0.45)
Black	0.11	(0.32)	0.13	(0.33)	0.11	(0.31)
Hispanic	0.10	(0.30)	0.10	(0.30)	0.10	(0.29)
Other Race/Ethnicity	0.07	(0.25)	0.06	(0.23)	0.07	(0.25)
Married	0.81	(0.39)	0.75	(0.43)	0.83	(0.38)
High School or Less	0.15	(0.36)	0.25	(0.43)	0.13	(0.33)
Some College	0.28	(0.45)	0.35	(0.48)	0.27	(0.44)
College Graduate	0.57	(0.50)	0.40	(0.49)	0.61	(0.49)
N	455,772		83,350		372,422	

Notes: The unit of observation is household-month. Standard deviations appear in parentheses to the right of the mean values. The sample includes 9,784 unique households. The race/ethnicity and marital status variables refer to the household head. The education variables reflect the highest degree of schooling of an adult in the household.

Table 3: Difference-in-Differences Estimates of the Impact of the WIC Package Changes on Household Purchases

	Whole Grains	Produce	Food ($)
Panel A: Sample is Households With At Least One Age-Eligible Child			
Income-Eligible X After Package Change	3.485	1.035	9.943
	(1.228)	(4.592)	(6.031)
Income-Eligible	-0.394	-4.574	-19.335
	(1.125)	(3.736)	(4.983)
After Package Change	-1.711	-6.827	-11.509
	(0.862)	(3.095)	(3.653)
Pre-Revision Mean	23.48	193.48	302.16
Observations	180,796	180,796	180,796
Panel B: Sample is Households Without Any Age-Eligible Children			
Income-Eligible X After Package Change	1.969	2.108	6.237
	(1.484)	(5.360)	(7.158)
Income-Eligible	-2.181	-0.463	-13.20
	(1.782)	(5.236)	(6.469)
After Package Change	0.490	-0.251	-2.437
	(1.181)	(3.725)	(4.085)
Pre-Revision Mean	22.58	185.50	278.11
Observations	93,035	93,035	93,035

Notes: Each column displays estimates from separate regressions. In Panel A, the sample is restricted to households in which the youngest child is between 12 and 59 months of age. In Panel B, the sample is restricted to households in which the youngest child is at least 60 months of age. Standard errors are in parentheses and clustered within households. Additional variables included, but not shown, are age of the youngest in the household, household income, household size, race/ethnicity (black, Hispanic, and other race/ethnicity; white omitted), married, educational attainment (less than high school or high school, some college; college graduate omitted), and year, month, and household fixed effects. All units are in ounces except as specified. The pre-revision means are the means prior to the package change for income-eligible households for each sample.

Table 4: Difference-in-Differences Estimates of the Impact of Aging out of WIC Eligibility

	Before the Package Change	After the Package Change					
		All Periods	First 3 Months	First 6 Months	First 9 Months	First 12 Months	First 24 Months
Whole Grains	0.769	-3.954	-2.604	-3.521	-3.992	-3.682	-4.004
	(1.186)	(1.256)	(1.491)	(1.416)	(1.429)	(1.414)	(1.370)
Produce	-8.095	-6.211	-5.953	-6.787	-4.642	-3.603	-2.911
	(4.267)	(4.049)	(5.643)	(4.933)	(4.827)	(4.690)	(4.367)
Food ($)	-6.647	-11.902	-2.818	-5.445	-6.654	-5.708	-7.374
	(4.385)	(6.733)	(6.669)	(6.602)	(6.592)	(7.002)	(7.133)
N	133,882	139,949	91,243	95,972	100,346	104,404	118,838

