

## Three Essays on Food Policy and Health Consumption Patterns

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### Abstract

The overarching research aims of this work is to contribute to a well establish literature on food policy and health consumption with the final goal of building healthier societies. The dissertation consists of three essays. The first essay looks at the effect of food stamp distribution on food purchasing behavior. The second essay examines if children, during school lunch, suffer from hunger cues that could impact their behavior when choosing meals and the effect of providing a pre-lunch snack. The third essay explores the effect of retailer marketing mix on influencing food price inflation.

### Keywords

Food Policy, Consumer Behavior, Food Price Inflation

### Introduction

In recent years, food consumption and health habits have been increasingly attract the attention of policy makers and researchers aiming to establish healthy and sustainable living communities. The doctoral thesis " Three Essays on Food Policy and Health Consumption Patterns" wants to contribute to a well establish literature on food policy and health consumption with the final goal of building healthier societies. As suggested by the title the thesis collects three independent essays which are the summary of my work on some research projects during my doctoral program at the University of Connecticut. In the following summary I propose a brief explanation of the motivation behind each essay, the methods used and a preview of the results, conclusion follows.

#### *First Essay*

The Supplemental Nutrition Assistance Program (SNAP), also known as Food Stamp Program is a federal food-purchasing assistance for eligible low income people. The aim of the program is to "to alleviate hunger and malnutrition ... by increasing food purchasing power for all eligible households who apply for participation" as stated in the Food Stamp Act of 1977. Through the electronic benefit transfer systems (EBT) eligible low-income families receive monthly benefits which can be used to purchase food.

Not surprisingly, there is a rich amount of literature investigating the effectiveness of the program in ameliorating food insecurity and providing a nutritionally adequate diet (Daveney and Fraker, 1989; Fraker, 1990; Daveney and Moffitt, 1991; Gunderson and Zilliack, 2003).

Other literature focuses on the program's effect on health outcomes, for example, obesity (Gibson, 2003; Baum 2011) and child health (Currie, 2003, Currie and Moretti, 2008; Almond et al., 2011). The first essay investigates the relationship between the timing of food stamp receipt and food consumption patterns contribution to a separate literature that focuses not on participation, but on the timing of benefits and subsequent behavior over the food stamp cycle. Starting with Wilde and Ranney (2000), consumption has been shown to decrease during the food stamp month. Shapiro (2005), also using survey data, finds a 10-15% decline in overall consumption during the food stamp cycle.

### *Second Essay*

Most of the developed countries are facing the problem of increasing rate of obesity among children. In the United States child obesity is a relevant public issue. Almost one child in three is obese or overweight. American parents consider obesity the major health concern for their children before drug abuse and smoking (American Heart Association). Moreover child obesity plays a major role on health expenditure.

Adapting the school environment is seen as having the potential to reduce the risk of obesity in children by promoting positive behavioral changes. In January 2012, the US Department of Agriculture (USDA) provided new guidelines for school cafeterias as part of National School Lunch Program (NSLP). The new guidelines impose more stringent rules on the type of food provided, thus minimizing the opportunity for unhealthy choices. As pointed out by Hanks et al. (2013), however, a policy of enforcement finalized to promote a healthful choice might be costly and its effectiveness might be downsized by reactance and avoidance behavior. Several studies have engaged in examining how changing school lunchroom conditions might impact student behavior (<http://ben.dyson.cornell.edu/>). Less focus has been given, however, on how changes to the students' condition might impact their behavior. Healthier behavior can be stimulated, not only changing the external environment at the lunch line, but also changing the state of the subject making a choice can be influential.

### *Third Essay*

At the beginning of the last decade the European Union has been affected by a price inflation of about 2% per year. In 2008 the price inflation sharply increased to 3.7%. In 2009, following a decline in food prices, the inflation rate stood at 1% to accelerate again in 2010 (2%) and 2011 (3.1%), while going back to 2.2% at the end of 2012. As food is an essential good, everyone is affected by its price changes. However, changes in retailer food prices will have an effect on consumers' purchasing power at different degree depending on income levels and on the share of budget dedicated to the items interested by upward price trends (Schneepf, 2012). For instance, "lower income consumers who spend most of their income on food are most likely affected by rising food prices than high-income consumers with lower food budget shares" (Schneepf, 2012). This makes understanding food prices trends and the forces related to their variation an important matter to policy makers. As food prices picked, government agencies renewed their interest on understanding how volatility in

commodities prices affect food prices for the final consumption at the retailer level. Retailers' marketing mix, price practices and market power can play a role in determining final retailer prices.

