Unit Pricing Regulation and Assortment Competition:

Evidence from the U.S. Yogurt Market

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Selected Paper prepared for presentation at the 2022 Agricultural & Applied Economics Association Annual Meeting, Anaheim, CA; July 31-August 2

Abstract

Unit Pricing Regulation (UPR) was introduced to help consumers make purchase decisions by informing consumers of unit prices in addition to product prices. Despite a large body of research on the regulation effects on consumers' perceptions and decisions, much less is known about the impacts on retail stores' price and non-price responses under the intensified price competition brought by UPR. Relying on the geographic variation in UPR implementation across states, we identify UPR impacts on the store's product offerings. Results show that mass merchandizers remove products without changing prices, whereas grocery stores without same-chain stores not under UPR add brands and charge higher prices on average. Using a structural demand model to estimate consumer welfare changes, we find that, on average, consumer welfare falls for both retail formats, highlighting an unintended policy effect.[*]

Keywords: Consumer welfare, Product assortment, Retail stores, Unit price regulation.

[*] Researcher(s) own analyses calculated (or derived) based in part on data from Nielsen Consumer LLC and marketing databases provided through the NielsenIQ Datasets at the Kilts Center for Marketing Data Center at The University of Chicago Booth School of Business. The conclusions drawn from the NielsenIQ data are those of the researcher(s) and do not reflect the views of NielsenIQ. NielsenIQ is not responsible for, had no role in, and was not involved in analyzing and preparing the results reported herein.

1. Introduction

Retail stores selling differentiated products are usually incentivized to strategically obfuscate consumers by making direct price comparison more difficult, via offering consumers complicated price formats and non-price attributes, so that stores can soften competition and attain higher markups (Ellison and Ellison, 2009; Chioveanu and Zhou, 2013; Piccione and Spiegler, 2012; Allender, Sherif Nasser, and Richards, 2021). Policymakers try to protect consumers by making price comparison easier. Unit pricing regulation (UPR), for example, requires the store to display unit price along with the retail price of each item on the shelf. By directly observing unit prices (e.g., $/OZ) in addition to product prices (e.g., $/product), consumers are expected to compare prices across brands, package sizes, and other non-price attributes more easily. As a result, price competition among products is intensified, leading to lower equilibrium product prices *ceteris paribus*. Since the introduction of UPR in the 1970s in some states in the United States, many studies have examined its impacts on consumers – how consumers use the unit-price information to adjust purchase decisions (Manning et al., 2003; Mitchell et al., 2003; Weeks et al., 2016).

Much less attention has been paid to other players in the retail sector that are also affected by UPR; the reactions of retailers have been overlooked. Specifically, when price competition is intensified by UPR, a retail store may be incentivized to soften price competition for higher markups using various non-price strategies. They may improve the service quality, reduce the stockout rate, conduct promotion activities, etc. (Chiang, 1995; Low and Mohr, 2000; Clay et al., 2002; Matsa, 2011). They may also soften price competition via changing product offerings (Draganska and Jain, 2005; Dukes et al., 2009; Mantrala, 2009). On the one hand, offering more products helps draw consumers' attention away from price comparison to attribute comparison by increasing the number of products/brands (Bordalo et al., 2013). On the other hand, intra-store

product competition can be reduced by product differentiation or brand specification (Sullivan, 2020), which could reduce the number of products offered. The net effect of UPR on the portfolio of products is likely complicated and calls for a comprehensive empirical analysis using product-level observations.

We take the U.S. yogurt industry as an example to empirically investigate the effects of UPR on the product assortment of retail stores. We use the Nielsen Retail Scanner data covering 2006 to 2016 in five states that impose UPR as well as four neighboring states that do not. It contains rich information about yogurt attributes at the product level and product sales in 872 stores. We choose the yogurt market mainly because yogurt is one of the most popular retail products carried by stores (Villas-Boas, 2007). More importantly, yogurt products are highly differentiated and have many attributes, such as package sizes, flavors, types, and styles, allowing the store to adjust product offerings in various ways.

Our identification strategy relies upon the geographic variation in the time-invariant UPR status across states, which is exogenous to any store's assortment decision. According to the National Institute of Standards and Technology, the indication of unit prices is regulated by each U.S. state (Sefcik, 2014). There are 19 states and two territories where UPR is in effect. By comparing the product assortment for stores in and outside "UPR states", we are able to identify the effects of the policy. Our baseline empirical model follows the contiguous border county-pair framework of Dube, Lester, and Reich (2010). We focus on stores located on the two sides of the borderlines between states with mandatory and without UPR. By constructing county pairs, regulated stores are paired with their unregulated counterparts, assuming that these stores experience similar demand and supply shocks over time. To strengthen the identification of UPR effects, economic and demographic information at the county level, such as house prices,

unemployment rate, population, and gender ratio, are added to characterize local demand for yogurt products.

We focus on two retail formats – grocery stores and mass merchandisers.[1] These two channels target different consumer groups, conduct differential assortment strategies, and likely respond to UPR differently. Specifically, mass merchandisers are characterized by their lower prices and narrower product offerings, whereas grocery stores often carry many more varieties, including niche brands, and charge relatively high prices (Kim et al. 2002; Ellickson, 2006).

Further, we consider the zone-level management in retail chains. Prior studies show that stores belonging to the same chain charge nearly uniform prices and offer similar products across local markets with heterogeneous consumer base and local competition (DellaVigna and Gentzkow, 2019; Hitsch, Hortacsu, and Lin, 2019). In our context, the chain-level management implies that the effect of UPR on a store is likely to be weakened if the store has peer chain stores in states without UPR. We hence explore the differential impacts of UPR on stores with and without peer chain stores in UPR-free states (hereafter, stores with and without UPR-free peers).

Our baseline outcomes show significant product assortment adjustments by stores. We find that an average regulated mass merchandizers offer 21 fewer products compared to their unregulated counterparts, which is nearly one-third of the average number of products carried by mass merchandizers. Mass merchandizers in regulated states also tend to reduce their product varieties in terms of the number of brands, packaging formats, and varieties. Second, mass merchandizers in regulated states tend to offer more differentiated yogurt products compared to unregulated stores. Third, regulated mass merchandizers tend to introduce and remove more

[1] We exclude other channels like drug stores because grocery stores and mass merchandisers are two major channels selling yogurt products. These two channels account for more than 99% of yogurt total sales in our sample. Grocery stores refer to standard supermarkets which provide various food and non-food products. Mass merchandisers refer to supercenters like Walmart.

products over time. These results imply that mass merchandizers in regulated states tend to provide fewer but more distinctive yogurt products by adding product attributes and changing the product portfolio frequently to distract consumers' attention from prices.

For grocery stores, we find heterogeneous product assortment effects on stores with and without UPR-free peers. Our finding shows that regulated stores without UPR-free peers actively adjust their product offerings, which is consistent with previous studies (DellaVigna and Gentzkow, 2019). First, regulated grocery stores without UPR-free peers tend to offer 5 more yogurt brands, which is nearly 40% of the average number of brands. They also tend to offer more packaging sizes and varieties compared to unregulated stores without UPR-free peers. Second, regulated grocery stores without UPR-free peers are more likely to provide differentiated yogurt products. Regulated and unregulated stores that belong to retail chains, however, do not differ significantly in terms of the total number of products/brands/varieties offered. Third, regulated stores without UPR-free peers tend to introduce and remove more products over years. This is suggesting that stores that do not belong to the large retail chain are those who conduct assortment strategies to react to UPR more actively.