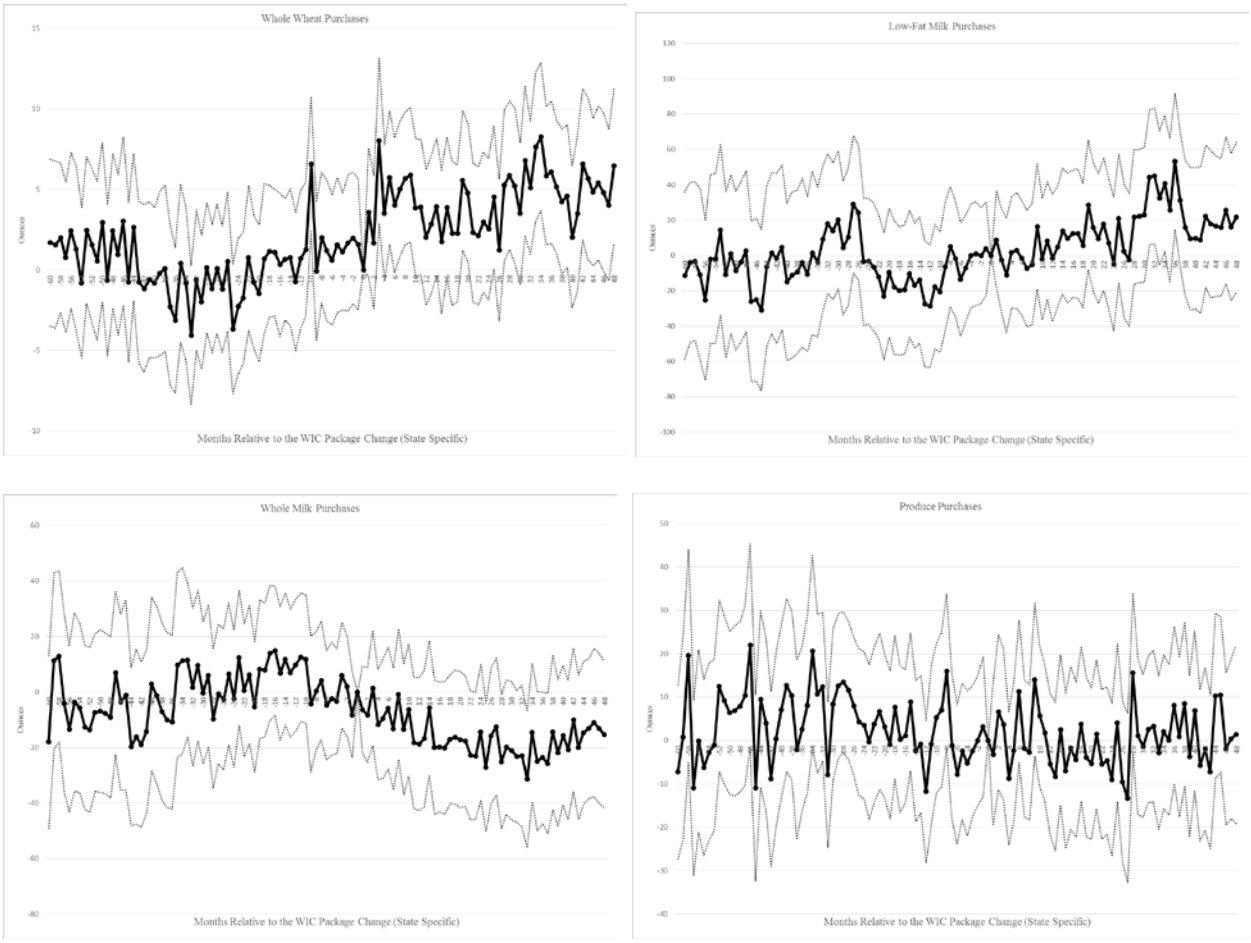
Notes: Each row and column displays estimates from a separate regression. These estimates are the coefficients corresponding to the interaction of income-eligibility (under 185% FPL) and having the youngest member of the household at least 60 months old (no longer age-eligible). Standard errors are in parentheses and clustered within households. The sample is restricted to households where the youngest child is within 48 months of turning 60 months of age. The first column displays estimates for households in which the youngest member of the household aged out of WIC eligibility prior to the package change. The second column displays estimates for households in which the youngest member of the household aged out of WIC eligibility after the package change. The sample for the third column is a subset of the sample from the second column that is restricted to households in which the youngest member is not older than 63 months of age (within the first 3 months of aging of out WIC eligibility). Each subsequent column has a sample that is constructed similarly. Additional variables included, but not shown, are age of the youngest in the household, household income, household size, race/ethnicity (black, Hispanic, and other race/ethnicity; white omitted), married, educational attainment (less than high school or high school, some college; college graduate omitted), and year, month, and household fixed effects. All units are in ounces except as specified.

Table 5: Impact of Potential Exposure to the Revised WIC Packages on Purchases after Aging Out of Eligibility

	All Periods	Within 3 Months	Within 6 Months	Within 12 Months	All Periods
Whole Grains	0.179	0.054	-0.031	-0.038	0.252
	(0.207)	(0.193)	(0.164)	(0.158)	(0.235)
Produce	-0.027	-0.011	-0.491	-0.405	-0.059
	(0.726)	(0.777)	(0.697)	(0.678)	(0.834)
Food ($)	1.506	0.842	0.616	0.750	1.853
	(0.942)	(1.025)	(0.941)	(0.934)	(1.065)
N	23,233	3,624	6,255	10,844	19,026

Notes*:* Each row and column displays estimates from a separate regression. These estimates are the coefficients corresponding to the interaction of months of exposure (the amount of time after the WIC package change and before the youngest child reached 60 months) and income eligibility (the household income was below 185% of the FPL in at least one month during the six months prior to the package change). Standard errors are in parentheses and clustered within households. The sample is restricted to households with an age-eligible member within the six months prior to the WIC package change and periods after the youngest child turned five. The second column analyzes the subset of household/month observations that occurred during the three months after the youngest child turned five. The subsamples for the third and fourth columns are analogous. The last column includes only households with at least one month of age eligibility for the new package. Additional variables included, but not shown, are age of the youngest in the household, household income, household size, race/ethnicity (black, Hispanic, and other race/ethnicity; white omitted), married, educational attainment (less than high school, high school, some college; college graduate omitted), and year, month, and state fixed effects. All units are in ounces except as specified.