Since the incidence of the raw material cost tends to be rather low for food products, Leibtag (2008) argued that the increase in food prices should influence retailer prices only to a small extent. However, Richards and Pofahl (2009) highlight that this can vary depending on the type of product, expecting highly processed food to have a lower rate of cost pass-through with respect to fresh products, where farm prices have a considerable share of the total inputs' cost.

The third chapter investigates the effect of retailer marketing mix on food price inflation, with particular focus given to pricing and Private Labels (PL) strategies. In particular, focusing on the Italian dairy market, we try to identify how some observable retailers' marketing mix variables may affect inflation rates.

## Methods

### *First Essay*

The principle dataset used in this paper is the Nielsen Homescan Consumer Panel Dataset (NHCPD); this dataset is collected and maintained by the Nielsen Corporation, and includes a sample of households from all U.S. states. The dataset contains approximately 40,000 households from 2004 to 2007, and 60,000 households from 2008-2011, providing us with a rich panel of household purchase data from all shopping trips. I have used this dataset to compute, for each household, the daily quantity purchases in beer, tobacco, bread, milk and soft drink. Further, to determine the date of food stamp distributions I construct the monthly distribution schedule of Supplemental Nutrition Assistance Program (SNAP) benefits for 49 states and the District of Columbia from 2004-2011, excluding only the state of New York.

In order to isolate the impact of SNAP distributions on household purchasing behavior, I estimate several versions of the following general household fixed effects model on SNAP eligible households:

$$Y_{hst} = \beta_0 + \text{SNAP}_{st}\beta_M + X_{hst}\beta_X + \tau_t + \gamma_s + \delta_h + \varepsilon_{hst} \quad (1)$$

$Y_{hst}$  is a quantity purchased measure from a particular product category (i.e. ounces of beer purchased), for household  $h$  in state  $s$  at time  $t$ .  $\text{SNAP}_{st}$  is the propensity that a particular household in state  $s$  is treated on a given day (as described in the data section).  $X_{hst}$  is a vector of household- and household head-level demographic characteristics, which includes individual or families of indicator variables for household size, household income, age, marital status, race, ethnicity, employment status, education status, presence of minor children (under 18 years old), and young children (under 6 years old). State-specific fixed effects, denoted by  $\gamma_s$ , absorb time-invariant differences in purchase patterns across states.  $\tau_t$  is a vector of time-fixed effects which account for year, month, day of the week, and "pay day" (defined as the 1st or 15th of each month) trends in household purchases that are

common nationally.  $\delta_h$  are household fixed effects, which account for persistent differences in purchase habits across households over time, and is a very powerful control in this context.  $\beta_0$  is a constant coefficient and  $\varepsilon_{hst}$  is the error term. In order to account for the non-independence of observations from within the same household we cluster all standard errors at the state level.

### *Second Essay*

For this essay I conduct a field experiment with 3 fourth grade classes at a public elementary school in Eastern Connecticut. For one week, we record what the children in the classes consume for snack and lunch. I also measure whether they consume breakfast at school, their level of hunger before and after the snack and the quantity of snack they consume. In the second week, I provide one class of students with a healthy, nutritious snack approximately one hour before lunch time.

The final dataset is an unbalanced panel containing nutrients and calories consumed over ten school days by the 24 subjects during snack and lunch time for a total of 458 observations after removing missing observations. For each student, I include survey response data before and after the snack each day.

