SNAP Eligible Products and Behavioral Demand

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Abstract

This paper evaluates demand and nutrition when making unhealthy products, like soda, ineligible for purchase with Supplemental Nutrition Assistance Program (SNAP) benefits. We utilize policy variation in product eligibility for purchase with SNAP benefits to identify how eligibility contributes to differences in the marginal propensity to consume. Difference-in-Difference estimates suggest a 14 to 21 percent decline in soda purchases if soda was made ineligible for purchase with SNAP benefits. We then estimate a structural behavioral model that incorporates mental accounting to rationalize observed spending patterns. Our model predicts soda purchases would decline by 18 percent if soda were made ineligible for purchase with SNAP benefits. Our model simultaneously predicts that juice purchases would increase by 7 percent, resulting in an almost 7 percent decrease in total sugars purchased from beverages. These findings highlight the potential of modifying SNAP to promote healthier choices and improve public health.

JEL codes: D12, I12, I18, I38, L66

Keywords: mental accounting, retail scanner data, SNAP

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1 Introduction

The Supplemental Nutrition Assistance Program (SNAP) is the largest of the domestic nutrition assistance programs administered by the United States Department of Agriculture (USDA 2014; Cronquist 2019).[1] The primary goal of SNAP is to supplement the food budgets of needy families so that they can purchase healthy food and move towards self-sufficiency (USDA 2021b). In recent years, considerable attention has been given to the higher rates of obesity and lower measures of diet quality among SNAP participants.[2] For example, Katare, Binkley, and Chen (2021) find that SNAP participants exhibit lower nutrition and diet quality measures relative to eligible non-participants. Findings such as these, as well as the costs of the program, have sparked policy debates about how to improve the healthfulness of purchases made by SNAP beneficiaries. For example, should participants receive a "Harvest Box" of healthy food, should benefit amounts be increased to promote healthy food purchases, or should unhealthy products, like soda, no longer be eligible for purchase with SNAP benefits?[3]

This paper utilizes household level panel data, obtained from a supermarket retail chain, to evaluate demand under the counterfactual policy in which soda is ineligible for purchase with SNAP benefits. These data contain universal product code / price lookup code (UPC/PLU) level purchases made by SNAP households and also include the form of tender utilized (cash, credit/debit, SNAP, etc.) at the transaction level.[4] We leverage variation in SNAP income that arises from SNAP adoption, as well as increases in SNAP benefits due to changes in SNAP policy.[5] We leverage variation in cash income due to stimulus checks. To identify the role of a product being eligible for purchase with SNAP

[1]In 2021, SNAP provided benefits to 41.5 million people, roughly 1 in 8 Americans, and cost $107.9 billion dollars to administer (USDA 2021a).

[2]For example, Condon et al. (2015) find that 40 percent of SNAP participants are obese while only 32 percent of income-eligible nonparticipants and 30 percent of higher income nonparticipants are obese.

[3]A Harvest Box was an idea tossed around by the Trump administration in which recipients would receive a box of food in lieu of a portion of their SNAP benefits.

[4]We can also identify Supplemental Nutrition Program for Women, Infants, and Children (WIC) and Temporary Assistance for Needy Families (TANF) benefits as forms of payment at the transaction level.

[5]Detailed household level panel data obtained from retail chains are growing in usage as they provide a rich environment to study consumer behavior (Hastings and Shapiro 2018; Hastings, Kessler, and Shapiro 2021). Furthermore, data obtained directly from an individual retailer sometimes has advantages over retail scanner data available for purchase through the Kilts Center for Marketing or IRI.

on the marginal propensity to consume out of SNAP (MPC_{SNAP}), we exploit variation in product eligibility due to administrative rules of the SNAP program. For instance, products that are sold heated are SNAP ineligible (heated rotisserie chicken) but products that are sold cold are SNAP eligible (cold rotisserie chicken). Similarly, products that have a supplemental nutrition facts label (e.g. tea or energy drinks) are SNAP ineligible but similar products with a nutrition facts label are eligible.[6]

Utilizing products that have SNAP eligible and ineligible counterparts, we explore differences in the MPC_{Cash} and the MPC_{SNAP} between these substitute foods.[7] Differencing out differences in the MPC_{Cash} between SNAP eligible and ineligible products effectively controls for differences in consumer preferences over similar eligible and ineligible products. We can then infer what percentage of the MPC_{SNAP} is due to the eligibility status of a product. We find that SNAP eligibility plays a significant role; 57 to 88 percent of the MPC_{SNAP} for SNAP eligible products can be explained by the product's eligibility for purchase with SNAP. These findings suggest that the MPC_{SNAP} for soda, which we estimate to be between 0.027 to 0.029, could be reduced by 57 to 88 percent, leading to a 14 to 21 percent reduction in soda spending if soda were made SNAP ineligible.

We then estimate a continuous demand model that distinguishes between products by SNAP eligibility with mental accounting. Our model captures how consumers are biased into prioritizing eligible foods when receiving SNAP, even among those for whom SNAP should be equivalent to cash. A novel aspect of our setup is the consumer micro-data, which is useful in demand estimation (Berry and Haile 2021). We estimate household-level parameters and capture budget and substitution effects. We find that making soda ineligible for purchase with SNAP would lead to an 18 percent decrease in soda purchases. Due to substitution to products like juice, sugar from beverage purchases only decreases by 7 percent. We also find that the nutrition from beverages improves (e.g. fiber and iron) as households substitute to juice. Absent mental accounting, there would be no

[6]Supplemental facts labels are labels that indicate the amount of vitamins contained in a product. They are often found on vitamins, tea, protein powders, and other forms of energy drinks.

[7]Note that SNAP is theoretically equivalent to cash if the household spent more on eligible products prior to SNAP adoption than they receive in SNAP benefits. For these households, the benefits can indirectly subsidize spending over ineligible products (e.g. MPC_{SNAP} can be non-zero for ineligible products.)

effect of the counterfactual policy on households for whom SNAP is equivalent to cash. Finally, we simulate a pure cash transfer in lieu of SNAP benefits. We find that consumer welfare slightly increases as they substitute away from beverages towards non-food.

This paper is related to prior literature that has evaluated whether or not SNAP benefits are treated equivalently to cash. Hastings and Shapiro (2018) estimate a marginal propensity to consume food out of SNAP ($MPCF_{SNAP}$) between 0.5 to 0.6 and a $MPCF_{Cash}$ no larger than 0.10; they reject equivalence between the $MPCF_{SNAP}$ and the $MPCF_{Cash}$. Other work has used the roll-out of SNAP benefits (Hoynes and Schanzenbach 2009) and administrative increases (decreases) in the SNAP benefit amount due the introduction (expiration) of the American Reinvestment and Recovery Act (Beatty and Tuttle 2015; Bruich 2014) in order to identify the $MPCF_{SNAP}$. Hoynes and Schanzenbach (2009) estimate the $MPCF_{SNAP}$ to be between 0.16 to 0.32, Bruich (2014) estimates it to be 0.30, and Beatty and Tuttle (2015) find a range of 0.53 to 0.64.[8] Research tangential to this literature evaluates the MPC out of labeled transfers or other types of in-kind transfers. Beatty et al. (2014) find that the MPC heat out of a labeled cash transfer is higher than the MPC heat out of cash. Griffith, Von Hinke, and Smith (2018) find that the MPC fresh fruits and vegetables out of an in-kind transfer is larger than out of cash.[9] Many of these papers attribute differential MPCs to mental accounting (Thaler 1999).

There is limited but growing research evaluating how a product's eligibility for purchase with SNAP benefits influences beneficiary demand. Basu et al. (2014) use National Health and Nutrition Examination Survey dietary recall data and a Quadratic Almost Ideal Demand System to simulate intake under an alternative SNAP policy in which soda is no longer SNAP eligible. They find that this policy would lead to a 15.4 percent decline in calories from soda intake and a 17.1 percent increase in juice purchases. Oberg and

[8] There are relatively few papers that have extended this literature to evaluate the MPC soda out of SNAP. Existing estimates of the MPC soda out of SNAP benefits are between 0.0 and 0.03 (Cohen and Young 1993; Fraker et al. 1992; Ohls et al. 1992). Not all of this research has been able to reject the equality of $MPCF_{SNAP}$ and $MPCF_{Cash}$. Hoynes and Schanzenbach (2009) estimate the $MPCF_{Cash}$ to be between 0.09 to 0.10 and fail to reject to equality. In contrast, Beatty and Tuttle (2015) find that the changes in food shares upon the increase in SNAP benefits are not consistent with Engel's law, suggesting differences in the MPCF out of cash and SNAP income. Engel's law predicts that the growth in food expenditure should be at a lower rate than the growth in income because food is a necessity.

[9] The sample in Griffith et al. (2018) contains households for whom the in-kind transfer should be equivalent to cash and households for whom the in-kind transfer should not be equivalent to cash.

Musalem (2021) estimate a structural model and simulate scenarios in which the kinds of products that are eligible for purchase with SNAP are expanded.[10]

Our paper is also related to research studying the effectiveness of soda taxes. The literature largely finds that soda taxes have been effective at reducing soda purchases (Allcott, Lockwood, and Taubinsky 2019).[11] Cawley et al. (2019) find that the implementation of a 1.5 cent per ounce soda tax in Philadelphia resulted in a 31 percent decrease in soda purchases among adults.[12] Fletcher, Frisvold, and Tefft (2010) find that soda taxes lead to a reduction in soda consumption by children and adolescents, but also find that this decrease is offset by increases in other high calorie beverages. Aguilar, Gutierrez, and Seira (2021) also find declines in purchased calories among taxed drink and food products to be offset by increases in purchased calories of non-taxed products. Relatedly, Harding and Lovenheim (2017) simulate and compare the effectiveness of product (e.g. soda) taxes to nutrient (e.g. sugar) taxes; they find nutrient taxes are more effective at altering the nutritional composition of purchases because it is more difficult to substitute away from a tax placed on nutrients as opposed to products.[13] These findings parallel our results, which indicate a substitution from soda toward juice if soda were made SNAP ineligible.

We contribute to the literature in multiple ways. First, we contribute to the sin tax literature by evaluating the effectiveness of additional public policies designed to reduce the purchases of certain goods. Specifically we consider what would happen to soda purchases if soda were no longer eligible for purchase with SNAP benefits. This is a complimentary policy to soda taxes for the SNAP program because, under federal law, beneficiaries do not pay taxes on items purchased with SNAP. Second, we take a novel

[10]They estimate that the $MPCF_{SNAP}$ would be 0.36 and 0.05 under counterfactual scenarios where SNAP dollars could be used to buy food and household items and all items, respectively.

[11]In terms of an optimal rate, Alcott et al. (2019) find evidence for an optimal "sugar-sweetened beverage" tax between 1 to 2.1 cents per ounce.

[12]Recently, Rojas and Wang (2021) evaluate the effectiveness of soda taxes in Washington state and Berkeley. They find that the implementation of a 0.17 cent per ounce soda tax in Washington led to a 5 percent reduction in the volume of soda sold; however, they find little evidence that the implementation of a soda tax in Berkeley reduced soda purchases.

[13]They estimate cross-price elasticities which indicate that soda (diet and regular) are substitutes for orange juice, fruit/vegetable juice, and sports drinks. Finally, their soda tax simulations show that the budget share for cold drinks (water, orange juice, fruit/vegetable juice and sports drinks) increases by roughly 1 percent in response to a 20% tax on soda. They find that the share of budget allocated towards soda would decline by 3.4 percent.

approach to this question by leveraging administrative variation in the rules over which food products are eligible for purchase with SNAP and which food products are ineligible. This allows us to infer what proportion of the MPC_{SNAP}, for SNAP eligible products, is due to being eligible. Third, we estimate a behavioral model that directly incorporates mental accounting as a possible rationale for differences in the $MPCF_{SNAP}$ and $MPCF_{Cash}$. This approach allows us to consider policy counterfactuals incorporating budget and substitution effects in the presence of mental accounting. Our framework adapts and extends Hastings and Shapiro (2018) to the case of multiple products within eligibility status, and we exploit our unique dataset to estimate the model. Attempts at estimating the effect of removing soda from SNAP eligibility have failed to account for behavioral effects, relying on standard models (Basu et al. 2014; Oberg and Musalem 2021).[14] Such approaches cannot rationalize the observed MPC differences across eligibility that justify why making soda ineligible for SNAP may be effective at reducing purchases. Finally, we confirm results from Hastings and Shapiro (2018) with different data.

There are various threats to identification. First is the extent to which household product preferences change upon SNAP adoption.[15] In the reduced form analysis we evaluate pre-trends prior to SNAP adoption and find little evidence for changes in purchasing patterns prior to SNAP adoption. In addition, we utilize variation in SNAP income derived from administrative changes to SNAP policy in addition to variation in SNAP income generated by SNAP adoption. In the structural estimation, we test for changes in the estimated preference parameters leading up to SNAP adoption and find little evidence that they change, after accounting for the household's budget. Second, because SNAP households do not pay taxes on items purchased with SNAP benefits, SNAP income changes the slope of the budget constraint when a state normally levies taxes on SNAP eligible

[14]Basu et al. (2014) may overestimate the effect of a soda ban because they associate soda spending to come out of a consumer's SNAP budget, but for consumers who spend more than their SNAP on eligible products, changing eligibility of a product does not lead to lower purchases because total expenditure is unchanged. Oberg and Musalem (2021) acknowledge this fact and notice that the main channel through which a change in purchases could be rationalized is via mental accounting, but then argue that changing eligibility effectively changes the price and thus quantities would change; we demonstrate that this is incomplete and not the case for many households, necessitating a formal behavioral mechanism.

[15]SNAP adoption is correlated with an increase in household size and a decrease in income (Hastings and Shapiro 2018).

products. We evaluate the robustness of our results to this by limiting the sample to households that reside in a state without food or soda taxes. In this analysis, we continue to find results aligned with the main findings of the paper.

The rest of this paper is organized as follows. Section 2 introduces the conceptual framework that motivates our analysis. Section 3 describes the data and presents summary statistics. Section 4 discusses the reduced form strategy and results. Section 5 details the structural model and estimation method. Section 6 presents the model results and counterfactual analysis on changing the SNAP eligibility of soda. Section 7 concludes.

2 Conceptual Framework

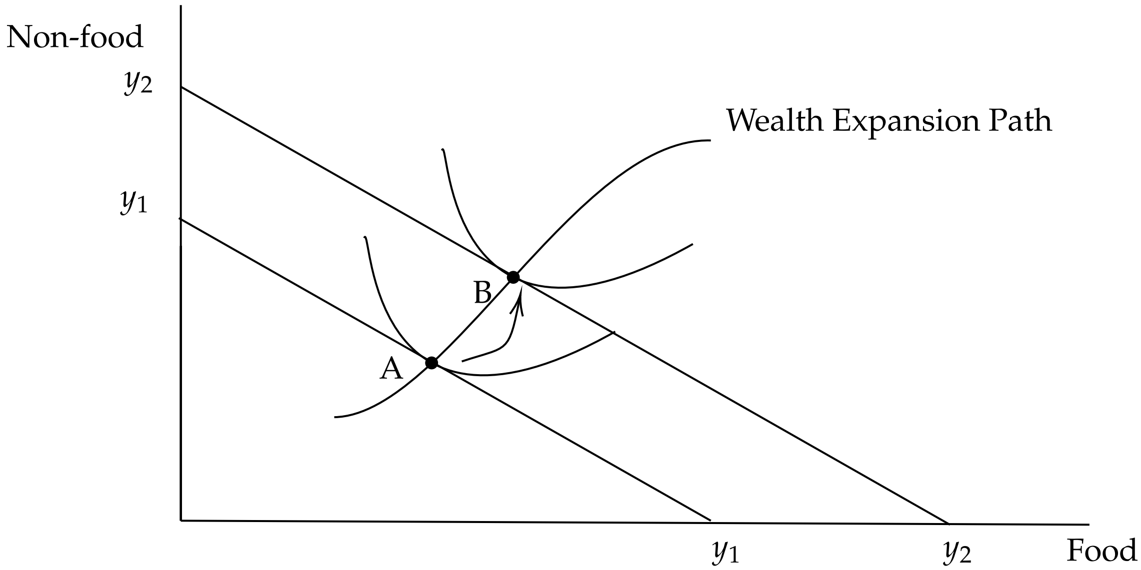
Traditional economic theory indicates that households who spend more on food than they receive in SNAP benefits should treat SNAP and cash income equivalently. In this section, we sketch the theoretical framework behind our study by illustrating the changing budget line between food and non-food products that occurs upon SNAP adoption.