Further, we investigate the UPR effect on the store's retail price. We find that regulated grocery stores without UPR-free peers manage to charge a higher price together with introducing more products. On average, the price in a regulated grocery store without UPR-free peers is 16% higher than that in an unregulated store. Regulated and unregulated stores that belong to retail chains, however, do not charge significantly different prices. Mass merchandizers in states with UPR do not charge significantly different prices compared to unregulated stores, though they conduct various product assortment strategies to soften the price competition brought by UPR.

Given that grocery stores and mass merchandizers respond to UPR differently, we conduct several counterfactual welfare analyses and explore the UPR impacts on consumer welfare. Results show that the implementation of UPR leads to a loss of welfare for mass merchandizer consumers. On average, each consumer loses surplus worth $0.82 per year, which accounts for 2.2% of their total yogurt expenditure. For consumers shopping at grocery stores without UPR-free peers, they face higher prices and experience welfare loss although more brands are introduced under UPR. On average, each consumer loses $0.45 per year, which is 1.2% of their annual yogurt expenditure.

We make two major contributions to the literature. To our knowledge, this is the first study that investigates the impacts of UPR on the store's product assortment strategies. A store's reactions to product assortment are important because the choice set faced by consumers as well as the competitive landscape within and across stores are changed. Studies have examined the effect of UPR on consumers' purchase decisions. They find that consumers' awareness of unit prices makes it more difficult for retailers to use pricing strategies, such as package downsizing and quantity surcharge (Çakır and Balagatas, 2014; Miyazaki et al., 2000; Kachersky, 2011) to confuse consumers about the actual value of products. Only a few studies have examined the effect of UPR on retailer stores, but only from the perspective of prices and sales (Russo et al., 1975; Russo, 1977; Creyer and Ross, 1997; Kachersky, 2011). No prior study tries to understand how UPR induces store's product assortment reactions to soften price competition which is intensified by UPR. We fill the research gap by empirically investigating the regulation effects on variations of products provided by stores.

Moreover, our findings have important policy implications. Although the aim of introducing UPR is to help consumers make better purchase decisions, the unintended effect on product varieties would change consumer choice sets, which affects consumer surplus. We show

that UPR leads to the welfare loss for consumers loyal to mass merchandizers because fewer options are offered. The welfare of grocery store shoppers also decreases because the welfare loss due to higher retail prices exceeds the welfare gain from introduction of new brands. Considering stores' assortment adjustments avoids bias in evaluating UPR impacts on consumers.

The rest of the paper is organized as follows. We present a simple conceptual model which captures the store's reaction to UPR in the next section. Section 3 describes the empirical strategies and the construction of key variables. Section 4 presents the datasets we use to conduct the empirical analyses. Section 5 summarizes the results of baseline analysis and sensitivity checks. Section 6 concludes with policy implications.

2. Conceptual Model

Changing product assortments is one of the most common approaches stores use to distinguish themselves from others. Previous studies have shown that product offerings play a strategic role in firms (Dixit and Stiglitz, 1977; Draganska and Jain, 2005; Richards and Hamilton, 2006). From the Food Marketing Institute's annual survey of grocers, the number of items (referred to as stock-keeping units) per store was just over 14,000 in 1980, then climbed to about 51,000 in 2008, and dropped to 33,055 in 2018 subsequently (Baum, 2019). The fluctuation implies that stores change their product offerings over time.

To rationalize the influence of the implementation of UPR on the store's variety choice, we build a simple conceptual model by considering a store's profit maximization problem. We assume that the demand for the product offered by store i in a local market is q_i. We normalize it to 1 for simplicity. Let $p_i(.)$ and $c_i(.)$ be the revenue and cost function for store i. The key choice variable is v_i, which is the number of products that a store offers. Following the literature, we assume that the revenue and cost functions are concave and convex in variety, respectively: $p_v >$

$0, p_{vv} < 0, c_v < 0$, and $c_{vv} > 0$) (Bayus and Putsis, 1999; Draganska and Jain, 2005; Draganska, Mazzeo, and Seim, 2009).

The profit maximization problem of a retail store is expressed by:

$$max_{v_i}\pi_i = [1 + \gamma_i(\tau_i)]p_i(\theta, \tau_i) - c_i(v_i)$$

A store maximizes the profit from current sales by choosing the number of product varieties to offer. In the equation above, γ is the potential expansion of the current market size, implying that the store can capture an extra consumer base if they satisfy consumer demand for variety. We assume that $\gamma(.)$ is concave in v_i, meaning that the more varieties a store offers, the larger consumer demand there will be, but at a decreasing speed ($\gamma_v > 0, \gamma_{vv} < 0$). We use θ to represent the intensity of price competition, which is increased by UPR. The term τ_i is the consumer preference for variety in the local market and is exogenous to stores. A larger τ_i implies that consumers have a strong preference for variety.

The first-order condition of the objective function is:

$$p_v - c_v + \gamma_v p + \gamma p_v = 0$$

The optimal varieties offered is denoted by $v^*(\theta, \tau_i)$. To see how v^* changes under UPR, we rely on the Implicit Function Theorem (IFT) and obtain:

$$\frac{\partial v^*}{\partial \theta} = \frac{-(1+\gamma)p_{v\theta} - \gamma_v p_\theta}{(1+\gamma)p_{vv} - c_{vv} + \gamma_{vv}p + 2\gamma_v p_v}$$

Assume that the revenue and marginal revenue with respect to product variety decrease when price competition intensifies, namely, $p_{v\theta} < 0$ and $p_\theta < 0$. Knowing that $\gamma_v > 0$, the numerator of $\frac{\partial v^*}{\partial \theta}$ is always positive. The sign of the denominator is, however, ambiguous.

Consider two extreme cases. First, consumers in the local market do not care about product varieties at all, or τ_i approaches 0. The retail price and consumer demand would hence not change in v_i, meaning that p_v, p_{vv}, γ_v, and γ_{vv} are all approach 0. Thus, $\frac{\partial v^*}{\partial \theta}$ is negative. Second, in contrast, consumers care about the product varieties strongly. Stores then face a very large τ_i.

Hence, p_v and γ_v are likely positive and large, while p_{vv} and γ_{vv} are small and negative, implying $\frac{\partial v^*}{\partial \theta} > 0$. Although v_i is defined as product varieties offered in a store in the conceptual model, the rationale can be easily extended to other choice variables. For example, changes of brand proximity and dynamics in product portfolio in a store can be seen as approaches to adjust product variety. Thus, v_i can be generalized to store's product assortment strategies that affect the number of products with different attributes.

Stores of different formats target different consumer groups (Ellickson, 2006). Mass merchandisers are, for instance, featured by their lower prices and narrower product assortments. This attracts price-sensitive consumers who may not care much about the product variety. For consumers who value product varieties, they are more likely to shop at traditional supermarkets which provide them with more distinct product items. Hence, based on comparative statistics above, mass merchandizers may try to reduce varieties in response to an intense price competition due to the UPR, corresponding to the first extreme case above ($\frac{\partial v^*}{\partial \theta} < 0$). Grocery stores under UPR, in contrast, may offer more varieties to further divert consumers' attention away from prices, which is consistent with the second extreme case ($\frac{\partial v^*}{\partial \theta} > 0$). In the following sections, we identify UPR effects on mass merchandisers and grocery stores, respectively.

3. Empirical Strategy

In this section, we first present our identification strategy for the effect of UPR on the store's product assortment and pricing. We then construct variables that characterize product offerings and retail prices of yogurt products at the store level.

