Consumer purchasing response to mandatory genetically engineered labeling

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On January 1, 2022, mandatory genetically engineered (GE) food disclosure labeling will be required nationwide in the United States. To date, the only mandatory GE labeling law implemented in the U.S. was Act 120 in Vermont. This thesis examines the consumer purchasing response to the implementation of Vermont Act 120 using store-level scanner data of food purchases. I measure the effects of Vermont Act 120 on the grocery store sales of non-GMO, organic, and GE- labeled products in Vermont. Using a difference-in-difference approach, I can compare stores in Vermont to control states before and after the law was passed, implemented, and repealed. I find that during the implementation period, sales of non-GMO and organic labeled products increased, and the sales of GE-labeled products decreased. The sales trend reverted after the law was repealed but not quite to the baseline levels for organic and GE-labeled products.

The analysis, findings, and conclusions expressed in this report should not be attributed to IRI

DEDICATION

I dedicate this thesis to my parents for their resilience and constant support.

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CHAPTER I

INTRODUCTION

On January 1, 2022, mandatory genetically engineered (GE) food disclosure labeling will be fully required nationwide in the United States on foods produced with GE ingredients[1]. To date, the only mandatory GE labeling law implemented in the U.S. has been Vermont Act 120, which required foods with GE ingredients sold in Vermont be labeled with a GE disclosure statement on the package.

The law was implemented for the month of July 2016 before being preempted by the National Bioengineered Food Disclosure Standard (NBFDS). In this research I study the consumer purchasing response to the initial implementation of mandatory GE labeling in Vermont using store-level scanner data of food purchases. Using Vermont Act 120 as a natural experiment, I measure the effects of the GE labeling law on the quantities sold of Non-GMO (GMO - Genetically Modified Organism, equivalent to GE), Organic, and GE- labeled products in Vermont grocery stores compared to comparable control states using difference-in-differences for the main analysis and synthetic control method as a primary robustness check.

While the implementation of the law was unique to Vermont and rife with complications, I will attempt to control for these complications in several ways. Once Vermont Act 120 was

[1] The National Bioengineered Food Disclosure Standard will require foods with over 5% bioengineered (BE) ingredients to labeled. While GE and BE are different terms, to date the list of approved bioengineered crops listed by the USDA Agricultural Marketing Service are the same as the GE crops approved for production in the United States.

passed in May 2014, the law met immediate opposition from the food industry, which feared a state-by-state patchwork of labeling requirements would affect their ability to distribute food nationally. This led to efforts in Congress to pass a law preempting Vermont Act 120. While these efforts failed to preempt the initial July 2016 implementation of the law, there was a sense that Congress would eventually preempt the law, which they did by the end of July by passing the NBFDS. Additionally, there was a six-month grace period for foods without a GE label produced prior to July 1, 2016 and a one-year grace period before lawsuits could be brought against manufacturers for non-compliance (O'Gorman 2016). In anticipation of Vermont Act 120 being overturned and the grace periods, many food companies were apprehensive to begin labeling in Vermont, creating a fundamental empirical challenge. Therefore, we are unable to definitively conclude whether each product was or was not correctly labeled during the month the policy was in place. I account for this ambiguity by focusing on products that were most likely to be labeled: non-GMO labeled products, organic labeled products, and GE labeled Campbell's soup.

Overall, food manufactures feared consumers would decrease purchases of GE labeled products, due to mistrust and confusion over genetic engineering, and increased food costs (Van Eenennaam, Chassy, and Kalaitzandonakes 2014). Although there is no scientific evidence that GE foods are unsafe for human consumption (National Academies of Science, Engineering, and Medicine 2016), food manufacturers were concerned that GE labels could potentially signal to consumers that the product was inferior. A 2018 Pew Research Center survey found that 49% of Americans believe that foods with GE ingredients are worse for one's health than non-GE foods, an increase of 10 percentage points from the same survey question compared to 2016 (Funk and Kennedy 2016; Funk, Kennedy, and Hefferon 2018).