Figures 1 and 2 portray changes in the budget line between food and non-food products associated with an equivalent cash and SNAP income transfer, respectively. In Figure 1, y_1 is initial income and $y_2 = y_1$+cash transfer, whereas $y_2 = y_1$+SNAP for Figure 2. Suppose that with y_1 wealth one optimizes at point A. For a household to treat SNAP and cash equivalently, initial food purchases (prior to SNAP adoption) is somewhere between the dashed vertical line and point y_1 on the horizontal axis. In other words, the household spent more on food prior to the transfer than the amount of the cash or benefit transfer. When wealth increases, one either moves to point B for the cash transfer or point C for the SNAP transfer (even though B is feasible).[16] Our depiction of B and C allow cash and SNAP income to be treated differently, which we empirically test. This leads to different wealth expansion paths based on the source (Mas-Colell, Whinston, and Green 1995).[17]

[16]Note that if a household spent less on food prior to SNAP adoption than the amount of their SNAP benefits, they would maximize utility by locating at the kink in the budget line. A household for which SNAP is not theoretically equivalent to cash would naturally develop distinct Engel curves for cash and SNAP income transfers due to their low preference over food items and the kink in their budget line.

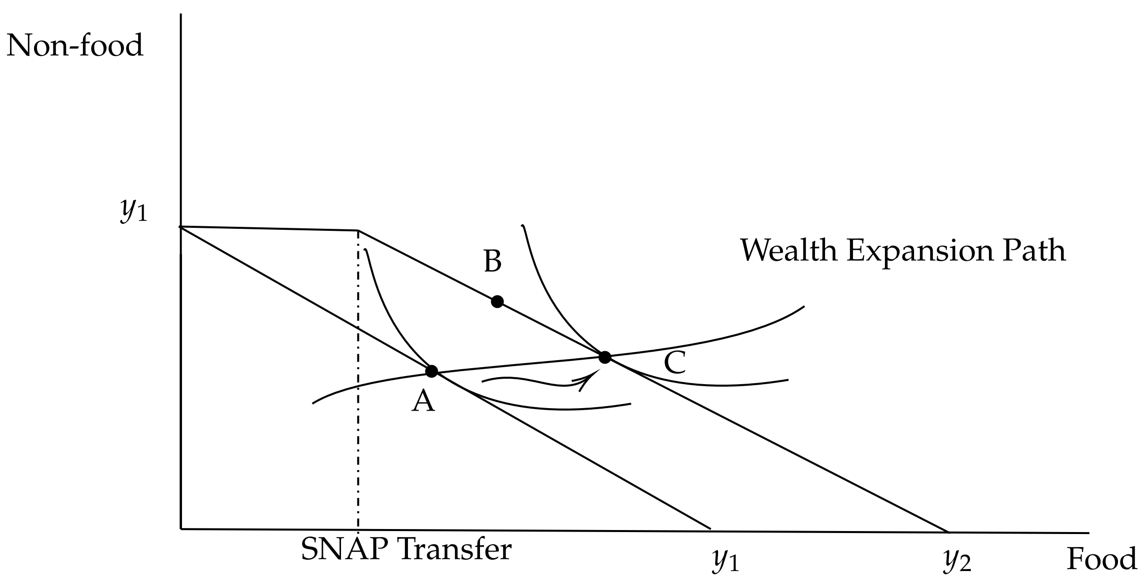
[17]Note that these figures do not capture substitution effects on the overall diet of the household. Our structural model considers a specific mechanism for this behavioral effect and allows us to incorporate

Figure 1: Wealth Expansion Path for Cash Transfer



This figure depicts the wealth expansion path generated by a cash transfer. In this Figure, y_1 is initial income and $y_2 = y_1$+cash transfer. With y_1 wealth one optimizes at point A. When wealth increases due to a cash transfer, one optimizes at point B.

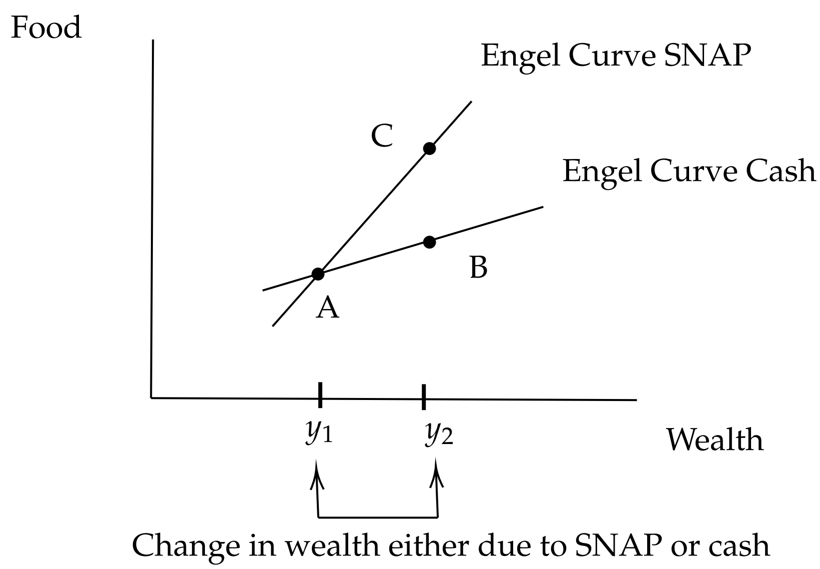
Figure 2: Wealth Expansion Path for SNAP Transfer



This figure depicts the wealth expansion path generated by a SNAP transfer. In this Figure, y_1 is initial income and $y_2 = y_1$+SNAP transfer. With y_1 wealth one optimizes at point A. For a household to treat SNAP and cash equivalently, initial food purchases (prior to SNAP adoption) is somewhere between the dashed vertical line and point y_1 on the horizontal axis. When wealth increases due to a SNAP transfer, one optimizes at point C, despite the availability of point B.

Taking the new optimal points of food purchases, given changes in income due to cash and SNAP, we can outline two different income expansion paths (or Engel curves) based on the form of income. Figure 3 depicts the Engel curves for the scenario presented in Figures 1 and 2. Note that the slopes of the Engel curves are the marginal propensities to consume (MPC) out of the corresponding income type. Our reduced form analysis tests for the equivalence of these slopes.

Figure 3: Engel Curves



This figure depicts the Engel curves for the scenario presented in Figures 1 and 2. Note that the slopes of the Engel curves are the marginal propensities to consume (MPC) out of the corresponding income type. Our reduced form analysis, tests for the equivalence of these slopes among all SNAP eligible products (generically), as well as soda.

We extend this analysis to analyzing differences in the MPC out of cash and SNAP income between products that have SNAP eligible and SNAP ineligible counterparts. The left pane of Figure 4 presents four different income expansion paths: income expansion path for eligible (EL) products out of SNAP, ineligible (IE) products out of SNAP, EL products out of cash and IE products out of cash. In our reduced form analysis, we will estimate the slopes (e.g. the MPCs) of each of these four Engel curves.

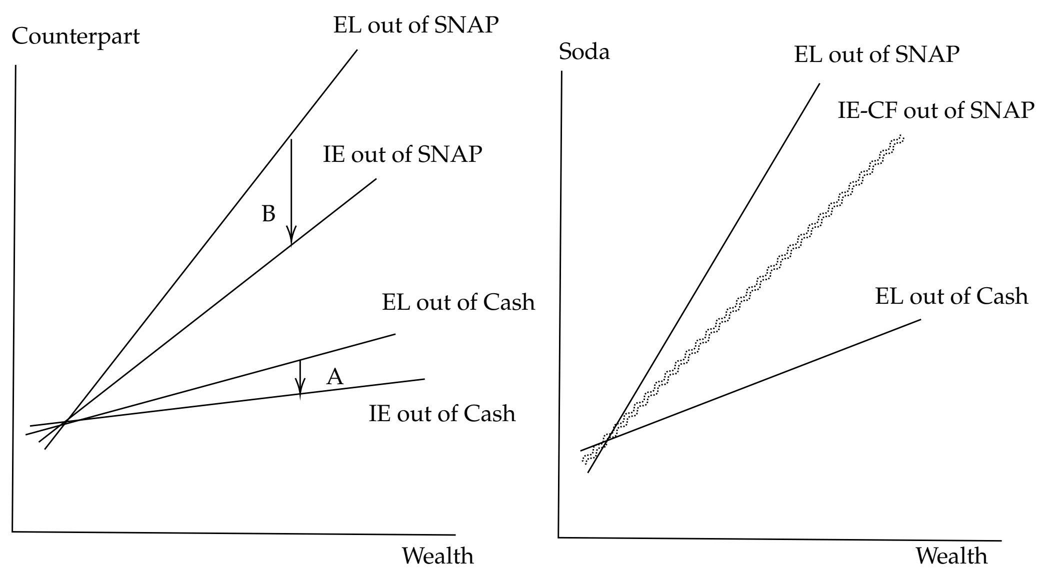
Differences in the slopes of these four Engel curves inform our counterfactual analysis. In Figure 4, the difference in the MPC out of cash between SNAP eligible and ineligible

substitution patterns into the analysis.

products is represented by the distance A; this difference is due to preference differences between eligible and ineligible products. Furthermore, the difference in the MPC out of SNAP between eligible and ineligible products is represented by the distance B; this is due to preference differences between eligible and ineligible products and may be different from the distance A if SNAP eligible products command an implicit preference premium (via a mechanism like the mental account) when income changes are due to SNAP benefits. Hence, the difference between the differences (B-A) is the value of interest.

The right pane of Figure 4 illustrates the counterfactual object of interest: the marginal propensity to consume soda in the event that soda was no longer eligible for purchase with SNAP benefits. Suppose that $B - A > 0$, as depicted in the left pane of Figure 4. The curvy line (labeled IE-CF out of SNAP) depicts the Engel curve for soda (out of SNAP) if SNAP benefits could not be used to purchase soda. Specifically, we expect that the counterfactual Engel curve out of SNAP, to be $\frac{B-A}{MPC_{SNAP|Eligible}}$ percent smaller than the Engel curve out of SNAP when soda is eligible for purchase with SNAP benefits.

Figure 4: Engel Curve Variation Across Eligibility



This figure displays income expansion paths (left pane) which are used to inform the counterfactual income expansion path for soda (right pane) in the event that soda were no longer eligible for purchase with SNAP benefits. The four paths are: income expansion path for eligible (EL) products out of SNAP, ineligible (IE) products out of SNAP, EL products out of cash and IE products out of cash. A=Difference due to imperfect subtitution. B=Total difference. B-A=SNAP preference difference.

3 Data

We utilize household level purchasing data, obtained from a supermarket retailer, that spans from September of 2017 through April of 2021. In their most granular form, an observation in this data set contains the UPC/PLU level purchases made by a household on a particular day, from a specific store location. For each UPC/PLU we know the quantity (and weights, where applicable) purchased, as well as the price paid for that specific item. Each UPC/PLU purchase can then be mapped to the purchasing transaction which includes information regarding the total payment made by the household, for all of the items in their basket, as well as an indicator for whether or not SNAP benefits, WIC benefits and/or TANF benefits were used as a form of payment.[18]

SNAP is an in-kind transfer program meaning that SNAP benefits can be used to purchase food that is meant to be prepared and consumed at home and (or) for seeds that can be used to plant a garden. Practically this means that households can purchase any form of food (baby formula, vegetables, frozen pizza, candy) so long as it is not heated or intended for in-store consumption (e.g. heated deli sandwiches, heated deli soups, heated rotisserie chicken are not SNAP eligible). SNAP benefits cannot be used to buy vitamins or dietary supplements; essentially, any product with a supplement facts label as opposed to a nutrition facts label. Along with the purchasing data, the retailer also provided us with a product hierarchy which indicates whether or not the product is eligible for purchase with SNAP benefits. Within this product hierarchy, we identify products that are eligible for purchase with SNAP (e.g. cold rotisserie chicken) that have close substitutes that are ineligible for purchase with SNAP (e.g. hot rotisserie chicken). We refer to these products as counterpart products. Counterpart products include hot/cold items available in the deli and drinks/drink mixes some of which have a nutrition facts label (SNAP eligible) and some of which have a supplemental facts label (SNAP ineligible).

[18]Since 2004, benefits have been delivered electronically to households via the Electronic Benefits Transfer (EBT) system. Each SNAP household receives a card, similar to a debit card, that is electronically loaded with benefits on the appropriate distribution date for the household. Distribution dates for each household are determined at the state level and all fifty states currently deliver benefits according to a monthly distribution cycle. The amount of benefits a SNAP household receives depends directly on their income and the size of their household.

Within the purchasing data, we identify households that shop at least bi-monthly with the retailer over the time frame of the data set. We exclude households that spend more than five thousand dollars with the retailer in a single month.[19] We define a SNAP household as one that has utilized SNAP as a form of tender with the retailer at any point over the time frame of the data set. We exclude SNAP households who have also utilized WIC and/or TANF as a form of tender with the retailer. Our data set contains 187,775 SNAP households who have not used WIC and/or TANF as forms of tender with the retailer. Within the population of SNAP households, we identify households who have recently adopted SNAP by a purchasing pattern in which SNAP is not used as a form of tender for six months, followed by a period of six months in which SNAP is consecutively used as a form of tender with the retailer. Utilizing this definition of SNAP adoption, 6 percent of SNAP households (11,220 households) adopt SNAP at some point over the time frame of the data set. We further identify households for whom SNAP should be theoretically equivalent to cash as those for whom average SNAP eligible spending is higher in the six months prior to adoption than the average amount of SNAP benefits redeemed in the six months following adoption. Of the SNAP households for whom an adoption spell can be identified, 63 percent (7,090 households) exhibit cash equivalence.[20]

We retain households who have never redeemed any form of government assistance (e.g. SNAP, WIC or TANF) as a form of tender and who are ineligible for stimulus checks. Explicitly, we retain 42,376 households that have income greater than $198 thousand.[21] The rapid policy response to COVID-19 and the ways in which stimulus checks and SNAP benefit increases were implemented leaves very little variation across time in SNAP household exposure to these policies. This creates a need for a group of households who were exposed to other elements of the pandemic that influenced grocery purchases (e.g. restaurant and school closures, lockdown, etc.) but not to the stimulus checks and SNAP benefit policies. These high income households allow us to incorporate year-month fixed effects into our instrumental variables research designs which rely on stim-

[19]Small businesses shop with the retailer, so we exclude households with extremely high levels of spending to avoid including them in the data set.

[20]We omit non-cash equivalent SNAP adoption households from our analysis.

[21]Household income was provided to us from the retailer who collects them from a third party.

ulus checks, SNAP adoption and policy induced increases in SNAP benefit amounts as sources of variation in cash and SNAP income.

One limitation is that we only observe purchases made by the household with the particular retail chain featured in our study.[22] The nature of our identification strategy restricts the households in our featured sample to a subset who are frequent shoppers with the retailer and who are likely to be loyal to the retailer. Upon SNAP adoption, the average household in our data redeems roughly $203 in SNAP benefits as a form of payment with the retailer; SNAP households, living in the states the retailer operates in, received an average of $283 in SNAP benefits per month over the timeframe of our data. Comparisons of these means suggest our retailer captures 72 percent of the household's SNAP benefits.[23] Relatedly, there is evidence that SNAP participation is only weakly related to a household's retailer choice (Ver Ploeg et al. 2015; Hastings and Shapiro 2018).

3.1 SNAP Adoption

Figure 5 depicts the average amount of SNAP tender redeemed in the months leading up to and following SNAP adoption. Upon adoption, the amount of SNAP tender redeemed increases from $0 in the pre-adoption period to roughly $203 in the six months following adoption. We conduct event study analyses around SNAP adoption to obtain estimates of the marginal propensity to consume goods out of SNAP benefits. In these analyses, we incorporate sets of households who do not experience SNAP adoption as way to control for changes in purchasing patterns induced by the COVID-19 pandemic. The inclusion of these households allows us to incorporate year-month fixed effects into our event study design and establishes the identification of our event study estimates separately from the time fixed effects since these sets of households never experience treatment (e.g. SNAP adoption) (Borusyak, Jaravel and Spiess 2022). We present estimates that utilize two dif-

[22] As is common with retail scanner data, our data reflect purchases, not the actual amount consumed. We refer to quantity purchased when using the word "consume" in MPC.

[23] Mean household expenditures on food at home by SNAP eligible non-participants is reported to be $292 per month (Consumer Expenditure Interview Survey in 2010), while SNAP participants were reported to spend $380 per month (Mabli and Malsberger 2013). In our data, households average spending on SNAP eligible food prior to SNAP adoption is $501 per month pre-COVID ($567 per month post-COVID) and $586 per month after adoption ($639 post-COVID).