3.1 Identification Strategy

Our identification strategy for estimating the net effect of UPR on the store's product assortment strategies contains two parts. First, to eliminate the potential omitted variable bias and selection bias to the best we can, we use a large set of control variables, including the market-specific trends to capture demand or supply shocks that may affect the regulation status of a store and its product assortment. We also include various fixed effects to capture the time-invariant factors across markets that affect local demand or supply costs but are not observed by researchers.

Time-variant unobserved demand and supply factors, such as costs of changing the price tags, that affect both the implementation of UPR and the retail store's product offerings may still cause the endogeneity problem and bias the estimates. One non-experimental approach to tackle this problem is difference-in-difference (DID) estimation that would require store's pre-treatment and post-treatment product assortments. However, our treatment, mandatory UPR, was imposed at the state level in the 1970s and is fixed from 2006 to 2016, ruling out the DID estimator.

To address the endogeneity problem, we adopt the framework developed by Dube, Lester, and Reich (2010) that takes advantage of policy discontinuity at the state border to identify the regulation effect on the store's product offerings. Following the framework of Dube, Lester, and Reich (2010) (hereafter, DLR), we assume that regulated and unregulated stores in the contiguous border counties share demand and supply shocks over time because of their geographical proximity. Stores across the border only differ in whether they follow the mandatory UPR, controlling for store types and local demand and supply features.

We pair the regulated counties with their contiguous border unregulated counterparts, so that regulated stores are compared against stores in UPR-free contiguous border counties. In practice, a county can be paired with multiple contiguous border counties, so stores may be

duplicated to match with stores in each contiguous border county. One concern is that mechanical correlations among store observations are created by construction. We will revisit this issue and discuss the solution below.

3.2 UPR Effects on Product Offerings

We measure a store's product offerings using three sets of measurements. Each captures one aspect of the product portfolio. The first set of measurements depicts the number of product varieties offered at the store-month level. The second measurement characterizes the level of product differentiation in a store. Thirdly, we create the store's product creation and destruction to measure the dynamics in the store's product offerings.

The first group of outcome variables measuring the number of products offered by stores is constructed by simply counting the number of Universal Product Codes (UPCs), brands, packaging sizes, and varieties at the store-month level. To count the number of product varieties, we create the variety code for each UPC by combining the product flavor, type, and style codes in the RMS data (see Appendix Table A1). Then we count the number of unique variety codes in a store in a month.

Second, we measure how differentiated brands are within a store. Following Sweeting (2010), we construct the variety uniqueness index at the store-month level. This index is defined as the average percent of varieties of each brand that are not carried by other brands at all in a store. The measure ranges from 0 to 100. When it equals 0, no yogurt brand in the store offers any unique variety; if it equals 100, each brand in the store offers a completely unique set of flavors, types, and styles. Between 0 and 100, the larger the index, the more distinctive attributes of products of different brands have in a store.

Besides measuring the store's product assortment in each month, we are interested in how the regulation affects the way that the store changes its product portfolio by adding new products and dropping old products over time. We follow Broda and Weinstein (2010) to measure the store's product creation and destruction. Specifically, we define four variables below:

$$Product\ Creation_{t,t-1}{}^{1} = \frac{\#New\ UPCs_{t,t-1}}{Total\ \#UPCs_t}$$

$$Product\ Creation_{t,t-1}{}^{2} = \frac{Sales\ of\ new\ UPCs_{t,t-1}}{Total\ sales\ of\ UPCs_t}$$

$$Product\ Destruction_{t,t-1}{}^{1} = \frac{\#Disappearing\ UPCs_{t,t-1}}{Total\ \#UPCs_{t-1}}$$

$$Product\ Destruction_{t,t-1}{}^{2} = \frac{Sales\ of\ disappearing\ UPCs_{t,t-1}}{Total\ sales\ of\ UPCs_{t-1}}$$

Product creation is defined as the share of newly introduced UPCs in year t by number or sales. Product destruction is defined in a similar way. The net creation is obtained by subtracting product destruction from creation. These variables together describe how different the product portfolio is in the current year compared to that in the previous year for a store.

Our baseline econometric model is specified below:

(1) $y_{j_k rmt} = \beta_0 + \beta_1 Reg_m + BP_{j_k rm} + X'_{jmt}\rho_{jmt} + \delta_r + \phi_t + \tau_{mt} + \epsilon_{j_k rmt}$,

where j refers to stores and k refers to the instances of the store appearing in the sample (to be explained below). The term r refers to retail chains, m refers to counties, and t refers to months. The dependent variable, $y_{j_k rmt}$, refers to the first and second sets of variables, including the total number of UPCs, brands, packaging sizes, and varieties, and the variety uniqueness index.

In this baseline model, we focus on stores located on the two sides of the borderlines between states with mandatory UPR and states without UPR (see Figure 1). Dummy variable Reg_m equals 1 if the store is in the state with mandatory UPR. All stores located in states with mandatory UPR are required to offer unit price tags. Stores in states without mandatory UPR can voluntarily choose whether to provide the unit price tags. This potential contamination of the

control group makes us effectively estimate the Intent-To-Treat or β_1. The potential contamination is likely to attenuate the regulation effect, implying that our estimated effect is conservative.

$BP_{j_k rm}$ is the indicator of contiguous cross-border county pairs. Stores in one county may be matched with multiple groups of stores from border counties because one county may have more than one contiguous border counterpart. Some stores may enter the datasets multiple times. We index the number of a store that enters the dataset as *k*. To correct the mechanical correlation in the residuals, $\epsilon_{j_k rmt}$, across stores in each county pair, we follow DLR and cluster the standard errors for estimates at both state level and border segment level.[2]

Vector X'_{jmt} contains store-level and county-level characteristics that may influence the store's product assortment strategies, including the number of competitor stores in the county, county population, monthly unemployment rate, house value, and gender ratio. Vector δ_r contains the retail chain fixed effects, which accounts for characteristics that are in common for stores belonging to the same retail chain. Vector ϕ_t contains year and quarter fixed effects, accounting for seasonal and trends of the store's product assortment decisions. We add τ_{mt} to capture a county-specific time trend, which allows counties with and without mandatory UPR to have differential trajectories in product assortment.

If a store belongs to a large retail chain, its product offerings and retail prices may not be adjusted due to local regulation (DellaVigna and Gentzkow, 2019; Hitsch, Hortacsu, and Lin, 2019).[3] Thus, it is reasonable to expect that stores that do not belong to a retail chain may react

[2] Border segment is the set of all counties on both sides of a border between two states.

[3] A study from Butters, Sacks, and Seo (2022) shows that stores belonging to large national chains do not respond to local demand shocks, but they do adjust local prices when facing local cost shocks. In our study, we do not expect UPR is related to the local cost shocks. However, we assume that UPR may influence consumer demand through an indirect way. For example, by knowing the unit price of products, consumers with lower income who are more sensitive to prices would prefer products with lower unit price.

actively to UPR by offering more product varieties. Furthermore, retail stores facing price competition may use other strategies to differentiate their products to reduce the substitutability among products (Sullivan, 2020). Thus, how a store under UPR changes its product offerings is an empirical question to answer. To investigate the differential effect of UPR on the store's product assortment, we add a dummy variable, $Peer_j$, that equals 1 if store j has peer chains stores located in unregulated states and 0 otherwise. The econometric model is:

(2) $y_{j_k rmt} = \beta_0 + \beta_1 Reg_{jm} + \beta_2 Peer_j + \beta_3 Reg_{jm} Peer_j + BP_{j_k rm} + X'_{jmt}\rho_{jmt} + \delta_r + \phi_t + \tau_{mt} + \epsilon_{j_k rmt}$,

The term, $Reg_{jm}Peer_j$, is the interaction between regulation and peer store dummies. All other variables are the same as in equation (1). We apply equation (2) to grocery stores since not all of them have UPR-free peers. All mass merchandizers in the sample have UPR-free peers, so that $Peer_j$ dummy does not have any variation. Thus, we apply equation (1) to investigate the assortment effects of UPR on mass merchandizers.