The primary purpose of this experiment is to examine how providing a nutritious snack impacts students' consumption of snack and lunch. I test our hypothesis on the effect of the snack provision using a Difference-in-Differences (DiD) estimation approach and the following econometric model:

$$y_{i,t} = \beta_0 + \beta_1 T + \beta_2 S + \beta_3 DID + \beta_4 X + \varphi_i + \omega_t + u_{i,t} \quad (2)$$

where  $y_{i,t}$  is the dependent variable from subject  $i = 1 \dots 24$  during days  $t = 1 \dots 10$ . The dependent variable will have a different specification depending on the hypothesis we want to test (Table 1).  $T = 0$  if the subject is part of the control group and  $T = 1$  otherwise;  $S = 0$  during the first week before the snack has been offered and  $S = 1$  during the second week;  $DID = T \times S$  is the difference-in-differences estimator which capture the effect of the snack introduction on the dependent variable.  $X$  is a set of control variables which contain a gender dummy variable (one if female, zero otherwise), a dummy to control if the subject did not have snack in the morning (1 if the subject did not eat snack, zero otherwise) and the 1-5 hunger level rating in the morning before the snack had been consumed for subject  $i$  at time  $t$ . I use a fixed effect panel data estimator to control for heterogeneity due to day and subject:  $\varphi_i$  is the subject specific effect,  $\omega_t$  is the day specific effect,  $u_{i,t}$  is the normal distributed reminder error.

*Table 1. Description of the dependent variables used on testing hypothesis 1 to 6 in model (2).*

Hypothesis	$y_{i,t}$	Variable description
H1	$\Delta$ Level of hunger $_{i,t}$	Difference between the hunger status prior and post snack for subject $i = 1 \dots 15$ during day $t = 1 \dots 10$ .
H2	Level of hunger $_{i,t}$	Level of hunger on a scale of 0-4 registered with after snack survey for subject $i = 1 \dots 15$ during day $t = 1 \dots 10$ .
H3	Probability to eat F – $V_{i,t}$	Binary variable equals to one if subject $i = 1 \dots 24$ during snack at day $t = 1 \dots 10$ ate fruit or vegetables, equals to zero otherwise.
H4	Snack intake $_{i,t}$	Amount of calories, sugar (grams), carbohydrate (grams), fiber (grams), fat (grams), proteins (grams) or sodium (mg) consumed during snack time by subject $i = 1 \dots 24$ during day $t = 1 \dots 10$ .
H5	Lunch intake $_{i,t}$	Amount of calories, sugar (grams), carbohydrate (grams), fiber (grams), fat (grams), proteins (grams) or sodium (mg) consumed during lunch time by subject $i = 1 \dots 24$ during day $t = 1 \dots 10$ .
H6	Snack and lunch intake $_{i,t}$	Amount of calories, sugar (grams), carbohydrate (grams), fiber (grams), fat (grams), proteins (grams) or sodium (mg) consumed during snack or lunch time by subject $i = 1 \dots 24$ during day $t = 1 \dots 10$ .

### Third Essay

I use Symphony IRI dataset to compute price indexes and to measure retailers' marketing mix by chain and type of store. Our scanner database provides brand level weekly prices and sales for seven different dairy product categories: refrigerated and ultra-high temperature (UHT) liquid milk, yogurt, cheese, mozzarella cheese, fresh cream, and butter.

I first compute drift-free GEKS indexes (Ivanic et al., 2009). The GEKS is a multilateral index. The GEKS index is free of chain drift as it satisfies the multi-period identity test, ensuring the price index will not suffer from chain drift bias. Further, another advantage of the GEKS index is its suitability when using a flexible basket. Thus, the GEKS index is a good candidate for CPI computation using high frequency data, given that scanner data present a high heterogeneity in product assortment over time.

I use the same dataset to measure the retailers' marketing mix by chain and type of store. I consider five variables, related to the assortment, the role of PL, its extension within the category, the intensity of promotion, and the intensity of promotion in PL.

To evaluate the role of marketing mix instruments on the behavior of dairy prices we consider the following regression model:

$$y_{itj} = x'_{itj}\beta + \mu_i + v_t + \lambda_j + u_{itj} = x'_{itj}\beta + \varepsilon_{itj}, \quad (3)$$

where  $y_{itj}$  is the dependent variable, given by the GEKS index multiplied by the chain and type-of-store specific average price at time  $t = 1$ ;  $x_{itj}$  is a  $k$  vector of the explanatory

variables, used as proxies to measure the retailers' marketing mix, and  $\beta$  a  $k$  vector of parameters. We are planning to estimate equation (3) using an error component model estimator controlling for time, type of store and chain effects. For instance,  $\mu_i$  is the chain-specific effect (indexed  $i = 1, \dots, N$ ),  $v_t$  the time-specific effect (indexed  $t = 1, \dots, T$ ),  $\lambda_j$  the type of store-specific effect (indexed  $j = 1, \dots, L$ ),  $u_{itj}$  the reminder error term and  $\varepsilon_{itj}$  the composite error term.