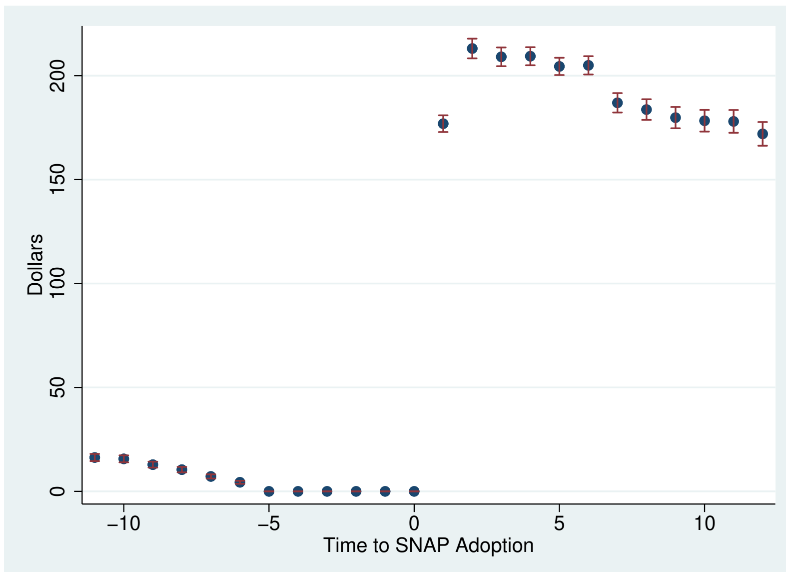
ferent sets of control households: (1) high income households who are ineligible for stimulus checks and (2) high income households who are ineligible for stimulus checks and SNAP households who never experience SNAP adoption. Our equation of interest is:

$$y_{ht} = \beta_0 + \sum_{e=-11}^{e=12} \beta_e 1\{EventTime = e_{ht}\} + \gamma_h + \gamma_t + \gamma_t \times 1\{SNAPHH_h\} + \epsilon_{ht} \qquad (1)$$

where y_{ht} represents the outcome for household h in year-month t, $1\{EventTime = e_{ht}\}$ is an indicator that turns to one when the household is e months from SNAP adoption, γ_h represents household fixed effects to control for any time invariant preferences over food purchases, γ_t represents year-month fixed effects, $1\{SNAPHH_h\}$ is an indicator for whether the household has ever utilized SNAP as a form of payment with the retailer and ϵ_{ht} represents the error term. The interaction between the year-month fixed effects and the indicator for having ever utilized SNAP as a form of payment allows for differential shocks to high and low income (e.g. SNAP household) purchasing patterns over time. For estimates where only the high income households are included as controls, the year-month fixed effect interacted with the indicator for being a SNAP household is dropped from the estimating equation. We cluster standard errors at the household level.

Figure 6 illustrates the event study estimates for SNAP eligible purchases, soda, eligible counterpart purchases and ineligible counterpart purchases around SNAP adoption. In each of these figures, we plot the event study estimates obtained from regressions which utilize high income households as controls and regressions which utilize high income and SNAP households without an adoption event as controls. The estimates in Figure 6 provide little evidence for changes in purchasing habits prior to SNAP adoption; furthermore, the point estimates which utilize only the high income households as controls are extremely similar to the estimates which utilize both high income and SNAP households without an adoption event as controls. Our event study estimates indicate a marginal propensity to consume out of SNAP of 0.30 to 0.38 for SNAP eligible items, 0.012 to 0.016 for soda, 0.005 to 0.006 for eligible counterpart products and 0.001 to 0.002 for ineligible counterpart products. Averages, provided in the appendix, indicate pre-COVID (post-COVID) MPCs out of SNAP to be 0.47 (0.31) for SNAP eligible products, 0.02 (0.02) for soda, 0.007 (0.006) for SNAP eligible counterparts and 0.000 (0.000) for SNAP ineligible counterparts.[24] Our estimates of the MPC out of SNAP are well aligned with the literature which estimates the MPC to consume food out of SNAP to be between 0.30 and 0.64 (Hastings and Shapiro 2018; Leung and Seo 2023; Song 2022; Beatty and Tuttle 2015; Bruich 2014). Estimates of the MPC soda out of SNAP benefits are between 0.0 and 0.03 (Cohen and Young 1993; Fraker et al. 1992; Ohls et al. 1992).

Figure 5: SNAP Tender Around Recent SNAP Adoption



This figure depicts the amount of SNAP tender redeemed in the months leading up to and following SNAP adoption. Upon SNAP adoption, the amount of SNAP tender redeemed increases from $0 in the pre-adoption period to roughly $203 in the six months following adoption.

[24] Averages utilizing data that spans May 2014 through October 2017, provided in the appendix, indicate MPCs out of SNAP to be 0.59 for SNAP eligible products, 0.03 for soda, 0.011 for SNAP eligible counterparts and 0.002 for SNAP ineligible counterparts.

Figure 6: Spending Event Study Estimates

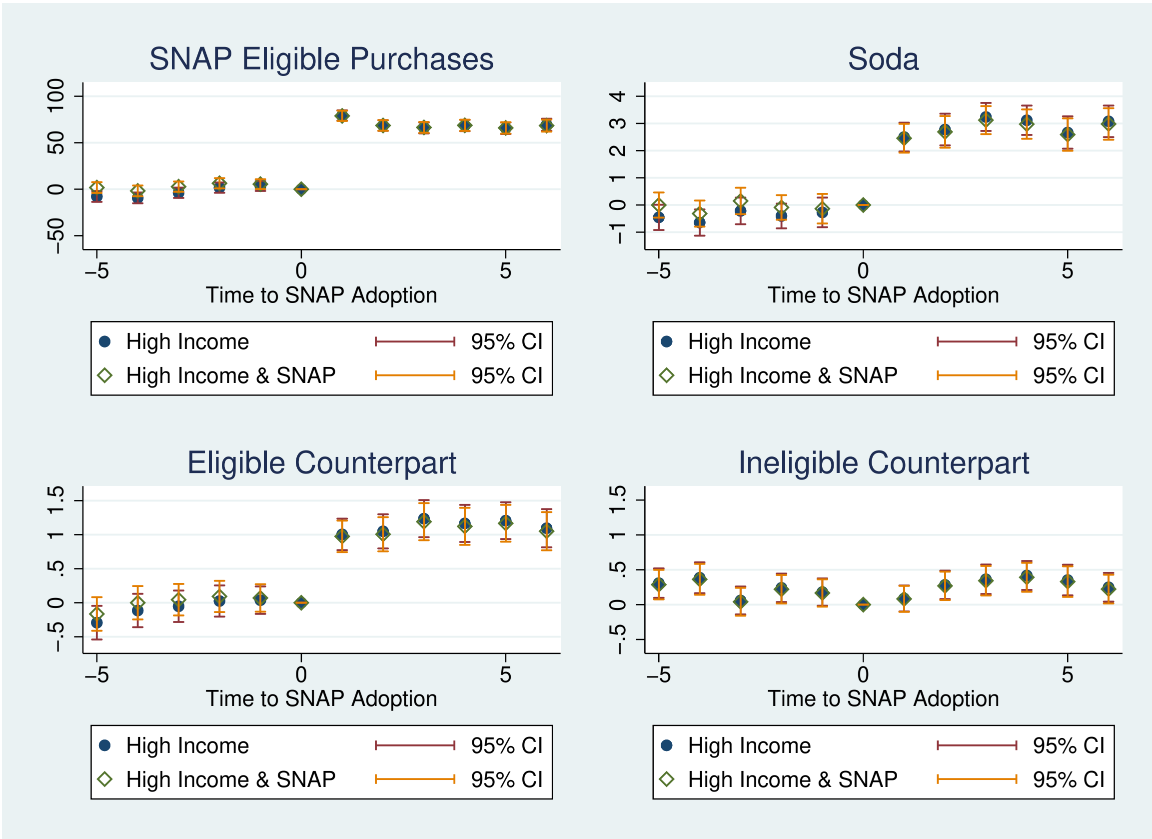


Figure 6 illustrates the event study estimates for SNAP eligible purchases, soda, eligible counterpart purchases and ineligible counterpart purchases around SNAP adoption. In each of these figures, we plot the event study estimates obtained from regressions which utilize high income households as controls and regressions which utilize high income and SNAP households without an adoption event as controls. Our event study estimates indicate a marginal propensity to consume out of SNAP of 0.34 for SNAP eligible items, 0.014 for soda, 0.0054 for eligible counterpart products and 0.0014 for ineligible counterparts.

3.2 Policy Induced Changes to SNAP Benefits

We isolate additional sources of variation in SNAP income due to policy changes that occurred during the COVID-19 pandemic. Emergency Allotments or EA benefits are one of the SNAP policy options that were created at the onset of the COVID-19 pandemic. This particular policy option removed income deductions from the benefit amount a household would receive; in other words, all SNAP households, regardless of income, were issued the maximum benefit amount given their household size. Almost all states adopted EA benefits as a policy option in March or April of 2020. Two of the states the retailer operates in adopted EA benefits in March of 2020, while the remaining four adopted EA benefits in April of 2020. While EA benefits have recently begun to sunset as a policy option, they remain active through the end of the time frame of our data set (April 2021).

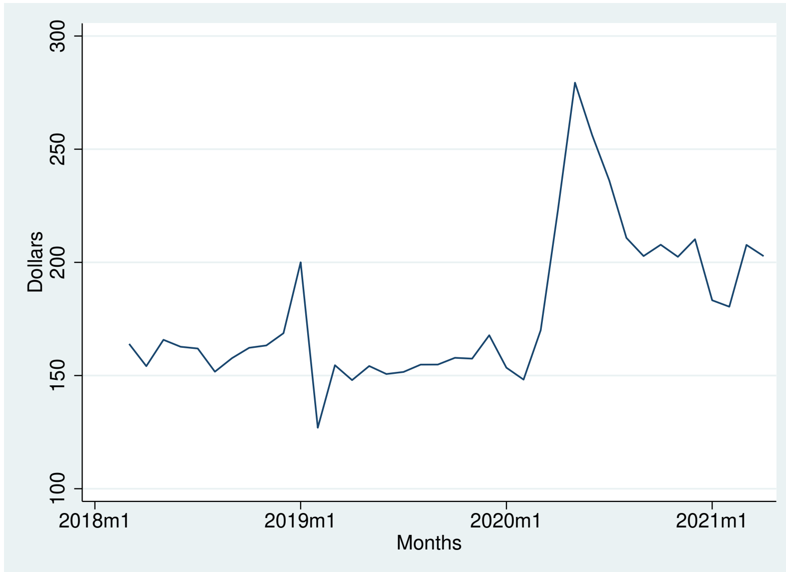
Figure 7 plots the mean SNAP benefits redeemed at the retailer, conditional on recent SNAP adoption, between March 2018 and April 2021.[25] Figure 7 illustrates that prior to March 2020, mean benefits remain fairly stable at $150 per month with the exception of January 2019 when SNAP recipients were paid both their January and February 2019 benefits in response to a shutdown of the federal government.[26] After the introduction and adoption of EA benefits in March/April of 2020, the mean benefit amount redeemed sharply increases to $280 in May of 2020 and then declines to roughly $210 in August of 2020. It is very likely that the sizable increase in SNAP benefits between May and July 2020 is due to the payment of Pandemic EBT benefits (P-EBT benefits). These benefits were paid to SNAP beneficiaries with school aged children and free and reduced price school lunch recipients to replace the value of missed school meals due to school closures. Although the exact timing of these early P-EBT payments payments is difficult to confirm, state documents indicate that many payments were planned to be distributed in late April and late May.[27] Due to the large run-up and subsequent decline in benefits between March and July of 2020, we present reduced form results with all time periods and results that omit March 2020 through July 2020. Figure 7 motivates our utilization of changes in SNAP benefit policies as additional instruments for SNAP income.

[25] This figure is replicated in the appendix utilizing the set of all SNAP households (e.g. unconditional on recent adoption).

[26] In February of 2019, many SNAP recipients received no benefits. However, some states paid half of the March 2019 benefit in February of 2019.

[27] Based on what we could find, P-EBT benefits were planned to be distributed in late April and May (state 1), late April and a second payment made at an unknown date (state 2), end of May (state 3), end of May (state 4), end of May (state 5) and late April and May (state 6).

Figure 7: Mean SNAP Benefits Redeemed



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3.3 Stimulus Checks

We isolate variation in cash expenditures due to changes in cash income by leveraging variation in the timing and generosity of stimulus check payments. Over the course of the pandemic, three stimulus checks were sent to households in April 2020, January 2021, and March 2021. The amounts and eligibility of these checks varied over the course of the pandemic. For example, the first check distributed $1,200 per adult and $500 per child, the second distributed $600 per person and the final check awarded $1,400 per person. Finally, married households (filing jointly) with incomes at or below $198 thousand, $174 thousand, and $160 thousand were eligible for some form of stimulus in the first, second and third round, respectively.[28] Most of these checks were direct deposited to eligible

[28]Single filers with incomes at or below $99 thousand, $87 thousand and $80 thousand were eligible for some form of stimulus payment in the first, second and third round, respectively. Heads of households with incomes at or below $136.5 thousand, $124.5 thousand and $120 thousand were eligible for some form

household's bank accounts on 4/15/20, 1/4/21, and 3/17/21 (Chetty et al. 2023).[29]

Figure 8 depicts weekly mean cash expenditure for our set of SNAP households and our set of stimulus ineligible households (e.g. households with a reported income greater than 198 thousand) over time. The solid vertical lines indicate the modal week in which stimulus checks were deposited; the first stimulus check was deposited on 4/15/20, the second on 1/4/21 and the third on 3/17/21. The dashed vertical lines correspond to the second week of April 2020 and the second week of March 2021 because some stimulus checks were deposited on 4/14/20 and 3/13/21.

Figure 8 illustrates that SNAP households and stimulus ineligible households generally tend to illustrate the same trends in cash expenditures over time. The large spike in cash spending prior to the deposit of the first stimulus check corresponds with the second and third week of March when many households were stocking up on groceries and home supplies due to lockdowns. Surprisingly, the set of SNAP households tends to spend roughly $30 more with the retailer each week, on average. This is likely due to low income households being more likely to use this retailer to cover more of their general shopping needs (e.g. clothing, toys, electronics, beauty products, sporting goods etc.) relative to high income households. Notably on the modal date of deposit of the first stimulus check, cash expenditure for stimulus eligible households increases while it decreases for stimulus in-eligible households. In addition, on the modal week of deposit for the third stimulus check, weekly cash expenditure for stimulus eligible individuals indicates a sharp increase, while stimulus in-eligible households illustrate a more modest increase. The weekly percent change in spending for stimulus eligible households on the modal week of the first (third) stimulus check is 2.2% (7.9%) while the percent change in spending for stimulus in-eligible households is -3.9% (1.4%).

On the week of the second stimulus check, both stimulus eligible and stimulus ineligible households illustrate a sharp decline in cash spending; decreased spending in the first week of January is a normal seasonal spending pattern which is also observed in Jan-

of stimulus payment in the first, second and third round, respectively.

[29] Note that some households received the first check on 4/14/20 and some households received the third check on 3/13/21.

uary 2018-January 2020.[30] The percent change in weekly spending is -18.5% for stimulus eligible households and -16.0% for stimulus ineligible households. There are a number of reasons that the second stimulus check may not have generated as noticeable of changes in cash expenditure with the retailer. First, the second stimulus check was considerably less generous than the first and third checks. Second, the timing of the payment may have led stimulus eligible households to utilize this money to pay off bills that may have accumulated during the holiday season. Consistent with this hypothesis, Chetty et al. (2023) find that even after adjusting for the generosity of stimulus payments made, the second stimulus payment had the lowest impact on consumer spending, of the three stimulus payments, for the bottom quartile of the income distribution. Figure 8 motivates our utilization of stimulus checks as instruments for cash income.

Figure 8: Weekly Cash Expenditures

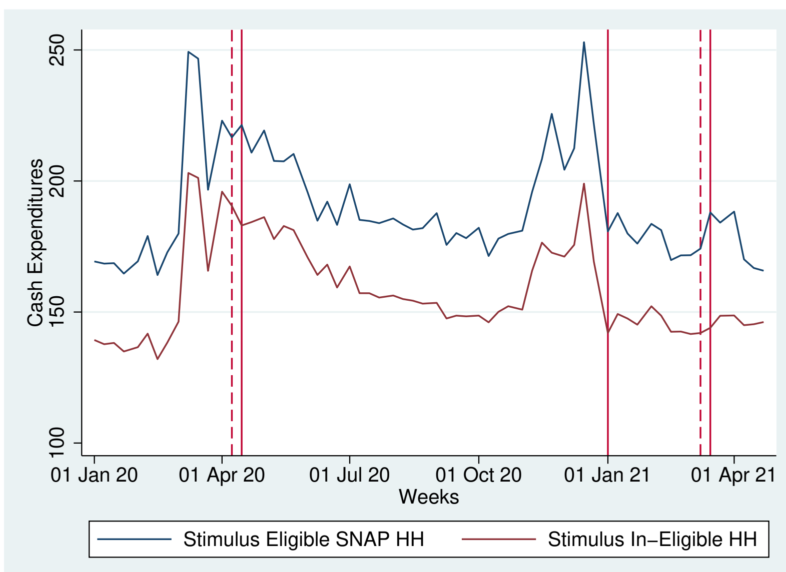


Figure 8 depicts weekly mean cash expenditure for our set of SNAP households and our set of stimulus ineligible households (e.g. households with a reported income greater than 198 thousand) over time. The solid vertical lines indicate the modal week in which stimulus checks were deposited; the first stimulus check was deposited on 4/15/20, the second on 1/4/21 and the third on 3/17/21. The dashed vertical lines correspond to the second week of April 2020 and the second week of March 2021 because some stimulus checks were deposited on 4/14/20 and 3/13/21.

[30]This part of the series is omitted from Figure 8 so that we may better focus on the weeks of stimulus payments but is available upon request.