For the third set of variables, the econometric model measuring the regulation effect on product creation and destruction is:

(3) $y_{j_k rmt} = \beta_0 + \beta_1 Reg_m + BP_{j_k rm} + X'_{jmt} + \delta_r + \phi_t + \tau_{mt} + \epsilon_{j_k rmt}$

Since product creation and destruction are constructed at the store-year level, t refers to year instead of month. The dependent variable $y_{j_k rmt}$ refers to the product creation and destruction at the store-year-county level. We use annual county median income to control for the local income level. Year and quarter fixed effects are dropped, while the county-specific yearly time trend is kept. All other variables are defined in equation (1). As mentioned before, we extend the model to consider the heterogeneous effects of UPR on stores with and without UPR-free peers.

3.3 UPR Effects on Prices

The UPR effect on prices can be imposed through two channels. First, the intensified price competition brought by UPR may directly impact product retail prices. Second, prices in a store can be affected indirectly through UPR-driven product assortment changes in the store. To isolate the direct effect on retail prices, we conduct a regression of UPC-store-month price for all "common UPCs" sold every month by stores in both regulated and unregulated states. By excluding "unique UPCs" that are only sold by stores either in states with or without regulation, we ensure that any differences in prices by different stores are not driven by any systematic differences between unique UPCs and common UPCs.

The specification involves three steps. First, we create three borderlines including New York-New Jersey-Maryland-Pennsylvania-Delaware, Oregon-Idaho, and Maine-New Hampshire. Common UPCs are defined as items that are sold by regulated and unregulated stores along the same borderline each month. We take the logarithm of the UPC price which is then used as the dependent variable. Second, we incorporate three variables to control for the indirect price impact of UPR through the store's product assortment. The three variables are the number of UPCs, variety uniqueness index, and average UPC size at the store-month level. Third, we follow Hausman's method (Hausman, 1996; Nevo, 2001) to create instrumental variables (IV) for the three product assortment variables because price and assortment may be jointly determined by a store. The IVs include the average number of UPCs, average variety uniqueness index, and average UPC size for stores that are in the inner counties of the same state. They capture shocks shared by border counties and inner counties in the same state that affect the store's retail prices only through its product offerings.

The regression model used to estimate the direct UPR effect on prices is specified as follow:

(4) $y_{ijlmt} = \beta_0 + \beta_1 Reg_m + X'_{jmt} + Z'_{jmt} + B_l + \delta_i + \phi_t + \tau_{mt} + \epsilon_{ijlmt}$,

where y_{ijlrmt} is the logged retail price of UPC i in store j in borderline l in county m in month t. The vector Z'_{jmt} contains the three product assortment variables mentioned above. The vector B_l includes borderline fixed effects. The UPC fixed effect, δ_i, captures unobserved time-invariant UPC features that impact retail prices, such as flavors. All other variables are the same as those in equation (3). The coefficient β_1 indicates the direct UPR effect on prices. For grocery stores, we add a dummy variable, $Peer_j$, and its interaction term, $Reg_{jm}Peer_j$, as in section 3.2 to explore the differential UPR effects on retail prices.

4. Data

We describe two main datasets in this section, including the regulation dataset and the Nielsen Retail Scanner Dataset. We complement these two datasets by collecting various county-level economic and demographic information. Summary statistics that depict the store's product offerings are reported.

4.1 Regulation Dataset

The indication of unit prices is regulated by each U.S. state from National Institute of Standards and Technology (2020) (hereafter, NIST). There are 20 states/regions and two territories where UPR exists. In 10 of these states or regions, stores have to follow the mandatory UPR either from the state legislation or from NIST Handbook. They are Connecticut, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Oregon, Rhode Island, Vermont, and the District of Columbia. Ten other states and 2 territories have not developed their UPR but adopted the UPR from the NIST Handbook 130, which are called voluntary states/regions. All other states neither adopted the UPR from NIST Handbook nor developed their legislation of unit pricing. Figure A1 shows the states with mandatory or voluntary UPR and without UPR.

We create the UPR dataset including the implementation of UPR in each state based on the information from NIST. We divide states into three groups, which are states with mandatory UPR, voluntary UPR, and no UPR. In the analysis, we focus on the stores located in the counties that are on the two sides of the borderlines between states with mandatory UPR (Maryland, New Hampshire, New Jersey, New York, and Oregon) and states without UPR (Delaware, Idaho, Maine and Pennsylvania). This gives us a sample containing 9 states and 75 counties. Among the 75 counties, 41 of them are located in states with mandatory UPR whereas 34 of them are in states without the UPR.

4.2 Nielsen Retail Scanner Dataset

The Nielsen Retail Scanner dataset includes the weekly volume and dollar sales of retail products carried by more than 30,000 retail stores from some 90 retail chains throughout 49 states in the U.S. from 2006 to 2016. Each product is represented by UPC. Because we care about the number of products and brands regularly carried by retail stores, the data are aggregated to the monthly level to avoid undercounting products that are not recorded in weekly observations due to zero sales in a week.

Table 1 presents the number of counties, grocery stores, and mass merchandizers by state in the border county pair sample. There are 265 grocery stores and 130 mass merchandizers in regulated states. More grocery stores and mass merchandizers are in unregulated states. Grocery stores are owned by over 20 retail chains, whereas mass merchandizers belong to three (four) retail chains in regulated (unregulated) states.

Table 2 displays a few key statistics. Observations in the summary table match with those in regressions. The upper panel of Table 2 shows that an average grocery store without UPR-free peers under mandatory UPR offers 267 UPCs, 27 brands and 47 varieties, which are nearly 10%,

6%, and 4% fewer than those offered by an average unregulated store, respectively. The mean uniqueness index is about 10% higher in regulated stores compared to their regulated counterparts. The average proportion of new UPCs stores add to their portfolio every year is 30%, while the proportion of UPCs they throw out is about 20%. Price of yogurt products is around 15 cents per ounce. The middle panel shows the summary statistics of grocery stores with UPR-free peers. On average, regulated stores offer 12 more UPCs, one more brand, and one more variety compared to unregulated stores. The mean retail price in unregulated stores is 0.3 cents higher than that in regulated stores, which is 2% of the average price.

The lower panel of Table 2 summarizes the statistics of mass merchandizers. Regulated mass merchandisers, on average, provide more UPCs, brands, and varieties of yogurt products compared to unregulated stores. Products on the shelf in regulated stores tend to be more similar as indicated by a relatively small uniqueness index. Compared to unregulated stores, regulated stores tend to carry more new products each year. The average proportion of new UPCs is nearly 50%. About 26% of UPCs are dropped by both regulated and unregulated stores each year. The average unit price is 0.6 cents lower in regulated stores than that in unregulated stores, which is around 4% of the average price.