Appendix Figure 1: Difference in Purchases for WIC-eligible and WIC-ineligible Households Before and After the Package Change



Notes: These figures show the differences in purchases for whole-grain products, low-fat milk, whole milk, and produce for WIC-eligible households compared to WIC-ineligible households by month relative to the WIC package change for the state of residence.

Appendix Table A1: Difference-in-Differences Estimates of the Impact of the WIC Package Change for Additional Food Purchases

	All Milk	Low-Fat Milk	Whole Milk	Pct. Low-Fat Milk	All Cereal	Whole Grain Cereals	Sugar Cereals	Cheese	Eggs	Juice	Fish	Produce ($)
Panel A: Sample is Households With At Least One Age-Eligible Child												
Income-Eligible X After	16.700	30.890	-14.190	4.636	0.744	1.022	-0.400	1.660	0.433	5.531	-0.202	0.424
	(17.090)	(16.900)	(9.874)	(1.305)	(1.637)	(0.779)	(1.079)	(1.234)	(1.537)	(9.823)	(0.386)	(0.555)
Income-Eligible	-32.500	-45.230	12.730	-3.295	-3.994	-1.671	-1.791	-3.620	-1.668	-16.830	0.182	-0.485
	(16.490)	(17.240)	(12.430)	(1.311)	(1.413)	(0.632)	(1.020)	(1.094)	(1.385)	(10.36)	(0.341)	(0.456)
After the Package Change	-19.300	-20.850	1.549	-1.404	-1.265	-1.835	0.511	-1.927	-0.741	1.217	0.147	-1.189
	(9.416)	(9.363)	(6.370)	(0.802)	(1.176)	(0.559)	(0.761)	(0.848)	(1.013)	(6.298)	(0.274)	(0.348)
Pre-Revision Mean	573.34	408.95	164.39	58.58	64.09	16.49	33.31	49.33	51.79	323.13	8.10	16.86
Observations	134,624	134,624	134,624	134,624	180,796	180,796	180,796	180,796	180,796	180,796	180,796	180,796
Panel B: Sample is Households Without Any Age-Eligible Children												
Income-Eligible X After	15.370	9.878	5.496	3.297	0.564	0.00795	-0.450	2.006	0.966	-1.909	-0.722	1.048
	(16.310)	(15.110)	(10.140)	(1.376)	(1.998)	(0.872)	(1.508)	(1.495)	(2.002)	(12.210)	(0.533)	(0.592)
Income-Eligible	-27.840	-16.060	-11.780	-2.974	-0.519	-0.383	1.029	-3.031	1.435	7.396	-0.172	-0.0509
	(15.570)	(15.200)	(10.070)	(1.571)	(1.889)	(0.884)	(1.481)	(1.539)	(1.962)	(12.110)	(0.525)	(0.546)
After the Package Change	-10.290	-8.888	-1.404	-1.372	-0.002	-0.929	0.923	-1.110	-1.675	9.148	0.810	-0.246
	(9.582)	(8.940)	(5.058)	(0.821)	(1.473)	(0.776)	(0.978)	(1.126)	(1.468)	(7.784)	(0.390)	(0.400)
Pre-Revision Mean	533.03	399.02	134.02	61.58	66.91	15.39	38.51	44.98	47.54	304.73	8.14	16.54
Observations	79,444	79,444	79,444	79,444	93,035	93,035	93,035	93,035	93,035	93,035	93,035	93,035

Notes: Each column displays estimates from separate regressions. In both panels, the sample is restricted to households in which the youngest child is at least 12 months of age. For milk, the sample is restricted to households in which the youngest child is at least 24 months of age, since the milk items in the WIC package differ for children below 24 months from the package for children at least 24 months of age. Additional variables included, but not shown, are age of the youngest in the household, household income, household size, race/ethnicity (black, Hispanic, and other race/ethnicity; white omitted), married, educational attainment (less than high school, high school, some college; college graduate omitted), and year, month, and household fixed effects. All units are in ounces except as specified. The pre-revision means are the means prior to the package change for income-eligible households for each sample. Fish is not included as part of the WIC package for children, either before or after the package change, but is included as part of the package for fully breastfeeding mothers. Cereal includes all hot and cold cereals, not just whole grain and sugar cereals. Standard errors are in parentheses and clustered within households.