4 Reduced Form Analysis

We evaluate differences in the marginal propensities to consume SNAP eligible and SNAP ineligible counterpart products out of cash and SNAP income. We do this by regressing SNAP eligible and SNAP ineligible counterpart sales on cash and SNAP expenditure. Explicitly we estimate the following model:

$$\begin{aligned} Sales_{eht} = {} & \beta_0 + \beta_1 Cash_{ht} + \beta_2 Cash_{ht} \times 1\{SNAPEligible_e\} + \beta_3 SNAP_{ht} + \beta_4 SNAP_{ht} \\ & \times 1\{SNAPEligible_e\} + \beta_5 1\{SNAPEligible_e\} + \gamma_t + \gamma_t \times 1\{SNAPEligible_e\} + \gamma_h + \epsilon_{eht} \end{aligned} \tag{2}$$

where $Sales_{eht}$ represents the expenditure on counterpart food with SNAP eligibility status e, for household h, in year-month, t, $Cash_{ht}$ is cash expenditure over grocery and non-grocery products, $1\{SNAPEligible_e\}$ is indicator that turns to one when the food is eligible for purchase with SNAP benefits, $SNAP_{ht}$ is the amount of total expenditure paid for with SNAP benefits, while γ_t and γ_h represent year-month and household fixed effects. Standard errors are clustered at the household level.

The marginal propensity to consume out of cash (MPC_{Cash}), given that the food is SNAP eligible (ineligible), is $\beta_1 + \beta_2$ (β_1). While the MPC out of SNAP (MPC_{SNAP}), given that the food is SNAP eligible (ineligible), is $\beta_3 + \beta_4$ (β_3). The difference in the MPC out of cash between the SNAP eligible and SNAP ineligible food, β_2, may be due to differences in consumer preferences over the types of products that are SNAP eligible vs. ineligible.[31] The difference in the MPC out of SNAP between the SNAP eligible and SNAP ineligible food, β_4, captures the pre-existing difference in consumer preferences over the types of products that are SNAP eligible vs. ineligible (β_2) and the additional change in the MPC for SNAP eligible products when utilizing SNAP tender. The difference in the difference between the MPC out of SNAP and the MPC out of cash for SNAP eligible and SNAP ineligible products is given by $(MPC_{SNAP|Eligible} - MPC_{SNAP|Ineligible}) - (MPC_{Cash|Eligible} - MPC_{Cash|Ineligible}) = (\beta_3 + \beta_4 - \beta_3) - (\beta_1 + \beta_2 - \beta_1) = \beta_4 - \beta_2$. We interpret $\beta_4 - \beta_2$ as the

[31] The term β_3 captures a disturbance to the marginal propensities to consume SNAP eligible and SNAP ineligible food generated by the use of SNAP tender. This disturbance term could simply be due to the income shock associated with receiving SNAP benefits.

amount of $MPC_{SNAP|Eligible}$ that is due to the fact that the food is eligible for purchase with SNAP. We also interpret the estimate of $\beta_4 - \beta_2$ relative to the estimated $MPC_{SNAP|Eligible}$, $\frac{\beta_4-\beta_2}{\beta_3+\beta_4}$, in order to understand the percentage of $MPC_{SNAP|Eligible}$ that is due to the fact that the food is eligible for purchase with SNAP.

We isolate exogenous variation in $SNAP_{ht}$ by identifying periods of recent SNAP adoption and by utilizing indicators for the introduction of Emergency Allotments. We present estimates that interact SNAP adoption with the indicator for EA benefits as well as estimates that utilize the instruments without interactions. Finally, we interact each of these instruments with the indicator for SNAP eligibility in order to construct additional instruments for the interaction between SNAP payment and SNAP eligibility.

We isolate exogenous variation in $Cash_{ht}$ by utilizing variation in the timing and generosity of stimulus checks. We create a variable, $StimulusperPerson_{ht}$, capturing the maximum amount of payment made to an income eligible adult for the three stimulus payments. This variable takes the value \$1,200 in April 2020, \$600 in January 2021, \$1,400 in March 2021 and zero in all other months for SNAP households.[32] We interact the stimulus per person variable with the indicator for SNAP eligibility in order to construct an additional instrument for the interaction between cash and SNAP eligibility.

4.1 Results

Table 1 presents results utilizing SNAP eligible and SNAP ineligible food counterpart sales as the outcome variable. Panel A of Table 1 presents the regression output and Panel B presents the estimated $MPCF_{SNAP|Eligible}$ as well as the percentage of $MPCF_{SNAP|Eligible}$ that is due to SNAP eligibility. Column one contains the two-stage least squares estimates which utilize SNAP adoption, the introduction of EA benefits and SNAP adoption interacted with the introduction of EA benefits as the instruments, column two contains results which utilize SNAP adoption and the interaction between SNAP adoption and the introduction of EA benefits as instruments, columns three and four utilize only SNAP adoption and only the introduction of EA benefits as instruments, respectively. Column

[32] This variable is zero in all months for households with an income greater than \$198 thousand.

five replicates column one, but omits March - July 2020 (the first five months of pandemic) from the data. All results utilize stimulus checks as instruments for cash income.

Panel B of Table 1 presents the estimated marginal propensities to consume. The marginal propensity to consume the SNAP eligible counterpart out of SNAP income ranges between 0.007 and 0.008, while the marginal propensity to consume the SNAP ineligible counterpart out of cash ranges between 0.001 to 0.002. Notably, across four of the five specifications in Panel A, the estimated coefficient for the difference between $\beta_{SNAP|Eligible} - \beta_{Cash|Eligible}$, which represents the amount of $MPCF_{SNAP|Eligible}$ that is due to the fact that the food is eligible for purchase with SNAP, is statistically significant and positive at the five percent significance level. Results utilizing only EA benefits as an instrument for SNAP income, column (4), indicate a positive but statistically insignificant difference between $\beta_{SNAP|Eligible} - \beta_{Cash|Eligible}$. Columns (1) through (5) indicate that the estimated amount of the $MPC_{SNAP|Eligible}$ that is due to the fact that the food is eligible for purchase with SNAP is between 0.004 to 0.007; these findings indicate that 57 to 88 percent of the $MPC_{SNAP|Eligible}$ is due to SNAP eligibility.

Alternative reduced form results are available in the appendix. First we present results utilizing households who live in states that do not levy taxes on food or soda. This alleviates concerns associated with the slope of the budget line changing (due to tax exemptions) when the household pays for SNAP eligible items with SNAP benefits. These results indicate that 73 to 81 percent of the $MPC_{SNAP|Eligible}$ is due to SNAP eligibility.[33] Second we present results which utilize SNAP eligible and ineligible food (more broadly) as the outcome variable. These results indicate that 61 to 82 percent of the $MPC_{SNAP|Eligible}$ is due to SNAP eligibility.[34]

[33]Results utilizing only EA benefits as an instrument for SNAP income indicate that 17% of the $MPC_{SNAP|Eligible}$ is due to SNAP eligibility. The estimated coefficient on the interaction between cash spending and the indicator of eligibility is the reason for this discrepancy in findings. In column (4), of the restricted sample, this coefficient is noticeably larger (0.0025) relative to all other sets of estimates (0.0006 to 0.0018). A larger coefficient on the interaction between cash spending and the indicator of eligibility leads to the smaller percentage out of $MPC_{SNAP|Eligible}$ that can be accounted for by eligibility.

[34]Results utilizing only EA benefits as an instrument for SNAP income indicate that -70% of the $MPC_{SNAP|Eligible}$ is due to SNAP eligibility. Once again, the estimated coefficient on the interaction between cash spending and the indicator of eligibility is the reason for this discrepancy in findings. In column (4), this coefficient is noticeably larger (0.61) relative to all other sets of estimates (0.33 to 0.40).

Table 1: MPC SNAP Eligible Counterpart vs Ineligible Counterpart

Panel A: Two Stage Least Squares Estimates					
	All Time Periods				March-July 2020 Omitted
	(1)	(2)	(3)	(4)	(5)
Cash	0.000426	0.000006	0.000290	-0.000160	0.00120*
	(0.000558)	(0.000492)	(0.000473)	(0.000639)	(0.000662)
Cash x 1{Eligible}	0.00103	0.00124*	0.00112	0.00175*	0.000635
	(0.000848)	(0.000750)	(0.000728)	(0.00105)	(0.000987)
SNAP	0.000343	0.000333	0.000422	0.00142	0.000388
	(0.000900)	(0.000851)	(0.000829)	(0.00122)	(0.00103)
SNAP x 1{Eligible}	0.00766***	0.00741***	0.00758***	0.00599**	0.00786***
	(0.00183)	(0.00170)	(0.00168)	(0.00246)	(0.00206)
Product by Year-Month f.e.	X	X	X	X	X
Household f.e.	X	X	X	X	X
Observations	20,253,288	20,253,288	20,253,288	20,253,288	17,951,778
Households	230,151	230,151	230,151	230,151	230,151

Instruments	(1)	(2)	(3)	(4)	(5)
$Stimulus\ per\ Person_{ht}$	X	X	X	X	X
$1\{SNAP\ Adoption_{ht}\}$	X	X	X		X
$1\{EA\ Benefits_{s(h)t}\}$	X			X	X
$1\{EA\ Benefits_{s(h)t}\} \times 1\{SNAP\ Adoption_{ht}\}$	X	X			X

Panel B: Estimated Marginal Propensities to Consume					
MPCs	(1)	(2)	(3)	(4)	(5)
$MPC_{SNAP}\|Eligible$	0.0080024***	0.0077449***	0.0079975***	0.0074053***	0.0082493***
	(0.0010123)	(0.0009792)	(0.0009694)	(0.0014021)	(0.001125)
$MPC_{Cash}\|Eligible$	0.0014515**	0.0012477**	0.0014072**	0.0015853*	0.0018396**
	(0.0007033)	(0.0005995)	(0.0005768)	(0.0008176)	(0.00081460)
$\beta_{SNAP\|Eligible} - \beta_{Cash\|Eligible}$	0.0066337**	0.0061707**	0.0064576***	0.0042415	0.0072261**
	(0.0026643)	(0.002436)	(0.0023931)	(0.0034973)	(0.0030381)
Percent of MPC_{SNAP} due to Eligibility	82.9	79.7	80.7	57.3	87.6

This table presents results utilizing SNAP eligible and SNAP ineligible food counterpart sales as the outcome variable. Panel A presents the regression output and Panel B presents the estimated $MPC_{SNAP|SNAPEligible}$ as well as the percentage of $MPC_{SNAP|SNAPEligible}$ that is due to SNAP eligibility. Standard errors in parentheses; clustered at the household level. In the data set utilized to construct this table, there are two observations for each household-month: one for the eligible product and one for the ineligible product. Furthermore, the dataset spans 44 months. Hence the total number of observations is 230,151 households x 44 months x 2 product types = 20,253,288.

4.2 Marginal Propensity to Consume Soda

We modify Equation 2 to obtain estimates of the MPC soda out of cash and SNAP benefits. Explicitly we estimate regressions of the following form:

$$SodaSales_{ht} = \beta_0 + \beta_1 Cash_{ht} + \beta_2 SNAP_{ht} + \gamma_t + \gamma_h + \epsilon_{ht} \tag{3}$$

where $SodaSales_{ht}$ represents the expenditure on soda (diet and non-diet), for household h, in year-month, t, $Cash_{ht}$ is cash expenditure over grocery and non-grocery products, $SNAP_{ht}$ is the amount of total expenditure paid for with SNAP benefits, while γ_t and γ_h represent year-month and household fixed effects. Standard errors are clustered at the household level.

Table 2 displays the results. Column one contains the two-stage least squares estimates which utilize SNAP adoption, the introduction of EA benefits and SNAP adoption interacted with the introduction of EA benefits as the instruments, column two contains results which utilize SNAP adoption and the interaction between SNAP adoption and the introduction of EA benefits as instruments, columns three and four utilize only SNAP adoption and only the introduction of EA benefits as instruments, respectively. Column five replicates column one, but omits March - July 2020 (the first five months of pandemic) from the data. All results utilize stimulus checks as instruments for cash income.

Table 2 indicates that the MPC soda out of cash is between 0.022 to 0.024, while the MPC soda out of SNAP is between 0.027 to 0.029. Notably, for four of the five specifications, the difference between the MPC_{Cash} and MPC_{SNAP} is statistically significant (e.g. $MPC_{SNAP} > MPC_{Cash}$). The one exception to this is in column (4), where only EA benefits are used as an instrument for SNAP income; while the estimated MPC out of SNAP is larger than the estimated MPC out of cash, the two are not statistically distinguishable. Results utilizing households who live in states that do not levy taxes on food or soda are available in the appendix and are largely robust.[35]

[35] They indicate a MPC soda out of cash between 0.023 to 0.025 and MPC soda out of SNAP of 0.028; equivalence is rejected, at the 10% significance level, for two of the four specifications. Results using only EA benefits as a source of variation in SNAP income indicate a MPC soda out of cash of 0.028 and a MPC soda out of SNAP of 0.024. For this specification, we fail to reject equivalence.

Table 2: MPC Soda

Soda: Two Stage Least Squares Estimates					
	All Time Periods				March-July 2020 Omitted
	(1)	(2)	(3)	(4)	(5)
Cash	0.0224***	0.0234***	0.0230***	0.0241***	0.0235***
	(0.00147)	(0.00121)	(0.00119)	(0.00157)	(0.00174)
SNAP	0.0286***	0.0290***	0.0288***	0.0273***	0.0292***
	(0.000795)	(0.000913)	(0.000867)	(0.00154)	(0.000888)
Year Month f.e.	X	X	X	X	X
Household f.e.	X	X	X	X	X
Observations	10,126,644	10,126,644	10,126,644	10,126,644	8,975,889
Households	230,151	230,151	230,151	230,151	230,151

	(1)	(2)	(3)	(4)	(5)
p-value for null of equality	0.000	0.000	0.000	0.241	0.002

Instruments	(1)	(2)	(3)	(4)	(5)
$Stimulus\ per\ Person_{ht}$	X	X	X	X	X
$1\{SNAP\ Adoption_{ht}\}$	X	X	X		X
$1\{EA\ Benefits_{s(h)t}\}$	X			X	X
$1\{SNAP\ Adoption_{ht}\} \times 1\{EA\ Benefits_{s(h)t}\}$	X	X			X

This table presents estimates of the MPC soda out of cash and SNAP income. Standard errors are in parentheses and clustered at the household level. The reported p-value is for the null hypothesis of: $MPC_{Cash} = MPC_{SNAP}$.

4.3 Discussion and Interpretation

Our estimates of the marginal propensity to consume soda out of SNAP are between 0.027 to 0.029. Mean monthly SNAP benefits redeemed at the retailer upon SNAP adoption are roughly $200. Given an increase of SNAP income of $200, we would expect a $5.40 to $5.80 increase in soda spending. According to the estimates for counterpart SNAP eligible and ineligible products, if soda were no longer eligible for purchase with SNAP, we would expect the marginal propensity to consume soda out of SNAP to decline by 57 to 88 percent. Thus, reasonable counterfactual marginal propensities to consume soda, out of SNAP benefits given that soda is SNAP ineligible, lie between 0.003 to 0.012.[36] Given an increase in SNAP income of $200, we would expect a $0.65 to $2.49 increase in soda spending in the counterfactual scenario in which soda is no longer eligible for purchase with SNAP benefits.[37] Relative to post-SNAP adoption mean soda spending ($23), our counterfactual estimates of the increase in soda spending indicate that making soda ineligible for purchase with SNAP would reduce soda spending by 14.4 to 20.7 percent.[38]

We have identified a preference deviation in favor of SNAP eligible products. We formalize a possible mechanism that rationalizes the reduced form findings by specifying and estimating a food demand model with mental accounting. Modeling household behavior is important for estimating the effects of a SNAP policy counterfactual because they may alter their purchasing patterns of all goods. For example, if soda became ineligible, then households may allocate additional SNAP dollars towards juice. Accounting for this substitution effect is important for an accurate estimate of the effect of the policy change on the nutritional composition of foods purchased.

[36] These counterfactual MPCs are found by multiplying the current MPC by (1-0.88). For example, the lower bound is found by multiplying 0.027 with 0.12.

[37] These bounds represent a 57 to 88 percent reduction in the amount that soda purchases increase by upon SNAP adoption.

[38] These bounds are calculated by comparing the counterfactual expected increase in soda purchases to the mean soda purchase after SNAP adoption: (5.40-0.65)/23= 0.207 and (5.80-2.49)/23 = 0.144.

5 Structural Model and Estimation

A key aspect that the reduced form estimates show is that a standard demand model cannot rationalize the observed spending patterns as households whose SNAP is equivalent to cash do not treat it as such. One possible explanation of this is mental accounting, which we consider for our main analysis. A similar "behavioral" explanation is one of preferences over SNAP eligible products that only activate when one has SNAP; we explore this mechanism in Appendix E. Both models acknowledge that a simple product preference for products labeled "SNAP eligible" is not sufficient to explain behavior, thus motivating a deviation from a standard framework.