4.3 County-Level Economic and Demographic Data

To account for the potential that stores in counties with different local economic and demographic conditions differ systematically in terms of product offerings, we augment the RMS data with three county-level economic and demographic datasets. First, we collect Zillow Inc.'s House Value Index which is used to measure house values at the county-monthly level. The Zillow Index has been used in previous studies as a proxy to measure local wealth (Mian, Sufi, and Trebbi, 2015; Dube, Hitsch, and Rossi, 2018). In addition, we collect county monthly unemployment rates from

the U.S. Bureau of Labor Statistics. The monthly unemployment rate is used as a proxy to measure the local income status. We also collect county yearly median income from the U.S. Census Bureau. The logged county-year median income is used as a control variable in the product creation and destruction regression. Finally, annual county population estimates by gender are obtained from the U.S. Census Bureau. Summary statistics of county-level economic and demographic information are in appendix 3, and web links of data sources are found there, too.

5. Results

In this section, we present our baseline regression results regarding the regulation effect on the store's product offerings and pricing. We also report results from several sensitivity analyses.

5.1 Baseline Results

Table 3 reports estimation outcomes for equations (1) and (2) for mass merchandizers and grocery stores, respectively. Each column focuses on one dependent variable. The first panel presents the effect of mandatory UPR on grocery stores with and without UPR-free peers. We find a significant positive effect on product offerings for stores without UPR-free peers. On average, they offer 5 more brands, 1 more package size, and 5 more varieties compared to unregulated stores. They also enrich their product portfolio by introducing more products with distinctive attributes. The findings are rationalized by our conceptual model which suggests that grocery stores tend to offer more product varieties to countervail the intensified price competition.

However, regulated stores with UPR-free peers do not change their product assortment significantly. This result is consistent with findings from prior studies (DellaVigna and Gentzkow, 2019; Hitsch, Hortacsu, and Lin, 2019) showing that retail stores that belong to the same retail chain tend to offer similar product assortments. In our context, specifically, regulated stores with

UPR-free peers make no significant adjustments likely due to chain-level management decisions that do not prioritize the local UPR.

Results from panel 2 in Table 3 show that mass merchandisers react to the UPR by changing their product varieties in a significant way. We find that mass merchandisers in regulated states reduce the products offered by stores significantly in terms of the number of UPCs, brands, packaging formats, and varieties. On average, regulated stores carry 22 fewer UPCs compared to unregulated stores, which is about 40% of the average number of UPCs for mass merchandizers. The effect is statistically significant at the 1% level. Similar regulation effects are found in other dimensions of product varieties. On average, regulated mass merchandisers offer 3 fewer brands, 3 fewer packaging formats, and 5 fewer varieties compared to unregulated stores. All these effects are statistically significant at the 1% level. Relative to the sample mean, these estimates are equivalent to a 35% decrease in product varieties for regulated stores. This echoes our conclusion of the conceptual model that mass merchandizers tend to offer fewer product varieties when facing UPR.

Further, we find a significantly positive effect of regulation on product differentiation, implying that regulated mass merchandisers provide more distinct products in each brand than unregulated stores. According to the definition of the variety uniqueness index, 6.7% more product varieties offered by regulated stores are unique within brands than those by unregulated stores (i.e., a 10% increase in the level of product differentiation relative to the sample mean). This result echoes Sullivan (2020) who finds that Ben & Jerry's and Häagen-Dazs strategically choose to offer ice cream with distinct flavors and add-ins to avoid direct competition. By offering products with distinct attributes, regulated mass merchandizers can reduce the substitutability among products, making it difficult for consumers to compare products even with unit price tags.

In Table 4, we show the regulation effects on the store's dynamic portfolio decisions. Columns (1), (3), and (5) show regulation impacts on grocery stores' product creation, destruction, and net creation. We find that, on average, regulated stores without UPR-free peers add five more UPCs and discard nine more UPCs than their unregulated counterparts in year t for every 100 products offered in year $t-1$. For stores with UPR-free peers, regulated stores tend to add one fewer UPC and discard two more UPCs compared to unregulated stores in year t for every 100 products offered in year $t-1$. The results imply that regulated stores without UPR-free peers adjust their product portfolio more heavily over years. However, we do not find significant regulation effects on the net product creation for stores with and without UPR-free peers.

Regulation effects on dynamic changes in product portfolio for mass merchandizers are reported in columns (2), (4), and (6) of Table 4. Column (6) shows the impact of regulation on net product creation. We find that 33 more new products are introduced by regulated stores compared to unregulated stores for every 100 UPCs every year. Relative to the yearly average number of UPCs carried by mass merchandizers, this corresponds to around 21 more new items in regulated mass merchandizers each year compared to their unregulated counterparts. Results in Table 4, taken together, show that the UPR affects the dynamic change of product portfolio for mass merchandizers. Regulated stores tend to add more new items on the shelf. However, grocery stores in regulated and unregulated states do not differ significantly in terms of introducing and removing yogurt products.

Table 5 presents the direct UPR effect on retail prices for grocery stores and mass merchandizers, respectively. Considering all common yogurt products, we find that regulated grocery stores without UPR-free peers charge 16% higher than their unregulated counterparts, while regulated and unregulated stores with UPR-free peers do not charge significantly different

prices. Prices in regulated and unregulated mass merchandizers, however, are not significantly different.

Taken together with previous results, this implies that regulated grocery stores without UPR-free peers offer more brands and achieve higher equilibrium retail prices. Regulated grocery stores with UPR-free peers neither change the number of products nor adjust prices significantly, but they might conduct other types of non-price competition (i.e., advertising). Regulated mass merchandizers, however, react to UPR predominantly by conducting assortment competition, which does not result in a significant change in the retail price. Since an (a) increase (decrease) in the number of products/brands and the higher (lower) retail prices create conflict consequences in consumer welfare, the welfare effects of UPR are ambiguous.

5.2 Sensitivity Analyses

This sub-section presents results from several sensitivity analyses. First, we construct a new sample containing stores in border counties of states with voluntary UPR and without UPR. From NIST Handbook 130 (2020), ten other states and two territories have not developed their own UPR but adopted the UPR from NIST, and they do not require stores to provide unit price tags.[4] However, stores in these states and territories have to follow the requirements in the NIST Handbook once they decide to do so. Thus, the intensity of offering unit price tags in states following voluntary UPR is lower than that in mandatory UPR states, but higher than that in No UPR states. In this regard, we expect a similar but weaker regulation effect. From columns (1) and (2) in Table A3, we find that mass merchandizers in voluntary UPR states offer 24 fewer UPCs, 2 fewer brands, 2 fewer packaging sizes, and 3 fewer varieties compared to unregulated mass merchandizers. All these regulation effects are statistically significant at the 1% level. However,

[4] The ten states are Arkansas, California, Florida, Hawaii, Mississippi, Montana, Nevada, Virginia, Washington, and West Virginia. The two territories are Puerto Rico, Virgin Islands.

we do not find voluntary UPR affects the product variety uniqueness of mass merchandizers significantly. These effects are generally weaker than the effects in baseline, which is in line with our expectations.

Second, we use the same econometric models but focus on the sample period from 2012 to 2016. We focus on the period after 2012 to rule out the possible impact of the Great Recession on the store's product assortment strategies. It is shown that the recession has changed consumers' shopping decisions significantly. They care more about prices and use more time to economize their choices (Nevo and Wong, 2019). To meet consumers' demand, retail stores may adjust their prices and/or product assortments accordingly. For example, they may offer more products on sale and products in a larger size. Column (4) in Table A3 shows that regulated mass merchandizers provide fewer products with more distinctive attributes compared to unregulated stores. In addition, we find that regulated grocery stores tend to offer products with more different characteristics, although the number of products is not significantly different from that in unregulated stores (Column 3, Table A3).