## Results

### *First Essay*

Consistent with prior work we find a significant increase in purchases of goods on those SNAP distribution dates. For non-eligible households we see no such spikes in purchases. Further, the analysis document a surprising effect on total monthly purchases based on when in the week benefits are received. In particular, monthly purchases of beer are higher within the same households when the benefits are more likely to have been distributed on weekends. We find this effect in all states and in states that just distribute benefits on a single day, where we know with certainty whether benefits were distributed during the week or on a weekend. This effect does not appear in the non-eligible households. Monthly consumption of other goods is unchanged by when in the week benefits are distributed once the number of weekend days in the month are controlled for. Our results provide further support that households are very impatient and distributing benefits more than once a month might improve welfare. Additionally, our results suggest that distribution of benefits during the week could also have positive effects.

### *Second Essay*

The results of this experiment can provide relevant insight into the consumption behavior of children during school. Results have shown that providing a nutritious snack to the students does impact their consumption behavior. In particular, students tended to shift their consumption to snack time and reduce their consumption during lunch. Interestingly, students significantly reduced their consumption of sugar during lunch time and increased their consumption of sugar during snack. The increase in sugar during snack, however was due to increases in milk consumption rather than from processed sugars. This has important implications for children as excessive consumption of sugar can have important health implications arising from obesity and diabetes.

Results also show providing the snack lead to an increase in fruit and vegetable consumption. Based on observation, students did not often bring fruits and vegetables with them to school for snack or lunch. Providing additional opportunities to consume fruits and vegetables does not have a significant effect on the amount that they consumed.

Finally, the research have shown a significant change in hunger status due to the snack provision. Although we did not measure classroom performance, there may be important implications for the behavior and performance of students when they are not hungry.

### *Third Essay*

This paper can give a contribution on new applications of scanner data on topics related to price inflations rates. We use high frequency scanner data to empirically explore the contribution of some observed retailers' marketing mix on 7 dairy product categories. Moreover, we test if the unobserved heterogeneity among chains and types of stores (hypermarket, supermarket and superette) gives a significantly different contribution to dairy inflation rates.

Results show that while higher PL shares help in slowing down an upward dairy inflation rate, on the contrary higher PL line extension tends to accelerate it. Sales activities, as expected, alleviate the burden of a general increase in prices; however, PL sales have an effect on reducing the price inflation rate which is proportionally smaller than the overall average. This means that sales on PL may be less effective than sales on NB in alleviating a generalized upward price trend. Finally, assortment activities have a mixed effect depending on the competition environment of the market we refer to. In general, unobservable characteristics related to chains and types of store play a significant role in controlling the rise of prices.

### **Conclusion**

The thesis "Three Essays on Food Policy and Health Consumption Patterns" wants to contribute to a well establish literature on food policy and health consumption with the final goal of building healthier societies. In the first essay I examine the relationship between the timing of food stamp receipt and consumption patterns. Consistent with previous work I find that purchases of a variety of goods are higher on receipt days. Additionally, I find that when receipt days are more likely to be on weekends, total monthly consumption within the same households is affected. In particular, purchases of beer are higher in months where food stamps are distributed on a Saturday or Sunday than in months where benefits are distributed during the week in food stamp eligible households. In the second chapter I investigate if providing a healthy snack in the middle of the morning can alleviate the hunger level of fourth grade elementary students. Results highlight the importance in considering the timing and quality of meals provided during school time. Consistent with previous findings stating children tend to self-regulate their caloric intake, I found students appear to anticipate their caloric and nutrient intake from lunch to snack time with a significant reduction of their hunger level. The third chapter investigates the effect of retailer marketing mix on food price inflation, with particular focus given to pricing and Private Labels (PL) strategies. Results show the presence of PL helps to calm upward price trends, however PL expansion on multiple market segments can lead to opposite effects. Results from this last



essay can be of particular interest when considering the purchasing power of consumers, especially of low income households.

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