We now specify and estimate a formal model to account for substitution patterns that may occur in the wake of a policy which removes soda from being eligible for purchase with SNAP benefits. We incorporate mental accounting into the decision making process of the household as the mechanism through which a bias is developed in favor of SNAP eligible products. The model we propose extends Hastings and Shapiro (2018), which itself was based on Farhi and Gabaix (2020). In contrast with Hastings and Shapiro (2018), we estimate our structural model across multiple product categories in order to evaluate a policy counterfactual that incorporates mental accounting.

5.1 Behavioral Demand Model

In each time-period (month), the household receives benefits, b, greater than or equal to zero ($b \geq 0$) and cash income, y, greater than or equal to zero ($y \geq 0$). The household chooses quantities (to purchase) for various products x: q_x including SNAP eligible food, SNAP ineligible food, SNAP eligible soda, SNAP eligible soda substitutes, and non-food. The household's budget constraint is given in equation (4), where the household can use their SNAP benefits b to subsidize their eligible food purchases. Note that ineligible good, IE, expenditures are separated in the budget because SNAP cannot be used for them.

$$\sum_{x \in IE} p_x q_x + \max\left\{0, \sum_{x \in EL} p_x q_x - b\right\} \leq y \tag{4}$$

In a traditional setup, the household's goal is to maximize utility $U(\mathbf{q}_x)$ subject to the budget constraint. We augment this setup by having the household maximize utility that is also penalized by mental accounting:

$$\mathcal{M} = -\mathbb{1}[b > 0]\frac{\delta}{2}\left[\tau + b - \sum_{x \in EL} p_x q_x\right]^2. \tag{5}$$

The mental accounting term, $\mathcal{M}$, captures the household's desire to allocate SNAP b solely to eligible good EL purchases, where $\tau \geq 0$ is their "ideal" level of eligible spending beyond b and $\delta \geq 0$ is the importance of deviating from the ideal. The houshold does not have a direct preference over eligibility, but rather eligibility influences their decision via the mental account.[39]

$$\max_{\mathbf{q}_x \geq 0} U(\mathbf{q}_x) \exp\left(\mathcal{M}\right) \quad s.t. \sum_{x \in IE} p_x q_x + \max\left\{0, \sum_{x \in EL} p_x q_x - b\right\} \leq \; y \tag{6}$$

Consider an example: suppose τ is equal to the optimal level of eligible spending if $b = 0$. Then the mental account says that the household thinks of their SNAP as simply allowing them to spend more on eligible products than they did before (from τ to $\tau + b$), not internalizing the fact that they could buy the same amount of eligible products as before (using all of their SNAP in the process) and have more leftover cash in their budget. In other words, a non-behavioral household (i.e. with $\delta = 0$) could just buy τ dollars of eligible products and have their cash income minus whatever their SNAP did not cover on τ leftover for ineligible products: $y - (\tau - b)$. In this case, the mental account biases the household in favor of buying more eligible products whenever they have SNAP.

The counterfactual of soda (product g_1) no longer being SNAP eligible results in two changes. First, the budget constraint changes (IE and EL denote the old ineligible and eligible product groupings): $\sum_{x \in \{IE, g_1\}} p_x q_x + \max\left\{0, \sum_{x \in EL \setminus \{g_1\}} p_x q_x - b\right\} \leq \; y$, meaning that soda cannot be bought using SNAP anymore. For households whose SNAP would be equivalent to cash absent mental accounting (meaning they buy more eligible products

[39]Instead of a mental account, we might also think that the household preferences change once they receive SNAP because they internalize the "eligibility" status as a product characteristic and thus put a premium on them. We derive and estimate such an alternative model in Appendix E.

than their allotment b), the budget constraint does not meaningfully change. For the rest, the counterfactual policy affects their budget as now soda must be purchased with cash.

The second effect of the counterfactual policy is that soda is removed from the mental account, such that $\mathcal{M} = -\mathbb{1}[b > 0]\frac{\delta}{2}\left[\tau + b - \sum_{x \in EL \setminus \{g_1\}} p_x q_x\right]^2$. This implies that soda is ignored when determining the ideal eligible purchase level. If the target level is large, then removing soda from the account would lead to lower soda purchases, as now the household is incentivized to fill the mental account gap with other eligible products, such as soda substitutes.[40]

Beyond these direct effects, there may be substitution from the now ineligible soda to an eligible sweet beverage (juice for example) after the policy change. Substitution from soda to juice is an important factor to incorporate if our end goal is a nutritional evaluation of making soda ineligible for purchase with SNAP. With the policy change, the uncompensated demand for soda decreases due to both the mental accounting augmented budget effect and substitution. Our reduced form specification approximates how soda changes when it becomes ineligible. The substitution effect we are primarily interested is not a cross-price elasticity because the price for soda is not necessarily higher from being ineligible. The substitution is being driven by the fact that juice remains eligible.

Let the utility function be Cobb-Douglas between-group in types $g \in G = \{F, D, N\}$ for food, drink, and non-food with preference $\theta_g \geq 0$. These are broad categories that each household needs to varying degrees, which is captured with the group preference parameter. Let s denote the substitutes within groups. Within-group, let products be imperfect substitutes with exponential preference $\theta_{gs} \in [0, 1]$ and multiplicative preference α_{gs}. Given that utility is ordinal, we normalize the non-food exponential preference to 1.

$$U(\mathbf{q}_x) = \prod_{g \in G} \left(\sum_s \alpha_{gs} q_{gs}^{\theta_{gs}} \right)^{\theta_g} \tag{7}$$

[40] If τ is small, then this change could increase soda purchases as the household was constricted by the account, and are now free to buy more. This implausible scenario is allowed in estimation and is rare.

It is convenient to take a log transformation of the utility function:

$$\sum_g \theta_g \ln\left(\sum_s \alpha_{gs} q_{gs}^{\theta_{gs}}\right) - \mathbb{1}[b > 0]\frac{\delta}{2}\left[\tau + b - \sum_{x \in EL} p_x q_x\right]^2. \tag{8}$$

For products with positive spending levels and households who spend $\sum_{x \in EL} p_x q_x > b$, the first order condition (FOC) when maximizing log utility subject to the budget is given in equation (9), where λ is the Lagrangian multiplier on the budget.

$$\frac{\partial \ln(U)}{\partial q_x}\frac{1}{p_x} + \mathbb{1}[b > 0]\mathbb{1}[x \in EL]\delta\left(\tau + b - \sum_{x \in EL} p_x q_x\right) = \lambda \tag{9}$$

If we normalize the non-food preference parameters, then with a known pre-adoption estimate for each θ, this FOC can be be estimated for δ or τ. Other than the indicator functions, the right-hand side variables do not vary at the household-product level, just at the household-product-eligibility level. For households whose preferences are such that SNAP is not equivalent to cash, the optimal conditions are different as their eligible purchases will be at the kink in the budget, meaning they will set $\sum_{x \in EL} p_x q_x = b$.

Equation (9) has similarities to the reduced form specifications in relating specific product spending with payments for all products interacted by the kind of tender and SNAP eligibility. Key differences include the direct inclusion of the mental account parameters in this equation and the pre-estimated product preference (as opposed to product specific intercepts in the reduced form equation).

5.2 Estimation Method

We estimate the model using three sets of moments, described as steps. We simplify the exposition by focusing on households for whom SNAP would be equivalent to cash absent mental accounting. Our method can handle both types as we allow for household specific preferences. We estimate product specific preferences at the household monthly level and constant group (food, drink, and non-food) preferences. As the model is static, we assume away dynamic optimization across months, such as storage. The first question is how to get pre-SNAP estimates of the preference parameter θ_x.[41]

We first must determine how to conceptualize the behavioral parameters in the pre-SNAP period (T_0) when $b = 0$. By construction, the behavioral terms in $\mathcal{M}$ only affect behavior when $b > 0$ (post-SNAP T_1), meaning the household not does not differentiate products across eligibility until it matters. This restriction can be used to identify preference parameters pre-SNAP, where the FOC simplifies to $\frac{\partial \ln(U)}{\partial q_x}\frac{1}{p_x} = \lambda$.

The method below is at the monthly level for household h and time period (month) t with a monthly SNAP allocation b_{ht} and cash budget y_{ht} (total cash spending). Step one estimates group preferences θ_g using aggregated FOC in non-SNAP months. Step two estimates the preference parameters θ_x in non-SNAP months. The third step estimates the behavioral parameters. The Lagrange multiplier is known for each household-month if we normalize the non-food product (denoted with 1) parameters to one: $\hat{\lambda}_{ht} = \frac{1}{p_{ht1}q_{ht1}}$.

Since we have zeros in the data, a continuous demand model with both multiplicative α_{htx} and exponential θ_{htx} preferences will best fit the data. However, we cannot estimate an unrestricted α_{htx} as it is not meaningfully separately identified from a continuous θ_{htx}. Thus we let this extensive degree of preference for the good $\alpha_{htx} = \mathbb{1}[\varepsilon_{htx} > 0]$ be based on an unobserved shock ε_{htx}; this simply tells us whether the consumer will be on a corner for that product in that month. Given that products are imperfect substitutes, $\alpha_{htx} = 1$ is necessary and sufficient for an interior solution and likewise $\alpha_{htx} = 0 \iff q_{htx} = 0$. Thus α_{htx} is identified in a given time period and we know which products will have valid first order conditions. The FOC per product quantity choice that all estimation steps are based on is $F_{htx}(\Theta_{ht}) = 0$ per household-month, defined as the following:

$$
\begin{aligned}
F_{htx}(\Theta_{ht}) = & \frac{\theta_{htg}\theta_{htx}(q_{htx})^{\theta_{htx}}}{p_{htx}q_{htx}\sum_s (q_{htx_s})^{\theta_{htx}}} - \frac{1}{p_{ht1}q_{ht1}} \\
& + \mathbb{1}[b_{ht} > 0]\mathbb{1}[x \in EL_t]\delta_{ht}\left(\tau_{ht} + b_{ht} - \sum_{x \in EL_t} p_{htx}q_{htx}\right).
\end{aligned}
\tag{10}
$$

[41] How can the reduced form (RF) seemingly estimate both while the structural requires this additional step? First, the RF estimates MPCs which are comparative statics and thus composite terms of parameters. Second, when in the RF's CF we shift soda's MPC down to account for changing to ineligible, we are not capturing how soda's true demand function has interactions between soda preference and eligibility.

The equality $F_{htx}(\Theta_{ht}) = 0$ is valid when the budget constraint binds. We impose budget equality each period. This is reasonable as these households are selected into a means-tested welfare program and the vast majority of SNAP recipients spend all of it. Given Θ_{ht}, the system $\mathbf{F}_{ht} = \mathbf{0}$ can be solved for optimal choices q^*_{htx}. Our estimation approach is the reverse: we suppose observed choices are optimal $q_{htx} = q^*_{htx}$ and use the same system to identify the unknown parameters that rationalize the observed purchases given prices and income. We estimate the FOCs by minimizing the squared moment.

Since we are estimating these at the household-monthly level, there could be over fitting; the benefit is that we can track preference shocks in the pre-SNAP period, which is important for checking the validity of using these estimates in the post-SNAP period. Another interpretation is that there are household specific time-invariant preferences with monthly deviations, and we estimate the combined effect. Estimating household specific time-invariant preferences yields similar results with slightly worse fit.[42]

5.2.1 Step 1: Homogeneous Product-Group Preferences Pre-SNAP

At the household-monthly level, group level and product level preferences are not separately identified. We estimate a common product group preference (food, drink, and non-food) using across time variation in the pre-SNAP period. We transform the FOC and aggregate it across observations assuming homogeneous preferences: $\Theta_{ht} = \Theta \; \forall t \in T_0$.

$$\hat{\Theta} = \arg\min_{\Theta} \left\{ \sum_{t \in T_0} \sum_{h} \sum_{x} \left[\log(F_{htx}(\theta_g, \theta_x \forall x) + \hat{\lambda}_{ht}) - \log(\hat{\lambda}_{ht}) \right]^2 \right\} \tag{11}$$

Note that the mental account is absent because $b_{ht} = 0 \; \forall t \in T_0$. We let $\hat{\theta}_{htg} = \hat{\theta}_g$ and use the product preference estimates for starting values in step 2.

5.2.2 Step 2: Household-Monthly Product Preferences Pre-SNAP

Next, we estimate product-specific preferences conditional on known group level preferences in the pre-SNAP periods. By solving each household-monthly optimization, we

[42] In this case, the estimation method would allow for measurement error in the quantity and price of the non-food product as transforming F allows us to form a moment around such an error term.

allow for household-monthly level preference variation which is identified off the across product choices within household-month conditional on prices and income.

$$\hat{\Theta}_{ht} = \underset{\Theta_{ht}}{\arg\min} \left\{ \sum_{x} [F_{htx}(\hat{\theta}_g, \theta_{htx} \forall x)]^2 \right\} \quad \forall h, \forall t \in T_0 \tag{12}$$

5.2.3 Step 3: Household-Monthly Behavioral Preferences Post-SNAP

Finally, we estimate the behavioral parameters in the post-SNAP periods conditional on known product preferences. We set the product preference for period in T_1 to the average per household from T_0 periods, meaning $\hat{\theta}_{hx} = (1/T_0) \sum_{t \in T_0} \hat{\theta}_{htx}$.

$$\hat{\Theta}_{ht} = \underset{\Theta_{ht}}{\arg\min} \left\{ \sum_{x} [F_{htx}(\hat{\theta}_g, \hat{\theta}_{hx} \forall x, \delta_{htx}, \tau_{htx})]^2 \right\} \quad \forall h, \forall t \in T_1 \tag{13}$$

Note that we do not need to impose budget equality as a constraint in any of these steps as we are plugging in observed quantities and solving for the parameters that rationalize them. When we solve for counterfactual quantities using the estimated parameters, we impose a budget constraint. We validate the FOC approach by checking that the solution satisfies both the necessary conditions and the utility maximization problem.

Since we use the pre-SNAP months for preference identification, there is the assumption that preferences do not significantly change in SNAP months. Since our pre-SNAP preferences are estimated month to month, we check whether there are time trends that would suggest changes leading up to SNAP usage; we do not find a trend. The last few months' preferences are not significantly different from the entire non-SNAP average.

When there is a zero purchase of one product, the group preference is not separately identified from the product of the non-zero quantity good. For households with intermittent zeros, we simply use their non-zero months when calculating their average product preference that we use to impute preferences in the post-SNAP periods; this would generate bias if we did not include α_{itx} in each post-SNAP period.

6 Structural Results

6.1 Parameters and Fit

Table 3 show the mean parameter estimates.[43] Food as a group has a higher group mean preference over beverages as the purchases are substantially higher. Soda has a higher mean preference over the substitutes (primarily juice); this is a function of it being purchased more often conditional on price. Eligible food has the highest mean preference. Ineligible food is lower than eligible food but is high despite low levels of spending due to the high prices. The mental account parameters are the target level τ and the penalty for deviating δ. The target level captures how much above SNAP allotment that households would like to spend on eligible products, in this case an average of $450 per month. The mean penalty for deviating from the mental account is small but is best interpreted in the context of the counterfactual.

Table 3: Model Parameter Estimates

Type	Estimate	CI
Soda pref	0.1190	[0.1172, 0.1208]
Soda-sub pref	0.1380	[0.1357, 0.1391]
Elig-food pref	0.6965	[0.6943, 0.6993]
Inelig-food pref	0.5501	[0.5437, 0.5539]
Food-group pref	1.1966	[1.1854, 1.2066]
δ	0.0010	[0.0007, 0.0011]
$\tau/100$	4.5005	[4.4754, 4.5366]

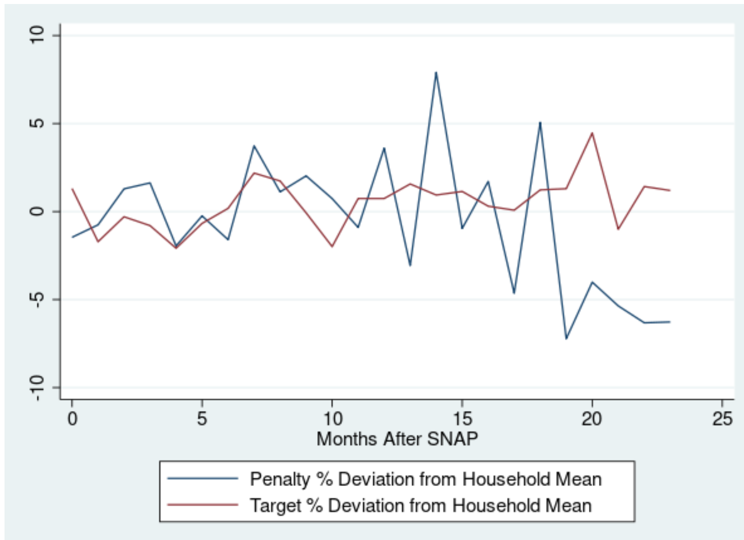
This table shows the model parameter estimates. "Pref" refers to preferences for that product. Soda-sub refers to soda substitutes. "Elig-food" is eligible food. "Inelig-food" is ineligible food. "food-group" is the group preference on all food. The term δ is the penalty on deviating from target level of eligible spending and τ is the target level in the mental account. Confidence intervals are 99 percent from nonparametric percentile simple bootstrap with 500 samples.