5.3 Welfare Analysis

We conduct welfare analysis by setting up several counterfactual scenarios to investigate the impact of UPR on consumer surplus (CS) through the store's price and product portfolio adjustments. Based on the baseline results in tables 3 and 5, we know that mass merchandizers respond to UPR by offering a smaller set of UPCs, which is harmful to consumers, without changing prices. Grocery stores without UPR-free peers tend to offer more yogurt brands and raise prices, resulting in an ambiguous effect on CS. Given different adjustments that stores make under UPR, we conduct the welfare analysis for mass merchandizers and grocery stores without UPR-free peers separately.

To measure the change in CS due to UPR, we need to first estimate the demand. We choose the simple logit discrete choice model for computational simplicity and flexibility. The simple logit model, admitted, has its disadvantages since it ignores the heterogeneity of consumer preference among product characteristics (Grigolon and Verboven, 2014). This leads to some unrealistic results, for example, cross-price elasticity only depends on market shares and prices but not demographic variables. But given that we focus on the average welfare impact on consumers, a more complicated demand model is unlikely to add much new insight.

Our goal is to calculate the changes in CS in unregulated counties if UPR were implemented. We briefly summarize the steps here and leave the details in Appendix 4. First, we estimate the logit demand model for all UPCs offered in regulated and unregulated border counties. The monthly prices and volume shares of all UPCs sold from 2012 to 2013 are calculated in each border county.[5] On average, the yogurt consumption per capita is 18.7 OZ and 19.9 OZ per month in 2012 and 2013, respectively (U.S. Department of Agriculture, 2022). The outside option is hence defined as the remaining yogurt products sold in the same market and month following Villas-Boas (2007). Household demographic variables from the Nielsen Home Scan Data are obtained by taking the weighted average of household income, head age, size, and children information based on the fraction of visits in a certain type of retail channel. They are proxies for consumer preferences for yogurt products for a given retail format.

Second, knowing the average UPCs offered by a store (see table 2), a representative set of UPCs in the unregulated market is constructed by ranking the frequency of appearances for each UPC at a particular format of store. The baseline CS_0 is then computed. Third, given the UPR

[5] Since the implementation of UPR is time-invariant, it should not matter what periods we choose to conduct welfare analysis. We thus choose 2012 and 2013 as baseline, and repeat the same process for 2015 and 2016 as well. The results do not change qualitatively, suggesting that the periods do not affect the results.

effects on product offerings and prices, we conduct several counterfactual analyses through varying the product portfolio and/or product price and calculate the corresponding CS_1. Finally, the welfare changes ($\Delta CS = CS_1 - CS_0$) are computed.

The logit demand model can be represented as follows:

(5) $ln(s_{jmt}) - ln(s_{0mt}) = \alpha p_{jmt} + X_{jt}\beta + D_{mt}\mu + \zeta_j + \pi_t + \epsilon_{jt}$

where s_{jmt} is the volume share of UPC *j* sold in county *m* at time *t*. Term s_{0mt} is the share of the outside option. The price of UPC *j* in county *m* at time *t* is represented as p_{jmt}. Vector X_{jt} represents characteristics of UPC *j*, including package size, flavor, style, and type. Vector D_{mt} contains four household demographic variables mentioned above. Term ζ_j refers to brand and retailer fixed effects, and other unobserved product characteristics. Term π_t is the quarter fixed effects. Term ϵ_{jt} is the error term. Due to the potential endogeneity of product price, we follow Nevo (2001) and use Hausman IV, which is the price of the same UPC sold in the same month in states other than the nine sample states, and apply Two-Stage Least Square (2SLS) method to estimate the model.

We define CS as the expected maximum indirect utility, which can be written as:

(6) $E(CS_{m0}) = \frac{1}{\alpha} ln\left(\sum_{j=1}^{J} e^{V_j^0}\right) + C$

where V_j is the indirect utility $\hat{\alpha} p_{jmt} + X_{jt}\hat{\beta} + D_{mt}\hat{\mu} + \zeta_j + \pi_t$. Term α is the price coefficient in equation (6), and C is a constant.

We consider different counterfactual scenarios for each channel. According to the baseline results, mass merchandizers remove 21 out of 55 UPCs and keep prices unchanged if the UPR is in effect. Knowing that regulated mass merchandizers are more likely to remove UPCs with regular style, niche type, and higher price (Columns 3 and 4, Table A7), we randomly remove UPCs from

the portfolio by assigning higher removal probabilities for products with these three attributes.[6] We consider the scenario that mass merchandizers only remove 21 UPCs, and scenarios that they remove and add UPCs simultaneously with a net reduction of UPCs as 21. For grocery stores without UPR-free peers, 5 out of 28 brands are added to the product portfolio with a 16% increase in price, but the number of UPCs is not changed. This suggests that stores add brands but exclude the same number of existing UPCs due to the introduction of the new brands. By adjusting the product portfolio and price, a new CS can be obtained as:

(7) $E(CS_{m1}) = \frac{1}{\alpha} ln\left(\sum_{j=1}^{J'} e^{V_j^1}\right) + C$

The change in CS is then calculated as:

(8) $\Delta E(CS) = \frac{1}{\alpha}\left[ln\left(\sum_{j=1}^{J'} e^{V_j^1}\right) - ln\left(\sum_{j=1}^{J} e^{V_j^0}\right)\right]$.

This process is repeated 100 times for each scenario to compute the average change in CS across months and counties.

Table 6 summarizes the simulation results of UPR impacts on consumer welfare. The upper panel presents the change in consumer welfare for mass merchandizers under each situation. If UPR takes effect and mass merchandizers remove 21 UPCs, on average, each consumer loses \$0.82 for yogurt products they purchase from mass merchandizers per year (Column 1, Panel 1, Table 6). As the average total expenditure of yogurt per year per capita in the sample market is around \$37.5, the welfare loss accounts for 2.2% of the yogurt expenditure.[7] The lower panel

[6] For mass merchandizers, the removal probability is written as $prbb = \theta_1 prbb_{style} + \theta_2 prbb_{type} + \theta_3 prbb_{rank(price)} = \theta_1(uniform(0,0.5) + 0.5 \times style) + \theta_2\big(uniform(0,0.5) + 0.5 \times (1 - type)\big) + \theta_3 \times uniform(0, \frac{rank(price)}{55})$, which is a weighted average of product style, type, and rank of price with weight θ_i and $\sum\theta_i = 1, i = 1,2,3$. Variable $style$ equals 1 if the yogurt product has a regular style, and 0 otherwise. Likewise, variable $type$ equals 1 if the yogurt product has a regular type, and 0 otherwise. Yogurt products with higher prices obtain larger $rank(price)$.

[7] The total expenditure of yogurt products per year per capita is obtained by multiplying the per capita yogurt consumption per year (USDA, 2022) and the average yogurt price summarized in Table A4.

shows the welfare changes for grocery stores without UPR-free peers. By adding five new brands, keeping the number of UPCs unchanged, and raising the price by 16%, welfare loss is $0.45 per year per capita, which accounts for 1.2% of the total yogurt consumption (Column 1, Panel 2, Table 6) and amounts to $0.14 billion for all U.S. consumers a year. The welfare loss does not vary across different scenarios significantly.