I find that the implementation of Vermont's GE labeling law led to increases in sales of non-GMO and organic labeled products and decreases in sales of GE labeled soups during the month it was implemented. Sales reverted back towards the baseline for all three product categories after Vermont Act 120 was preempted, but remained above the baseline for organic products, below the baseline for GE labeled soups, and fell below the baseline for non-GMO labeled products.

This thesis contributes to the literature in several ways. To the best of my knowledge, this is the first study to analyze the impact of mandatory GE labeling on the purchasing decisions of consumers using store-level scanner data and a multi-year framework. This is also the first study to investigate the impact of mandatory GE labeling on the sales of substitute products, i.e. non-GMO and organic labeled foods in a real-world context. While the Vermont GE labeling implementation was imperfect and differs from the NBFDS in a number of ways, this research will help inform industry groups on what to expect from consumers at the grocery store as NBFDS goes into effect and is relevant for policy makers who are curious about the impact of mandatory GE labeling on food sales.

CHAPTER II

BACKGROUND

Genetic engineering

The National Academies of Science, Engineering, and Medicine (2016) define genetic engineering as, "a process by which humans introduce or change DNA, RNA, or proteins in an organism to express a new trait or change the expression of an existing trait." Genetically Engineered foods, often referred to as Genetically Modified Organisms (GMO's) by the public, were first utilized commercially in the mid-1990's. There are ten GE crops in commercial production in the United States: corn, soybeans, cotton, potatoes, papayas, squash, canola, alfalfa, apples and sugar beets (ISAAA, 2018). Ingredients from corn, soybeans, cotton, sugar beets, and canola are particularly common in processed foods available in U.S. grocery stores[2]. In addition to the ten GE crops in commercial production in the United States, the Agricultural Marketing Service (AMS) includes eggplant, pink fleshed pineapple, and AquAdvantage Salmon on its List of Bioengineered Foods available worldwide (USDA AMS, 2018). Bioengineered foods are defined by the National Bioengineered Food Disclosure Standard as those that, "contain detectable genetic material that has been modified through certain lab techniques and cannot be created through conventional breeding or found in nature" (National Bioengineered Food Disclosure Standard, 2018). While these definitions are somewhat ambiguous, the current

[2] Ingredients derived from these crops are wide-ranging. Examples include many forms of oils, sweeteners, thickeners, starches, and more.

AMS bioengineered foods list includes all genetically engineered foods listed by ISAAA, the International Service for the Acquisition of Agri-biotech Applications.

Genetic Engineering is used to add desirable traits to crops such as herbicide-tolerance, insect-resistance (e.g., Bt Bacterium), or enhanced nutritional benefits (NASEM, 2016). Genetic Engineering has been found to increase the world supply of corn, cotton, and soybeans, reduce food prices, and reduce land conversion, preventing increases in greenhouse gas emissions (Barrows, Sexton, and Zilberman 2014; Taheripour, Mahaffey, and Tyner 2016; Lusk, Tack, and Hendricks 2017; Scheitrum, Schaefer, and Nes 2020). Switching from non-Bt to Bt crops specifically has led to decreases in synthetic insecticide use and higher insect biodiversity (NASEM, 2016).

Despite scientific consensus on the safety of GMOs, many consumers remain skeptical. A 2018 survey by the Pew Research Center found that 49% of Americans believe that foods with GE ingredients are worse for one's health than non-GE foods, 44% believe they are neither better nor worse, and 5% say GE ingredients are better for one's health than non-GE foods (Funk, Kennedy, and Hefferon 2018). This represents a 10% increase from 2016, when 39% of Americans believed that foods with GE ingredients were worse for one's health than non-GE foods (Funk and Kennedy 2016).

Arguments against GE foods tend to focus on the potential consequences on human health and the environment. The Non-GMO Project, which designates the Non-GMO Project Verified Label, cites the increased use of the herbicide glyphosate, emergence of herbicide and pesticide resistant weeds and pests, concerns over farmer sovereignty due to patented GE seeds, and lack of epidemiological studies on health impacts as reasons to avoid GE foods. Vermont Law 120 also cited concerns in the law's preamble over the effects on biodiversity, cross-