The variation over time in τ and δ are displayed in Figure 9 with mostly lower than

[43] Confidence intervals are 99 percent nonparametric percentile bootstrap (re-sampled at the household-month level) with 500 samples. There are other methods to estimate the behavioral parameters. One could calibrate the penalty to the value from Hastings and Shapiro (2018) and then back out the target or calibrate the target to their estimate and estimate a heterogeneous penalty. Both yield similar results with latter being less precise: household variation in the target affects fit more than heterogeneity in the penalty.

5 percent deviations from the within household mean over time. The variance on the penalty does increase near the end of the sample, particularly at the end of the sample, during the COVID lockdowns.

Figure 9: Behavioral Trend Post Adoption



This figure shows the trend in time-varying behavioral parameters, δ penalty and τ target, in the months after adopting SNAP.

Table 4 reports the correlations between the observed quantities and the model predictions for pre and post for the five product categories. All categories have a tight fit with the exception of ineligible food, which is a function of its frequent zeros. The Pre-SNAP fit is superior than the post-SNAP due to estimating the former at the household-monthly level and imputing household-level preferences for post-SNAP.

Table 4: Data vs Model Purchase Correlations

Type	Pre SNAP	Post SNAP
Soda	0.9830	0.7305
Soda-sub	0.9882	0.7375
Elig-food	0.9848	0.9784
Inelig-food	0.3347	0.6630
Non-food	0.9978	0.9714

This table shows the correlation coefficients between model and data purchases pre and post SNAP adoption. Soda-sub refers to soda substitutes. “Elig-food” is eligible food. “Inelig-food” is ineligible food.

Table 5 reports the mean quantities for the observed (quantity) purchases and the model predictions pre and post adoption per product.[44] Most fit closely and the confidence intervals are tight around the mean estimates. Soda has a slight upward bias post-SNAP and ineligible has a larger upward bias pre-SNAP; both of these had higher variances than the other categories.

Table 5: Data vs Model Purchase Means

Type	Data	Model	Confidence Interval
Soda-pre	4.4697	4.5604	[4.5069, 4.6135]
Soda-post	5.9714	8.9898	[8.8698, 9.1039]
Soda-sub-pre	7.4783	7.6042	[7.5468, 7.6578]
Soda-sub-post	10.2203	13.7531	[13.6214, 13.9229]
Elig-food-pre	100.3698	96.8424	[96.2555, 97.4420]
Elig-food-post	131.3737	132.3495	[131.8689, 133.4278]
Inelig-food-pre	1.1068	2.1614	[2.1084, 2.1950]
Inelig-food-post	1.6258	2.2759	[2.2443, 2.3312]
Non-food-pre	42.8081	43.3660	[43.0509, 43.6661]
Non-food-post	49.2088	46.4331	[46.1066, 46.8167]

This table shows the comparisons in purchase means between the model and data pre and post SNAP adoption. Soda-sub refers to soda substitutes. "Elig-food" is eligible food. "Inelig-food" is ineligible food. Confidence intervals are 99 percent from nonparametric percentile simple bootstrap with 500 samples.

6.1.1 Pre-SNAP Time Trend

Since we estimate preferences at the household-monthly level, we can track how preferences change month to month up until the point of adoption. Since SNAP adoption could occur around the time of other life-changing events, such as an increase in family size or job loss, the imputation of "baseline" level product preferences using pre-adoption variation may be inappropriate. We check for evidence of preferences changing near the time of adoption; if adoption is a response to an event, we should detect preference changes in the few months prior. This tells us whether we should expect preference changes to continue or if pre-adoption averages are sufficient to capture product preference per household.

We find that on average, there is not a significant change in soda preferences between the first few months of households in the panel and the last few months before they adopt

[44] The medians for post: soda, soda subs, eligible food, ineligible food, nonfood are 3.5372, 7.1335, 104.6318, 0.8555, and 35.4331. The model has 4.5840, 8.2038, 103.2424, 0.9348, and 34.8673 respectively.

SNAP. The mean difference in preference is a noisy 1.3 percent decrease prior to SNAP adoption with a t-statistic of 0.90 on the test of significance from zero. Figure 10 shows the preference trend not changing significantly for the two years prior to adoption.

Figure 10: Preference Trend Pre-Adoption

This figure shows the trend in time-varying preference parameters θ for each product in the months before adopting SNAP.

Another event that may preempt SNAP adoption is job loss. Such events would threaten our identification approach if they altered product preferences directly. However any changes in product choice driven by a changing budget constraint are captured in our model. The key assumption is that total cash spent at the retailer captures the household's "cash budget". If the income shock led to changes in the purchasing patterns across retailers, then that could bias the estimates.[45]

6.2 Counterfactual Results

The main counterfactual of interest is how soda purchases are affected by soda's SNAP eligibility status. To calculate this we first estimated preferences across product categories and mental accounting parameters that rationalize patterns in the data. We now resolve the model but make soda ineligible for purchase with SNAP, which also means that it is

[45] Prior literature has shown that SNAP participation is only weakly related to a household's choice of retailer (Hastings and Shapiro 2018).

not present in the mental account. We study how this changes demand for all products.[46]

We capture the substitution by solving for the demand functions; when eligibility changes, the utility from that product changes and thus demand decreases; this leads to re-allocating the additional funds to other products, with the substitutability of the product (alongside the price) determining which products see a demand increase. Since we model juice as being an imperfect substitute to soda, its demand increases after soda is made ineligible. It is important to solve the model when calculating the substitution because once soda's eligibility changes, it moves out from eligible mental account, which crowds out existing ineligible spending and invites more eligible spending.[47]

Table 6 reports the means for quantities in the model and counterfactual comparison.[48] Soda purchases decrease on average by 18.30 percent and average soda substitutes increase by 7.16 percent. The distributions of percent changes for both are displayed in Figure 11. Average eligible food increases by 1.56 percent, ineligible food decreases by 1.63 percent (although not statistically significant), and non-food decreases by 0.84 percent. Note that the mean change is different than the change in the means.

Table 6: Counterfactual Results

Type	Model	CF	Confidence Interval
Soda	8.9898	5.9399	[5.8853 ,6.0279]
Soda-sub	13.7531	15.5174	[15.3458, 15.6969]
Elig-food	132.3495	135.7342	[135.2545, 136.8994]
Inelig-food	2.2759	2.1394	[2.1038, 2.1902]
Non-food	46.4331	45.7973	[45.4559, 46.1783]

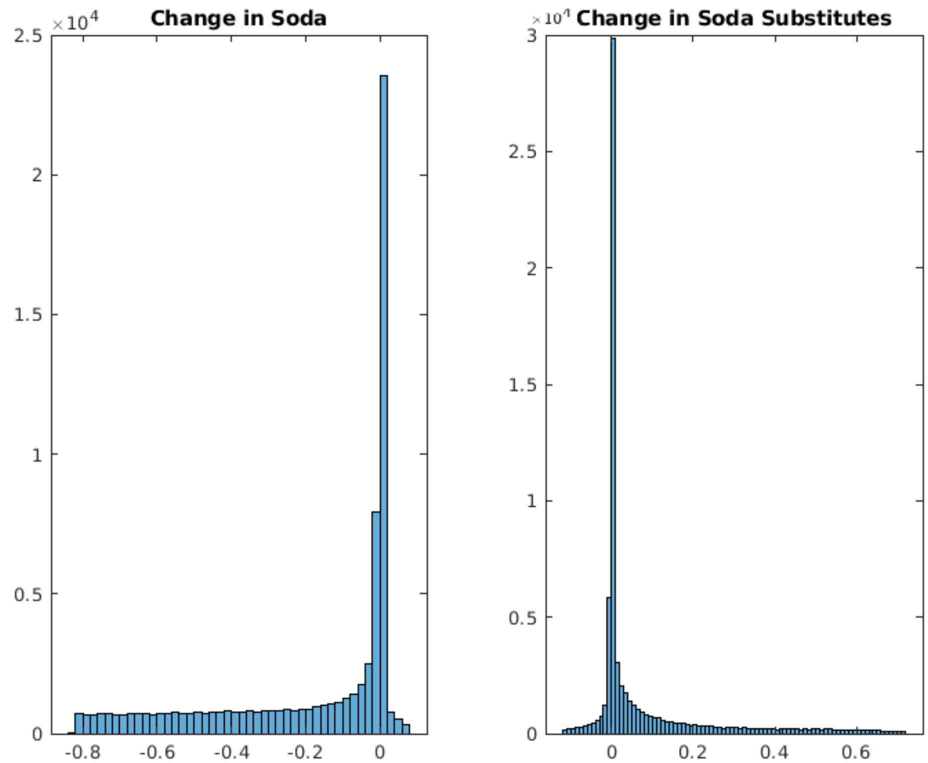
This table shows the model results from the counterfactual (CF) of soda being no longer eligible for SNAP. Soda-sub refers to soda substitutes. "Elig-food" is eligible food. "Inelig-food" is ineligible food. Confidence intervals are 99 percent from nonparametric percentile simple bootstrap with 500 samples.

[46]We do not incorporate supply-side price responses with the changing demand, as we take the prices during the post-SNAP period as fixed during the counterfactual. Incorporating such general equilibrium effects may attenuate the effects in the long run as the updated prices would depress the demand responses.

[47]To calculate this in the reduced form, we would need to run a regression for juice expenditure and include soda's eligibility status as a covariate. Extracting the substitution effect from the regression directly (using the regression for soda and then juice as a system of equations for pre/post status change) assumes that total eligible and ineligible spending does not change, which may or may not be true.

[48]The counterfactual medians for post: soda, soda subs, eligible food, ineligible food, nonfood are 3.4564, 8.6582, 105.0905, 0.8803, and 34.6494 respectively.

Figure 11: Percent Change in Soda Purchases from Soda Ineligibility Counterfactual



This figure shows the distribution of soda purchase percent changes from the counterfactual of soda being no longer eligible for SNAP.

Ineligible food and non-food also decrease in the counterfactual: this is due to crowd-out from the now ineligible soda purchases; the mental account incentivizes the household to increase eligible product choice now that soda has been made ineligible and this crowds out other purchases with the magnitude driven by the degree of substitutability.

Welfare calculations are complicated by the existence of the mental accounting term. Recall that there is a core utility U and the mental account $\mathcal{M}$. The core utility of the household goes down by almost 1% in the counterfactual. This is intuitive as they are now optimizing with an additional constraint. For households whose spending was below their target (plus SNAP), removing soda likely decreases utility as there is now more pressure to meet the target. For those whose eligible spending was above, removing soda can increase utility. Overall there is a 2% decrease in combined utility, and 64% of households have a combined utility decrease.

We can also contrast this counterfactual policy with a soda tax. Both cause substitution towards juices as soda becomes more expensive. The mental account differentiates the two as once soda is removed, it then starts to crowd out non-eligible spending. With a soda tax, soda is still eligible and thus continues to affect eligible spending. In fact, since the target is in terms of spending and not units purchased, the mental account may not even be substantially affected by a soda tax (price increases and quantity decreases). The changes to purchases from a soda tax are primarily through the core utility. One caveat is that using SNAP reduces the tax burden (in some states) and thus changing the status of soda to non-SNAP eligible can increase its price in addition to changing the mental account; for a soda tax this second order effect is not present.

6.2.1 Nutritional Effects of Soda Ban

We retrieve the nutritional information for each product, including calories, total sugar, protein, carbohydrates, various fats, sodium, calcium, fiber, and iron. We calculate the total of each aggregated at the level of soda and soda substitutes (which primarily includes juice). This allows us to evaluate how the counterfactual policy affects nutrition. We multiple the quantity purchased by the average nutrition per amount; the ounces for each unit are similar across soda and soda substitutes. We know the nutritional content of every item in each shopping trip per household for the observed data, but must use some form of average for the counterfactual quantity.

Total beverage purchases decrease by 1.9 percent (and 4.4 percent in ounces) as the decrease in soda is not fully matched by an increase in juice. Total calories decrease by 5.8 percent and total sugars decrease by 6.63 percent.[49] Other beverage nutrients change as well: soda has zero protein, fats, or fiber, so those increase by 8.82 percent. Carbohydrates decrease 6.29 percent, sodium decreases 2.1 percent, calcium increases 8.47 percent, cholesterol increases by 6.55 percent, and iron increases by 8.47 percent. Other nutritional content, such as vitamins, would likely improve as well. In the counterfactual, purchases of juice increase relative to the baseline, whereas food purchases do not

[49] Total ounces can go down more or less than calories or sugars because juices can have higher calories and sugar per ounce due to the presence of diet soda.

significantly change. Due to our level of aggregation, we do not incorporate possible complementaries or substitution between specific food products and soda.[50]

6.2.2 Cash Transfer Instead of SNAP

Finally, we consider a second policy counterfactual, namely the purchase and welfare effects of a cash transfer as opposed to in-kind SNAP. Under a classical framework, SNAP is equivalent to cash for most households, but the mental account changes that. Changes to SNAP affect the household differently than income changes. In particular, if SNAP is set to zero, the mental account has no effect on the household. Thus a cash transfer may lead to higher utility as the household is not bound by their mental account. In addition, the cash transfer can be used on non-eligible products. While this counterfactual is limited as we only observed one retailer, our sample has significant nonfood purchases.

We set their new income to $y' = y + b$, set $b' = 0$, and resolve the model.[51] We find that food purchasing does not significantly change, both beverage types decrease by 8% percent, and nonfood increases by 8 percent. Overall utility increases by over 1 percent. The beverages decrease in percentage terms while food (a broader category) does not due to its relatively higher preference and its larger overall purchasing level. Note that total sugar intake would decrease. Thus households would be slightly better off with a pure cash transfer, which is consistent with the loosened restriction.[52]

7 Conclusion

This paper considers the influence that SNAP eligibility has on demand and studies the effects of making certain products ineligible. Leveraging our novel dataset, we find consistent evidence for SNAP eligibility affecting consumer behavior using multiple estima-

[50] Expanding the number of categories, such as the increasing the number of substitutes per category, complicates identification and estimation. With multiple substitutes per product, the degree of substitutability of complementarity must be additionally estimated. We considered this using a nonlinear augmented version of the linear multiple complements model (Dubé 2019) and found it had poor fit.

[51] A similar approach to mimic the counterfactual would be to make all products SNAP eligible instead of changing income. This would not yield an identical result as $\mathcal{M}$ is a discontinuous function of b.

[52] However it should be noted that part of this effect is the disappearance of the behavioral term, thus even if the exact same purchases were made, there would be a utility difference.

tion strategies. We complement our parameter estimates with counterfactual analysis on alternative SNAP policy regimes. Our findings indicate that some of the potential health benefits of a policy which makes soda ineligible for purchase with SNAP could be a reduction in sugar intake from beverages. Additionally, such a policy may also increase the consumption of recommended nutrients due to substitution toward juice products.

While this paper provides important insights into the benefits of such a policy, the potential downsides should also be considered. Research studying the WIC program has shown that more stringent regulation over benefit redemption led to a decline in the number of retailers authorized to accept WIC and a decline in WIC participation (Meckel 2020). Removing products from being eligible for purchase with SNAP is a slippery slope and stringent restrictions over what can and cannot be purchased with SNAP could result in similar unintended consequences. Furthermore, changes in SNAP eligibility status for certain products could lead to alternative pricing strategies. Investigating how policy regulation over product eligibility for SNAP affects household participation, retailer participation, and pricing is an important avenue for future research.

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ONLINE APPENDIX

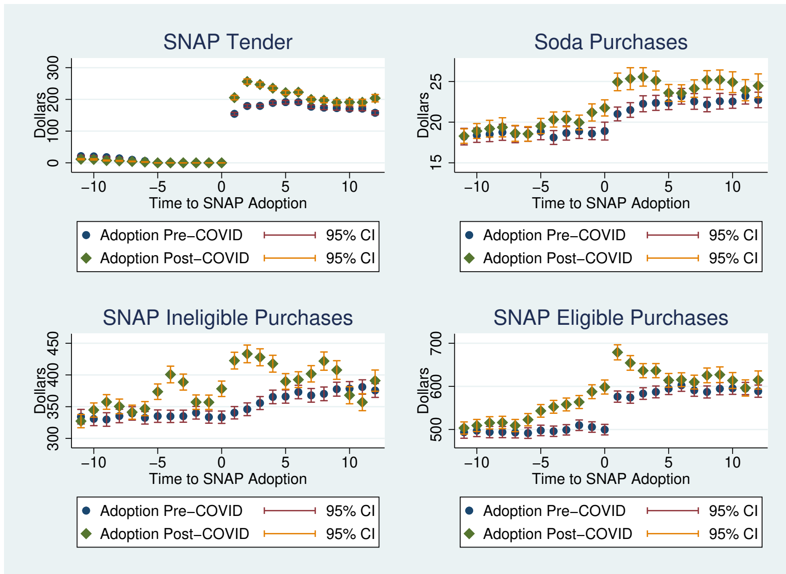
A SNAP Adoption Prior to COVID-19 vs. Post COVID-19

We plot average changes in expenditure around SNAP adoption based on whether the household adopted SNAP prior to COVID-19 or after the onset of COVID-19. Figure 12 depicts the amount the SNAP tender redeemed, soda spending, SNAP eligible purchases and SNAP ineligible purchases around the time of SNAP adoption by whether or not the household adopted SNAP prior to COVID-19 (March 2020) or after the onset of COVID-19. Upon SNAP adoption for pre-COVID adopters, the amount of SNAP tender redeemed increases from \$0 in the pre-adoption period to roughly \$180 in the six months following adoption. At the same time, soda purchases increase from and average of \$19 to \$22, SNAP eligible purchases increase from \$501 to \$586 and SNAP ineligible purchases increase from \$335 to \$357. Upon SNAP adoption for post-COVID adopters, the amount of SNAP tender redeemed increases from \$0 in the pre-adoption period to roughly \$231 in the six months following adoption. At the same time, soda purchases increase from and average of \$21 to \$25, SNAP eligible purchases increase from \$567 to \$639 and SNAP ineligible purchases increase from \$376 to \$414. Households that adopted prior to COVID-19 illustrate almost no pre-trend in spending prior to adoption, while households that adopted during COVID-19 illustrate distinct pre-trends in spending prior to adoption.