6. Conclusions

Since UPR was first introduced in the 1970s, many studies show that UPR helps consumers make better purchase decisions by providing unit price information in addition to product prices (Russo, 1977; Miyazaki et al., 2000; Kachersky, 2011), increasing consumer welfare. The implicit assumption is that the product assortments and prices are not adjusted by stores in response to the regulation. We relax this assumption and identify UPR impacts on the store's product assortments and prices. We find that grocery stores and mass merchandizers make different product assortments to countervail the intensified price competition due to UPR. Mass merchandizers offer fewer products without adjusting prices, whereas regulated grocery stores without UPR-free peers provide more brands and charge higher prices. Taking the store's product assortment adjustment into account, for both channels, we find that consumer welfare falls under UPR.

Our findings reveal unintended effects of UPR and highlight the importance of considering product assortments by stores under regulations. While we have focused on yogurt, it is of interest to examine how UPR affects other product categories. Store adjustments across product categories are also worth investigation. Furthermore, heterogeneous welfare impacts on consumers can be studied using more advanced demand models (Villas-Boas, 2009; Fan and Yang, 2020). From a policymaker's perspective, knowing which income levels suffer or benefit most from a particular regulation is important. We leave these questions for future research.

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Tables and Figures

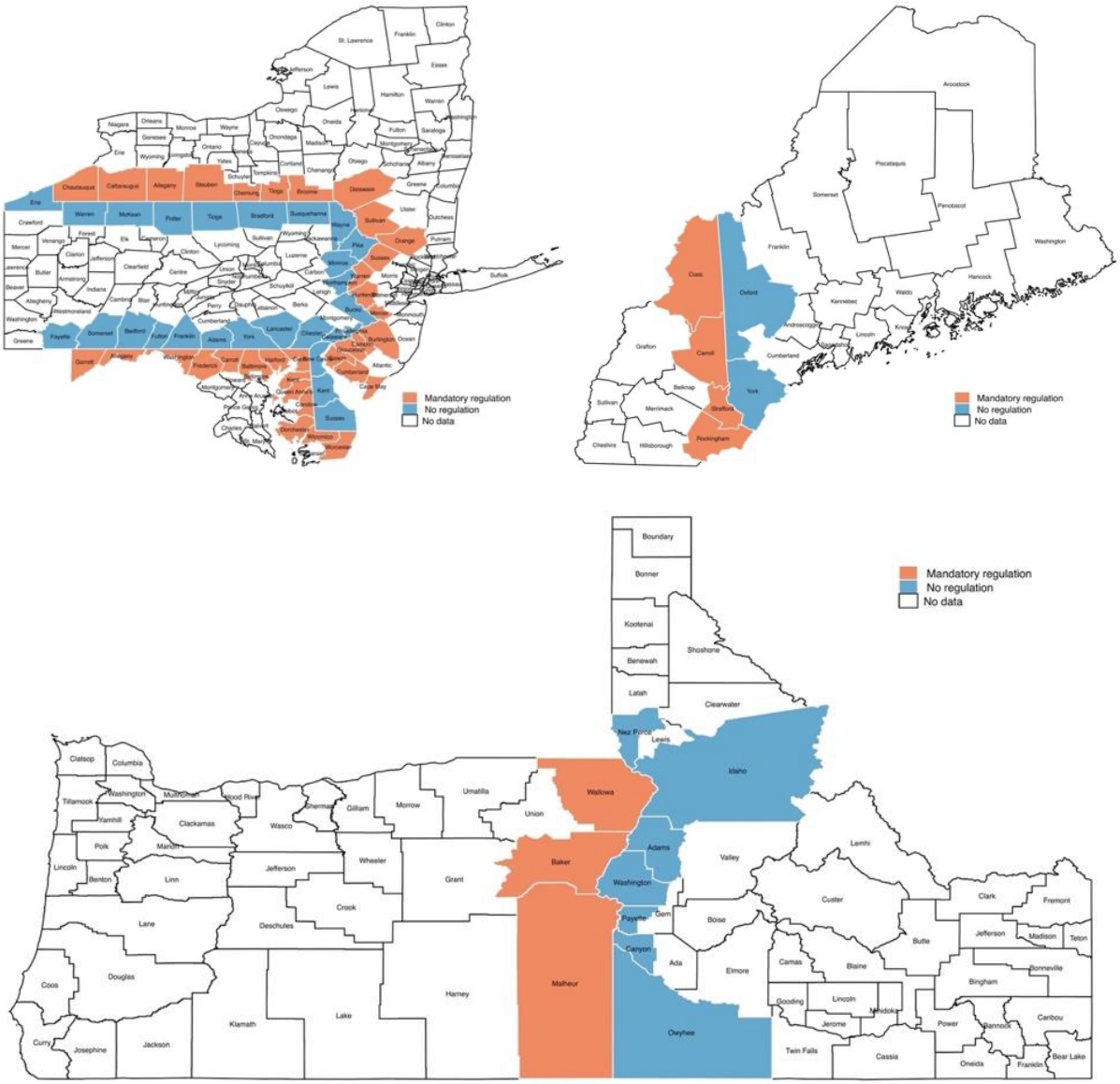

Figure 1. Border Counties in the Sample

Source: NIST Handbook 130, 2020.

Note: The upper-left panel refers to border counties in Pennsylvania/Delaware (no regulation)-New York/New Jersey/Maryland (mandatory UPR). The upper-right panel refers to border counties in Maine (no regulation)-and New Hampshire (mandatory UPR). The lower panel refers to border counties in Idaho (no regulation)-Oregon (mandatory UPR).

Table 1. The Number of Sample Counties and Stores by State

	Grocery store		Mass merchandizer		
	#Stores	#Retail chains	#Stores	#Retail chains	#Counties
States with mandatory UPR					
Maryland	128	11	37	3	14
New Hampshire	43	6	11	3	4
New Jersey	80	10	57	3	10
New York	10	3	24	3	10
Oregon	4	2	1	1	3
Total	265	21	130	3	41
States without mandatory UPR					
Delaware	64	9	20	3	3
Idaho	9	4	13	3	6
Maine	16	4	6	2	2
Pennsylvania	205	15	144	4	23
Total	294	26	183	4	34

Source: Author's calculation based on Nielsen data.

Table 2. Summary Statistics: Border County Sample

	Mandatory UPR	No Mandatory UPR	All
Store-level variables: Grocery stores w/o UPR-free peers			
Monthly Variables			
#UPCs	268.9 (93.2)	300.2 (80.7)	297.4 (82.4)
#Brands	26.8 (6.6)	28.6 (7.6)	28.4 (7.6)
#Packaging formats	18.3 (4.7)	18.4 (5.3)	18.4 (5.2)
#Varieties	46.9 (16.4)	48.9 (15.2)	48.7 (15.3)
Uniqueness index (0-100)	25.2 (7.2)	22.9 (6.1)	23.1 (6.2)
Unit price (cents/ounce)	16.3 (2.6)	14.7 (2.2)	14.8 (2.3)
No. Obs.	2,231	23,003	25,234
Yearly Variables			
Product creation (#UPCs)	0.3 (0.1)	0.3 (0.1)	0.3 (0.1)
Product destruction (#UPCs)	0.2 (0.1)	0.2 (0.1)	0.2 (0.1)
Product creation (sales)	0.2 (0.2)	0.2 (0.7)	0.2 (0.7)
Product destruction (sales)	0.1 (0.1)	0.1 (0.1)	0.1 (0.1)
No. Obs.	163	1,677	1,840
Store-level variables: Grocery stores with UPR-free peers			
Monthly Variables			
#UPCs	224.8 (90.8)	212.7 (83.0)	217.2 (86.2)
#Brands	21.3 (7.1)	20.1 (6.4)	20.5 (6.7)
#Packaging formats	16.7 (4.9)	16.6 (4.7)	16.6 (4.8)
#Varieties	37.9 (15.2)	36.3 (13.9)	36.9 (14.4)
Uniqueness index (0-100)	27.4 (10.1)	27.8 (10.7)	27.6 (10.5)
Unit price (cents/ounce)	15.0 (2.2)	15.3 (2.2)	15.2 (2.2)
No. Obs.	40,074	68,023	108,097
Yearly Variables			
Product creation (#UPCs)	0.3 (0.1)	0.3 (0.1)	0.3 (0.1)
Product destruction (#UPCs)	0.2 (0.1)	0.3 (0.1)	0.3 (0.1)
Product creation (sales)	0.2 (1.5)	0.2 (0.2)	0.2 (0.9)
Product destruction (sales)	0.1 (0.1)	0.1 (0.1)	0.1 (0.1)
No. Obs.	2,910	4,943	7,853