Appendix Table 2: The Relationship between the WIC Package Change and Household Characteristics

	Household Income	Household Size	Black	Hispanic	Other Race/ Ethnicity	Married	High School or Less	Some College	College Graduate	Age of the Youngest Child
Income-Eligible X After	-0.738	-0.059	-0.0003	0.004	-0.003	-0.023	0.004	-0.003	-0.001	-0.233
	(0.905)	(0.039)	(0.004)	(0.004)	(0.006)	(0.009)	(0.008)	(0.012)	(0.010)	(0.837)
Income-Eligible	-21.020	0.416	0.003	0.001	-0.005	0.019	0.002	0.001	-0.003	-1.481
	(0.988)	(0.038)	(0.003)	(0.004)	(0.005)	(0.007)	(0.009)	(0.012)	(0.009)	(0.669)
After the Package Change	0.296	0.020	0.001	-0.0004	0.001	0.007	0.0001	-0.005	0.004	-0.074
	(0.445)	(0.016)	(0.002)	(0.002)	(0.002)	(0.003)	(0.0031)	(0.005)	(0.004)	(0.325)
Pre-Revision Mean	28.97	4.89	0.12	0.11	0.05	0.75	0.27	0.35	0.37	34.91
Observations	180,796	180,796	180,796	180,796	180,796	180,796	180,796	180,796	180,796	180,796

Notes: Each column displays estimates from separate regressions, where the outcome variables are denoted by the column heading. The sample is restricted to households were the youngest child is at least 12 months of age and there is at least one age-eligible child in the household. Standard errors are in parentheses and clustered within households. Additional variables included, but not shown, are age of the youngest in the household, household income, household size, race/ethnicity (black, Hispanic, and other race/ethnicity; white omitted), married, educational attainment (less than high school or high school, some college; college graduate omitted), and year, month, and household fixed effects. The pre-revision means are the means prior to the package change for income-eligible households.

Appendix Table 3: Difference-in-Differences Estimates of the Impact of Aging out of WIC Eligibility for Additional Food Purchases

	Before the Package Change	After the Package Change			
		All Periods	First 3 Months	First 6 Months	First 12 Months
All Milk	10.790	5.990	15.400	10.230	10.760
	(14.990)	(12.810)	(13.390)	(12.820)	(13.560)
Low-Fat Milk	29.600	-10.750	7.103	-2.773	-6.914
	(14.070)	(13.340)	(12.680)	(12.470)	(14.110)
Whole Milk	-18.810	16.740	8.293	13.000	17.670
	(9.604)	(10.56)	(7.572)	(8.551)	(11.53)
Pct. Low-Fat Milk	1.998	-1.554	0.185	-0.679	-1.575
	(1.199)	(1.058)	(1.223)	(1.162)	(1.147)
All Cereals	0.676	0.169	0.088	-1.327	-0.963
	(1.730)	(1.607)	(1.943)	(1.824)	(1.779)
Whole Grain Cereal	0.082	-0.969	-1.628	-1.870	-1.830
	(0.763)	(0.736)	(0.950)	(0.858)	(0.797)
Sugar Cereals	2.239	1.841	1.962	1.250	1.630
	(1.370)	(1.091)	(1.370)	(1.266)	(1.261)
Cheese	-2.317	-0.805	-1.503	-2.355	-1.042
	(1.108)	(1.170)	(1.420)	(1.222)	(1.248)
Eggs	-0.658	-1.010	-1.714	-2.585	-1.990
	(1.817)	(1.513)	(1.848)	(1.613)	(1.573)
Juice	-4.249	-1.333	-8.749	-7.532	-1.954
	(11.250)	(9.310)	(10.860)	(10.250)	(10.070)
Fish	-0.076	-0.679	-0.206	-0.422	-0.338
	(0.500)	(0.341)	(0.472)	(0.424)	(0.407)
Produce ($)	-0.722	-2.099	-1.538	-1.724	-1.485
	(0.373)	(0.672)	(0.730)	(0.693)	(0.708)
N	133,882	139,949	91,243	95,972	104,404

Notes: Each row and column displays estimates from separate regressions. These estimates are the coefficients corresponding to the interaction of income-eligibility (under 185% FPL) and having the youngest member of the household at least 60 months old (no longer age-eligible). Standard errors are in parentheses and clustered within households. The sample is restricted to households where the youngest child is within 48 months of turning 60 months of age. Additional variables included, but not shown, are age of the youngest in the household, household income, household size, race/ethnicity (black, Hispanic, and other race/ethnicity; white omitted), married, educational attainment (less than high school or high school, some college; college graduate omitted), and year, month, and household fixed effects. All units are in ounces except as specified.