Figure 13 presents spending over SNAP eligible products (cold and/or nutrition facts label) that have SNAP ineligible counterparts (heated and/or supplemental facts label) by whether or not SNAP adoption occurred prior to or after COVID-19. Upon SNAP adoption for those that adopted SNAP prior to COVID-19, the amount of spending over SNAP eligible counterpart products increases from \$5.3 to \$6.5, while the amount of spending over SNAP ineligible counterpart products remains relatively stable hovering between \$4.17 and \$4.22. Upon SNAP adoption for those that adopted SNAP after COVID-19, the amount of spending over SNAP eligible counterpart products increases from \$5.6 to \$7.1, while the amount of spending over SNAP ineligible counterpart products declines prior to adoption and then remains relatively stable between \$3.7 and \$3.8.

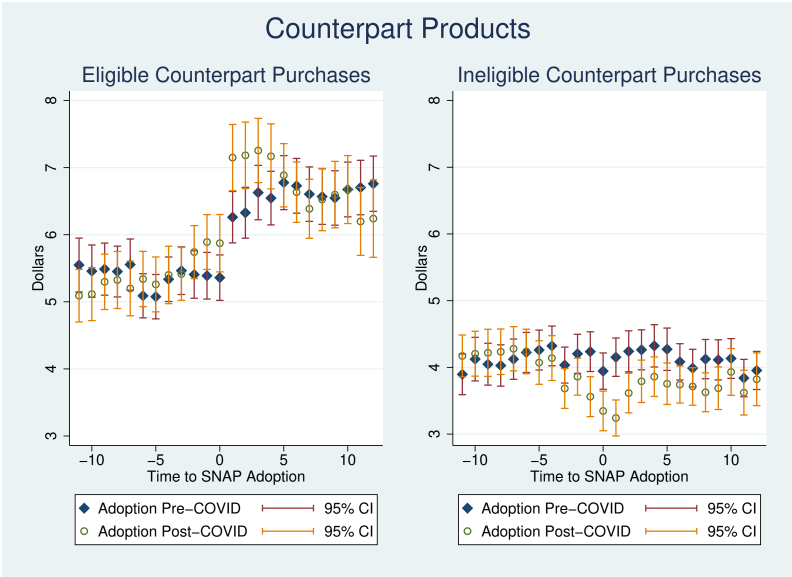
Table 7 compares and contrasts the mean SNAP tender and sales values in the six months prior to and the six months following SNAP adoption between the set of households that adopted SNAP prior to COVID-19 and the set of households who adopted SNAP after COVID-19. The changes in mean spending for households that adopt SNAP prior to (during) the COVID-19 pandemic indicates an MPC_{SNAP} of 0.47 (0.31) for SNAP eligible products, 0.12 (0.16) for SNAP ineligible products, 0.02 (0.02) for soda and 0.01 (0.01) for SNAP ineligible food. For both groups of SNAP adopters we find evidence that the MPC_{SNAP} for eligible (ineligible) counterparts is around 0.006 to 0.007 (0.000).

Figure 12: SNAP Tender and Purchases Around Recent SNAP Adoption



This figure depicts the amount the SNAP tender redeemed, soda spending, SNAP eligible purchases and SNAP ineligible purchases around the time of SNAP adoption by whether or not the household adopted SNAP prior to COVID-19 (March 2020) or after the onset of COVID-19. Upon SNAP adoption for pre-COVID adopters, the amount of SNAP tender redeemed increases from $0 in the pre-adoption period to roughly $180 in the six months following adoption. At the same time, soda purchases increase from and average of $19 to $22, SNAP eligible purchases increase from $501 to $586 and SNAP ineligible purchases increase from $335 to $357. Upon SNAP adoption for post-COVID adopters, the amount of SNAP tender redeemed increases from $0 in the pre-adoption period to roughly $231 in the six months following adoption. At the same time, soda purchases increase from and average of $21 to $25, SNAP eligible purchases increase from $567 to $639 and SNAP ineligible purchases increase from $376 to $414. Households that adopted prior to COVID-19 illustrate almost no pre-trend in spending prior to adoption, while households that adopted during COVID-19 illustrate distinct pre-trends in spending prior to adoption.

Figure 13: Counterpart Spending Around Recent SNAP Adoption



This figure presents spending over SNAP eligible products (cold and/or nutrition facts label) that have SNAP ineligible counterparts (heated and/or supplemental facts label) by whether or not SNAP adoption occurred prior to or after COVID-19. Upon SNAP adoption for those that adopted SNAP prior to COVID-19, the amount of spending over SNAP eligible counterpart products increases from \$5.3 to \$6.5, while the amount of spending over SNAP ineligible counterpart products remains relatively stable hovering between \$4.17 and \$4.22. Upon SNAP adoption for those that adopted SNAP after COVID-19, the amount of spending over SNAP eligible counterpart products increases from \$5.6 to \$7.1, while the amount of spending over SNAP ineligible counterpart products declines prior to adoption and then remains relatively stable between \$3.7 and \$3.8.

Table 7: Means Prior to and Following SNAP Adoption by Timing of SNAP Adoption

	Adoption Prior to COVID-19				Adoption After COVID-19			
	6 Months Pre Adoption	6 Months Post Adoption	Δ		6 Months Pre Adoption	6 Months Post Adoption	Δ	
SNAP Tender	0.00	180.82	180.82		0.00	231.32	231.32	
	(0.00)	(1.08)			(0.00)	(1.52)		
Observations	23,880	23,880			18,660	18,660		
Households	3,980	3,980			3,110	3,110		
Spending	6 Months Pre Adoption	6 Months Post Adoption	Δ	MPC_{SNAP}	6 Months Pre Adoption	6 Months Post Adoption	Δ	MPC_{SNAP}
SNAP Eligible	501.38	586.37	85.00	0.47	567.28	639.25	71.97	0.31
	(2.53)	(2.82)			(3.19)	(3.45)		
SNAP Ineligible	335.35	357.74	22.40	0.12	375.89	413.97	38.08	0.16
	(2.02)	(2.15)			(2.53)	(2.73)		
Soda	18.66	22.12	3.45	0.02	20.52	24.69	4.17	0.02
	(0.19)	(0.19)			(0.20)	(0.24)		
SNAP Ineligible Food	8.03	10.10	2.06	0.01	11.05	12.98	1.93	0.01
	(0.09)	(0.09)			(0.10)	(0.12)		
Observations	23,880	23,880			18,660	18,660		
Households	3,980	3,980			3,110	3,110		
Spending Over Counterpart Products	6 Months Pre Adoption	6 Months Post Adoption	Δ	MPC_{SNAP}	6 Months Pre Adoption	6 Months Post Adoption	Δ	MPC_{SNAP}
SNAP Eligible	5.34	6.54	1.21	0.007	5.60	7.05	1.45	0.006
	(0.07)	(0.08)			(0.09)	(0.10)		
SNAP Ineligible	4.17	4.22	0.06	0.000	3.78	3.67	-0.11	0.000
	(0.06)	(0.06)			(0.06)	(0.06)		
Observations	23,880	23,880			18,660	18,660		
Households	3,980	3,980			3,110	3,110		

This table presents the mean SNAP tender and sales values for various product groups in the six months prior to and the six months following SNAP adoption. It also shows the change in these means (Δ) as well as the marginal propensity to consume out of SNAP (MPC_{SNAP}), which is calculated by dividing the change in spending for the product by the change in SNAP tender redeemed (e.g. $\Delta_{Spending}/\Delta_{SNAP}$). Standard errors in parentheses. Each observation is a household-month.

B SNAP Adoption Between May 2014 and October 2017

Table 8 presents the mean SNAP tender and sales values for various product groups in the six months prior to and the six months following SNAP adoption utilizing data that spans May 2014 to October 2017. In Table 8 we also present the change in these means (Δ) as well as the marginal propensity to consume out of SNAP (MPC_{SNAP}), which is calculated by dividing the change in spending for the product by the change in SNAP tender redeemed (e.g. $\frac{\Delta_{Spending}}{\Delta_{SNAP}}$). The changes in mean spending indicate an MPC_{SNAP} of 0.59 for SNAP eligible products, 0.09 for SNAP ineligible products, 0.03 for soda and 0.01 for SNAP ineligible food. We also present the changes in mean spending for SNAP eligible and ineligible counterpart products and find evidence that the MPC_{SNAP} for eligible (ineligible) counterparts is around 0.011 (0.002). In addition to the striking difference in MPCs for the SNAP eligible and SNAP ineligible counterparts, it is interesting to note that soda and SNAP ineligible food have similar levels of expenditure in the pre-SNAP period ($22 to $23), but that soda, which is eligible for purchase with SNAP, has a MPC_{SNAP} that is roughly three times larger. These differences could be due to different preferences over the two product types, which would naturally lead to different income expansion paths. This highlights the importance of comparing the SNAP income expansion path to the cash income expansion path.[53]

[53] These summary statistics reveal how similar our data are to the data utilized in Hastings and Shapiro (2018). Hastings and Shapiro find that SNAP adoption is associated with roughly a $110 increase in SNAP eligible spending and a $5 increase in SNAP ineligible spending around the time of SNAP adoption. They also find that SNAP tender redeemed increases by roughly $200 upon SNAP adoption and report a marginal propensity to consume food out of SNAP ($MPCF_{SNAP}$) between 0.5 to 0.6, based on changes around the timing of SNAP adoption and SNAP recertification.

Table 8: Means Prior to and Following SNAP Adoption

	6 Months Pre Adoption	6 Months Post Adoption	Δ	
SNAP Tender	0.00	170.81	170.81	
	(0.00)	(146.40)		
Observations	14,468	14,778		

Spending	6 Months Pre Adoption	6 Months Post Adoption	Δ	MPC_{SNAP}
SNAP Eligible	286.22	386.45	100.23	0.587
	(245.47)	(278.13)		
SNAP Ineligible	201.14	217.05	15.92	0.093
	(218.20)	(226.83)		
Soda	22.69	26.95	4.27	0.025
	(34.55)	(35.28)		
SNAP Ineligible Food	22.34	23.84	1.50	0.009
	(37.64)	(38.96)		
Observations	14,468	14,778		

Spending Over Counterpart Products	6 Months Pre Adoption	6 Months Post Adoption	Δ	MPC_{SNAP}
SNAP Eligible	3.32	5.11	1.80	0.011
	(10.18)	(11.18)		
SNAP Ineligible	1.61	1.93	0.32	0.002
	(5.18)	(5.85)		
Observations	14,742	14,778		

This table presents the mean SNAP tender and sales values for various product groups in the six months prior to and the six months following SNAP adoption. It also shows the change in these means (Δ) as well as the marginal propensity to consume out of SNAP (MPC_{SNAP}), which is calculated by dividing the change in spending for the product by the change in SNAP tender redeemed (e.g. $\Delta_{Spending}/\Delta_{SNAP}$). Standard deviations in parentheses. An observation is a household-month.

C SNAP Benefits Over Time

Figure 14 plots the mean SNAP benefits redeemed at the retailer, conditional and unconditional on recent SNAP adoption, between March 2018 and April 2021. Panel (a) illustrates that prior to March 2020, mean benefits remain fairly stable at $150 per month with the exception of January 2019 when SNAP recipients were paid both their January and February 2019 benefits in response to a shutdown of the federal government.[54] After the introduction and adoption of EA benefits in March/April of 2020, the mean benefit amount redeemed sharply increases to $280 in May of 2020 and then declines to roughly $210 in August of 2020. It is very likely that the sizable increase in SNAP benefits between May and July 2020 is due to the payment of Pandemic EBT benefits (P-EBT benefits). These benefits were paid to SNAP beneficiaries with school aged children and free and reduced price school lunch recipients to replace the value of missed school meals due to school closures. Although the exact timing of these early P-EBT payments payments is difficult to confirm, state documents indicate that many payments were planned to be distributed in late April and late May.[55] In the reduced form analysis we present results that utilize all time periods, as well as results that omit March 2020 through July 2020 (the first five months of the pandemic).

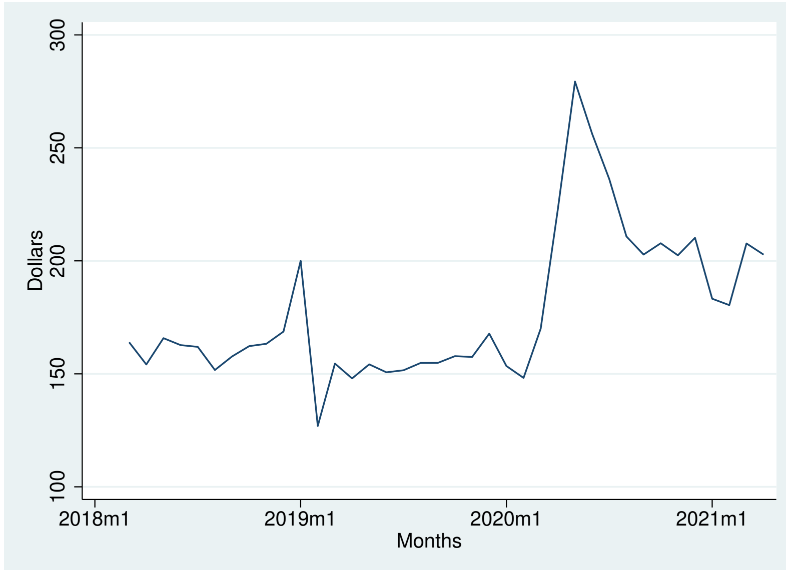
Panel (b) of Figure 14 illustrates similar trends in SNAP tender but at lower levels because SNAP households may not be SNAP beneficiaries in all periods of the data. In contrast to panel (a), panel (b) illustrates an increase in SNAP tender in 2021. There are a couple of policy changes that can be responsible for this increase in SNAP benefits. First, the maximum SNAP benefit was increased by 15 percent under the Consolidation Appropriations Act (2021) in January of 2021. Second, many states paid out P-EBT benefits for school days missed in the fall of 2020 starting in January/February of 2021. Finally, starting in April 2021, the EA benefit policy was expanded to pay a little less than $100 more in benefits for households who would've received the maximum benefit amount after income deductions under the pre-pandemic SNAP benefit rules.[56] These figures motivate our utilization of changes in SNAP benefit policies as additional instruments for SNAP income.

[54] In February of 2019, many SNAP recipients received no benefits. However, some states paid half of the March 2019 benefit in February of 2019.

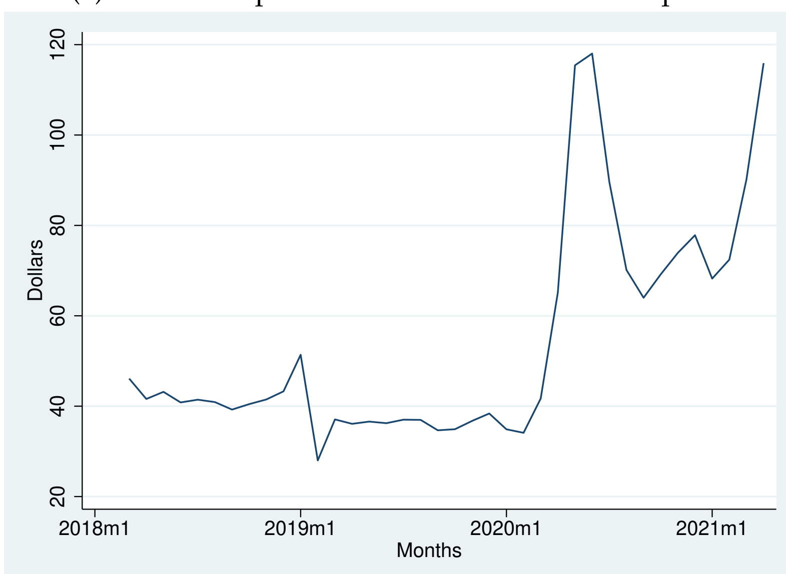
[55] Based on what we could find, P-EBT benefits were planned to be distributed in late April and May (state 1), late April and a second payment made at an unknown date (state 2), end of May (state 3), end of May (state 4), end of May (state 5) and late April and May (state 6).

[56] This ensures that EA benefits provide extra benefits to both households who would've received less than the maximum benefit amount after income deductions and household who already received the maximum amount after income deductions.

Figure 14: Mean SNAP Benefits Redeemed



(a) SNAP Adoption Households | SNAP Adoption



(b) All SNAP Households

Figure 14 plots the mean SNAP benefits redeemed at the retailer, conditional and unconditional on recent SNAP adoption, between March 2018 and April 2021. Panel (a) illustrates that prior to March 2020, mean benefits remain fairly stable at $150 per month with the exception of January 2019 when SNAP recipients were paid both their January and February 2019 benefits in response to a shutdown of the federal government. After the introduction and adoption of EA benefits in March/April of 2020, the mean benefit amount redeemed sharply increases to $280 in May of 2020 and then declines to roughly $210 in August of 2020. Panel (b) illustrates similar trends in SNAP tender but at lower levels because SNAP households may not be SNAP beneficiaries in all periods of the data. In contrast to panel (a), all SNAP households illustrate an increase in SNAP tender in the early months of 2021. There are a couple of reasons for this potential increase in SNAP benefits. First, many states paid out P-EBT benefits for school days missed in the fall of 2020 starting in January/February of 2021. Second, the maximum SNAP benefit was increased by 15 percent under the Consolidation Appropriations Act (2021) in January of 2021. Finally, starting in April 2021, the EA benefit policy was expanded to pay a little less than $100 more in benefits for households who would've received the maximum benefit amount after income deductions under the pre-pandemic SNAP benefit rules.

D Alternative Reduced Form Results

D.1 States Without Food Taxes

We restrict our main results to states that do not levy taxes on food or soda. We do this to evaluate whether our main results are robust to scenarios in which the price of food is changing when the household utilizes SNAP as a form of payment. According to federal law, when a household utilizes SNAP to pay for items, they are not subject to any taxes that may be imposed on those products.

Table 9 presents the results for the counterpart product analysis. The results in columns (1) through (3) are well aligned with the full sample results and indicate that 73 to 81 percent of the $MPC_{SNAP|Eligible}$ is due to being eligible for purchase with SNAP; furthermore, the parameter of interest, $\beta_{SNAP|Eligible} - \beta_{Cash|Eligible}$, is statistically significant at the 10% significance level. For comparison, the full sample results (columns (1) -(3)) indicate 80 to 83 of $MPC_{SNAP|Eligible}$ is due to being eligible for purchase with SNAP and the parameter of interest, $\beta_{SNAP|Eligible} - \beta_{Cash|Eligible}$, is statistically significant at the 5% significance level. The results in column (4), for the restricted sample, are noticeably smaller and indicate that 17 percent of the $MPC_{SNAP|Eligible}$ is due to being eligible for purchase with SNAP. The main results (column (4)) indicate that 57 percent of the $MPC_{SNAP|Eligible}$ is due to being eligible for purchase with SNAP. The parameter of interest is statistically insignificant for both the restricted sample and the full sample. The estimated coefficient on the interaction between cash spending and the indicator of eligibility is the reason for this discrepancy in findings; in column (4), of the restricted sample, this coefficient is noticeably larger (0.0025) relative to all other sets of estimates (0.0006 to 0.0018). A larger coefficient on the interaction between cash spending and the indicator of eligibility leads to the smaller percentage out of $MPC_{SNAP|Eligible}$ that can be accounted for by eligibility.

Table 10 presents the results that provide estimates of the marginal propensity to consume soda. In columns (1)-(3), the marginal propensity to consume soda out of cash ranges between 0.023 to 0.025. Furthermore, the marginal propensity to consume soda out of SNAP is 0.028 for each of these three specifications. In columns (1) and (2), equality of the MPCs can be rejected at the 10% significance level; while we fail to reject equality in columns (3) and (4). The estimated MPCs are well aligned with the main results but are unable to reject equality as easily, likely due to the reduction in sample size.

Table 9: MPC SNAP Eligible Counterpart vs Ineligible Counterpart | No Taxes on Food or Soda

Panel A: Two Stage Least Squares Estimates				
	(1)	(2)	(3)	(4)
Cash	0.000640	-0.000120	0.000156	-0.000867
	(0.000796)	(0.000691)	(0.000665)	(0.000763)
Cash x 1{Eligible}	0.000651	0.00111	0.00112	0.00249***
	(0.00131)	(0.00103)	(0.00102)	(0.000897)
SNAP	0.00102	0.00106	0.00124	0.00365***
	(0.00132)	(0.00119)	(0.00117)	(0.00112)
SNAP x 1{Eligible}	0.00783***	0.00735***	0.00734***	0.00374*
	(0.00273)	(0.00242)	(0.00241)	(0.00204)
1{Eligible}	-0.424	-0.637	-0.665	-1.266***
	(0.606)	(0.463)	(0.451)	(0.408)
Constant	2.421***	2.870***	2.699***	3.214***
	(0.441)	(0.389)	(0.371)	(0.426)
Product by Year-Month f.e.	X	X	X	X
Household f.e.	X	X	X	X
Observations	10,014,576	10,014,576	10,014,576	10,014,576
Households	113,802	113,802	113,802	113,802

Instruments	(1)	(2)	(3)	(4)
$Stimulus\ per\ Person_{ht}$	X	X	X	X
$1\{SNAP\ Adoption_{ht}\}$	X	X	X	
$1\{EA\ Benefits_{s(h)t}\}$	X			X
$1\{EA\ Benefits_{s(h)t}\}x1\{SNAP\ Adoption_{ht}\}$	X	X		

Panel B: Estimated Marginal Propensities to Consume				
MPCs	(1)	(2)	(3)	(4)
$MPC_SNAP\|Eligible$	0.0088479***	0.0084102***	.0085736***	0.0073826***
	(0.0015217)	(0.0014116)	(0.0014059)	(0.0012937)
$MPC_Cash\|Eligible$	.0012909	.0009923	.0012788	0.0016224*
	(0.001013)	(0.0008453)	(0.0007998)	(0.000894)
$\beta_{SNAP\|Eligible} - \beta_{Cash\|Eligible}$	.0071783*	0.0062336*	0.0062135*	0.0012477
	(0.0040242)	(0.003432)	(0.0034009)	(0.0029106)
Percent of MPC_{SNAP} due to Eligibility	81.1	74.1	72.5	16.9

This table presents results utilizing SNAP eligible and SNAP ineligible food counterpart sales as the outcome variable. Panel A presents the regression output and Panel B presents the estimated $MPC_{SNAP|SNAPEligible}$ as well as the percentage of $MPC_{SNAP|SNAPEligible}$ that is due to SNAP eligibility. Standard errors in parentheses; clustered at the household level. In the data set utilized to construct this table, there are two observations for each household-month: one for the eligible product and one for the ineligible product. Furthermore, the dataset spans 44 months. Hence the total number of observations is 113,802 households x 44 months x 2 product types = 10,014,576.

Table 10: MPC Soda | No Taxes on Food or Soda

Soda: Two Stage Least Squares Estimates				
	(1)	(2)	(3)	(4)
Cash	0.0231***	0.0247***	0.0251***	0.0275***
	(0.00178)	(0.00163)	(0.00157)	(0.00215)
SNAP	0.0275***	0.0281***	0.0283***	0.0239***
	(0.00108)	(0.00130)	(0.00123)	(0.00195)
Year Month f.e.	X	X	X	X
Household f.e.	X	X	X	X
Observations	5,007,288	5,007,288	5,007,288	5,007,288
Households	113,802	113,802	113,802	113,802

Instruments	(1)	(2)	(3)	(4)
$StimulusperPerson_{ht}$	X	X	X	X
$1\{SNAPAdoption_{ht}\}$	X	X	X	
$1\{EABenefits_{s(h)t}\}$	X			X
$1\{SNAPAdoption_{ht}\}x1\{EABenefits_{s(h)t}\}$	X	X		

	(1)	(2)	(3)	(4)
p-value for null of equality	0.054	0.095	0.109	0.329

This table presents estimates of the MPC soda out of cash and SNAP income. Standard errors are in parentheses and clustered at the household level. The reported p-value is for the null hypothesis of: $MPC_{Cash} = MPC_{SNAP}$.

D.2 SNAP Eligible vs. Ineligible Food

Table 11 presents estimates of equation 2 utilizing SNAP eligible and SNAP ineligible food sales as the outcome variable.

Panel A of Table 11 presents the regression output and Panel B presents the estimated $MPCF_{SNAP|SNAPEligible}$ as well as the percentage of $MPCF_{SNAP|SNAPEligible}$ that is due to SNAP eligibility. Column one contains the two-stage least squares estimates which utilize SNAP adoption, the introduction of EA benefits and SNAP adoption interacted with the introduction of EA benefits as the instruments, column two contains results which utilize SNAP adoption and the interaction between SNAP adoption and the introduction of EA benefits as instruments, columns three and four utilize only SNAP adoption and only the introduction of EA benefits as instruments, respectively. Column five replicates column one, but omits March through July of 2020 (the first five months of pandemic) from the underlying data. All results utilize stimulus checks as instruments for cash income.

Panel B of Table 11 presents the estimated marginal propensities to consume. The marginal propensity to consume SNAP eligible food out of SNAP income ranges between 0.39 and 0.79, while the marginal propensity to consume SNAP eligible food out of cash ranges between 0.34 to 0.62. Notably, across four of the five specifications in Panel A, the estimated coefficient for the difference between $\beta_{SNAP|Eligible} - \beta_{Cash|Eligible}$, which represents the amount of $MPCF_{SNAP|Eligible}$ that is due to the fact that the food is eligible for purchase with SNAP, is statistically significant and positive at the one percent significance level. Results utilizing only EA benefits as an instrument for SNAP income, column (4), indicate a negative and statistically significant difference between $\beta_{SNAP|Eligible} - \beta_{Cash|Eligible}$. Columns (1) through (3) and column (5) indicate that 61 to 82 percent of the $MPC_{SNAP|Eligible}$ is due to SNAP eligibility.

Table 11: MPC SNAP Eligible Food vs Ineligible Food

Panel A: Two Stage Least Squares Estimates

	(1)	(2)	(3)	(4)	(5)
Cash	0.0160**	0.0353***	0.0403***	0.00642***	0.0186**
	(0.00645)	(0.00492)	(0.00476)	(0.00173)	(0.00822)
Cash x 1{Eligible}	0.361***	0.400***	0.404***	0.612***	0.325***
	(0.0137)	(0.0106)	(0.0105)	(0.0131)	(0.0170)
SNAP	-0.154***	-0.114***	-0.106***	0.0526***	-0.184***
	(0.0136)	(0.0111)	(0.0109)	(0.0118)	(0.0167)
SNAP x 1{Eligible}	0.913***	0.868***	0.863***	0.338***	0.971***
	(0.0281)	(0.0229)	(0.0227)	(0.0308)	(0.0342)
1{Eligible}	91.59***	70.81***	68.31***	-7.889	108.1***
	(5.800)	(4.481)	(4.402)	(5.251)	(7.223)
Constant	0.974	-10.82***	-13.79***	-1.443	0.645
	(3.090)	(2.353)	(2.270)	(0.896)	(3.949)
Product by Year-Month f.e.	X	X	X	X	X
Household f.e.	X	X	X	X	X
Observations	20,253,288	20,253,288	20,253,288	20,253,288	17,951,778
Households	230,151	230,151	230,151	230,151	230,151

Instruments	(1)	(2)	(3)	(4)	(5)
$StimulusperPerson_{ht}$	X	X	X	X	X
$1\{SNAPAdoption_{ht}\}$	X	X	X		X
$1\{EABenefits_{s(h)t}\}$	X			X	X
$1\{EABenefits_{s(h)t}\}x1\{SNAPAdoption_{ht}\}$	X	X			X

Panel B: Estimated Marginal Propensities to Consume

MPCs	(1)	(2)	(3)	(4)	(5)
$MPC_{SNAP\|Eligible}$	0.76***	0.75***	.76***	0.39***	.79***
	(0.015)	(0.013)	(0.012)	(0.020)	(0.018)
$MPC_{Cash\|Eligible}$	0.38***	0.43***	.44***	0.62***	.34***
	(0.010)	(0.008)	(0.008)	(0.013)	(0.012)
$\beta_{SNAP\|Eligible} - \beta_{Cash\|Eligible}$	0.55***	0.47***	0.46***	-0.27***	0.65***
	(0.042)	(0.033)	(0.033)	(0.044)	(0.051)
Percent of MPC SNAP due to Eligibility	72.4	62.7	60.5	-69.2	82.1

This table presents results utilizing SNAP eligible and SNAP ineligible food sales as the outcome variable. Panel A presents the regression output and Panel B presents the estimated $MPC_{SNAP|SNAPEligible}$ as well as the percentage of $MPC_{SNAP|SNAPEligible}$ that is due to SNAP eligibility. Standard errors in parentheses; clustered at the household level. In the data set utilized to construct this table, there are two observations for each household-month: one for eligible food and one for ineligible food. Furthermore, the dataset spans 44 months. Hence the total number of observations is 230,151 households x 44 months x 2 product types = 20,253,288.

E Eligibility Premium Model

Instead of a mental account, one can consider a "eligible premium" parameter θ_E on top of the original product preference θ: $x^{\theta+\theta_E}$.[57] Since there may be other preference changes, assuming just the existence of θ_E post adoption implicitly sets preferences for ineligible products equal to pre-adoption level θ. Thus we can also allow for ineligible food preferences to change as well. However we must still normalize the non-food outside good's preference to 1; this is not too unrealistic as the expenditures on non-food do not significantly change in the pre and post periods. Then to identify the additional difference that eligibility makes, we can subtract off the change in θ for ineligible food.

The estimation step 1-2 remain the same. The alternative step 3 considers household-monthly extra product preferences post-SNAP. This sets $\delta = 0$ as an alternative model and estimates additional preferences during post-SNAP.

$$\hat{\Theta}_{it} = \arg\min_{\Theta_{it}} \left\{ \sum_{x} [F_{itx}(\hat{\theta}_g, (\hat{\theta}_{ix} + \theta^E_{itx}) \forall x)]^2 \right\} \quad \forall i, \forall t \in T_1 \tag{14}$$

The alternative model re-estimates the preference only specification for eligible products when SNAP is available. Post-SNAP, the preferences for all go up: average gain in θ_{alt} for the 3 eligible food groups are 0.054, 0.0318, and 0.0446 respectively.

Effects under the alternative model are similar with muted counterfactuals. The fit is closer because there the post-SNAP model is estimated with more parameters that are product specific, potentially leading to over-fitting.

Table 12: Alternative Model Parameters

Type	Estimate	Confidence Interval
Soda -alt post-extra	0.0543	[0.0355, 0.0523]
Soda-sub -alt post-extra	0.0318	[0.0263, 0.0405]
Elig-food -alt post-extra	0.0446	[0.0397, 0.0447]

This table shows estimates from the alternative model. Confidence intervals are 99 percent from nonparametric percentile simple bootstrap with 500 samples.

[57] An alternative model but similar idea to the eligible premium is to treat the SNAP status of a given product as a characteristic of that product (over which the households have preferences) and adapt the frameworks from Dubois, Griffith, and Nevo (2014) and Allcott, Diamond, and Dubé (2017).

Table 13: Alternative Model Purchase Correlations

Type	Post-alt
Soda-pos	0.9494
Soda-sub	0.9484
Elig-food	0.9059
Inelig-food	0.7529
Non-food	0.9526

This table shows correlations between alternative model and the data purchases in the post SNAP adoption periods.

Table 14: Alternative Model Quantity Purchase Means

Type	Data	Model	Confidence Interval
Soda-post alt	5.9714	6.6956	[6.6070 , 6.7475]
Soda-sub-post alt	10.2203	11.6394	[11.5698, 11.7680]
Elig-food-post alt	1131.3737	118.7519	[117.7458, 119.2774]
Inelig-food-post alt	1.6258	2.6808	[2.6147, 2.7201]
Non-food-post alt	49.2088	52.5214	[52.3315, 53.1266]

This table shows estimates the alternative model and data mean purchases. Confidence intervals are 99 percent from nonparametric percentile simple bootstrap with 500 samples.

Table 15: Alternative Counterfactual Results

Type	Model	CF	Confidence Interval
Soda-post alt	6.6819	6.2153	[6.1412, 6.3142]
Soda-sub -post alt	11.6697	11.9055	[11.8047, 12.0210]
Elig-food -post alt	118.5176	119.9225	[118.7872, 120.3233]
Inelig-food-post alt	2.6670	2.5944	[2.5438, 2.6449]
Non-food-post alt	52.7267	52.2266	[52.0567, 52.8578]

This table shows the alternative model results from the counterfactual (CF) of soda being no longer eligible for SNAP. Confidence intervals are 99 percent from nonparametric percentile simple bootstrap with 500 samples.