Table 2. Summary Statistics: Border County Sample, Continued.

	Mandatory UPR	No Mandatory UPR	All
Store-level variables: Mass merchandisers			
Monthly Variables			
#UPCs	61.8 (57.3)	51.1 (58.4)	54.9 (58.2)
#Brands	8.6 (7.2)	7.2 (7.3)	7.7 (7.3)
#Packaging formats	8.9 (7.6)	7.4 (7.7)	8.0 (7.7)
#Varieties	17.1 (14.1)	14.1 (14.5)	15.2 (14.4)
Uniqueness index (0-100)	62.9 (30.0)	71.5 (31.3)	68.4 (31.1)
Unit price (cents/ounce)	15.6 (4.6)	16.3 (4.9)	16.1 (4.6)
No. Obs.	10,991	20,038	31,029
Yearly Variables			
Product creation (#UPCs)	0.5 (0.8)	0.4 (0.8)	0.5 (0.8)
Product destruction (#UPCs)	0.3 (0.3)	0.3 (0.3)	0.3 (0.3)
Product creation (sales)	0.3 (0.3)	0.3 (0.5)	0.26 (0.4)
Product destruction (sales)	0.1 (0.2)	0.1 (0.2)	0.12 (0.2)
No. Obs.	876	1,566	2,442

Source: Author's calculation based on Nielsen data.

Note: Standard deviations are in the parentheses. The gender ratio is calculated by dividing the total population of males by the total population of females. A competitor store is defined as a store that does not belong to the same chain of that retail store in the county. The observations are in contiguous border counties of states with mandatory UPR (OR, NY, NJ, NH, MD) and states without UPR (PA, DE, ME, ID). These statistics are store-county pair weighted averages. The four product turnover variables (product creation (#UPCs, sales), product destruction (#UPCs, sales)) are at the yearly level.

Table 3. Baseline Results of Effects of UPR on Product Assortment Strategies

Var.	(1) #UPC	(2) #brands	(3) #packages	(4) #varieties	(5) Uniqueness index
Grocery Stores					
Regulation	-3.14	5.42***	1.19*	5.41***	9.31***
(1=yes, 0=no)	(4.68)	(0.87)	(0.58)	(1.87)	(1.40)
Regulation	6.24	-5.07***	-1.12**	-4.70***	-9.26***
#Peer store	(6.19)	(0.53)	(0.47)	(0.82)	(1.13)
County-pair indicators	Yes	Yes	Yes	Yes	Yes
County-specific yearly trend	Yes	Yes	Yes	Yes	Yes
Retail chain FE	Yes	Yes	Yes	Yes	Yes
Year and quarter FE	Yes	Yes	Yes	Yes	Yes
R^2	0.80	0.71	0.76	0.82	0.50
#Obs.	133,331	133,331	133,331	133,331	133,331
Mass Merchandizers					
Regulation	-21.37***	-2.76***	-2.81***	-4.79***	6.67**
(1=yes, 0=no)	(3.17)	(0.34)	(0.29)	(0.63)	(2.47)
County-pair indicators	Yes	Yes	Yes	Yes	Yes
County-specific yearly trend	Yes	Yes	Yes	Yes	Yes
Retail chain FE	Yes	Yes	Yes	Yes	Yes
Year and quarter FE	Yes	Yes	Yes	Yes	Yes
R^2	0.85	0.87	0.88	0.88	0.89
#Obs.	31,029	31,029	31,029	31,029	31,029

Note: Standard errors in parentheses are clustered at the state and border segment levels. P-values for coefficients of regulation are in brackets. ***Significant at 1% level, ** Significant at 5% level, * Significant at 10% level. In all regressions, the control variables are the number of competitor stores, unemployment rate, log house value, county population, and county gender ratio.

Table 4. Baseline Results of Effects of UPR on Product Creation and Destruction

	(1)	(2)	(3)	(4)	(5)	(6)
	Creation		Destruction		Net Creation	
Var.	GS	MM	GS	MM	GS	MM
#UPCs						
Regulation	0.05**	0.41**	0.09***	0.08	-0.05	0.33**
(1=yes, 0=no)	(0.02)	(0.18)	(0.02)	(0.07)	(0.04)	(0.14)
Regulation	-0.06***		-0.07***		-0.01	
#Peer store	(0.01)		(0.01)		(0.02)	
R^2	0.16	0.10	0.45	0.18	0.09	0.07
#Obs.	9,693	2,442	9,693	2,442	9,693	2,442
Sales						
Regulation	0.43	0.19*	0.09***	0.04	0.35	0.15
(1=yes, 0=no)	(0.26)	(0.09)	(0.02)	(0.06)	(0.27)	(0.11)
Regulation	-0.35		-0.08***		-0.27	
#Peer store	(0.20)		(0.01)		(0.21)	
R^2	0.03	0.16	0.24	0.17	0.03	0.13
#Obs.	9,693	2,229	9,693	2,229	9,693	2,229
County-pair indicators	Yes	Yes	Yes	Yes	Yes	Yes
County trend	Yes	Yes	Yes	Yes	Yes	Yes
Retail chain FE	Yes	Yes	Yes	Yes	Yes	Yes
Year and quarter FE	Yes	Yes	Yes	Yes	Yes	Yes

Note: Standard errors in parentheses are clustered at the state and border segment levels. ***Significant at 1% level, ** Significant at 5% level, * Significant at 10% level. GS and MM refer to grocery stores and mass merchandizers, respectively. In all regressions, the control variables are the number of competitor stores, log of median income, log house value, county population, and county gender ratio. We exclude the extreme value of product creation by limiting the creation indicator to 3.

Table 5. Baseline Results of Effects of UPR on Product Prices

	(1) Grocery stores	(2) Mass merchandizers
All common UPCs		
Dependent variable: Logged UPC price		
Regulation (1=yes, 0=no)	0.16***	0.04
	(0.05)	(0.06)
Regulation	-0.16**	
#Peer store	(0.06)	
Borderline FE	Yes	Yes
County-specific monthly trend	Yes	Yes
UPC FE	Yes	Yes
Year and quarter FE	Yes	Yes
#Obs.	10,870,631	738,891

Note: Standard errors in parentheses are clustered at the state level. ***Significant at 1% level, ** Significant at 5% level, * Significant at 10% level. In all regressions, the control variables are the number of competitor stores, county monthly unemployment rate, log house value, county annual population, and county gender ratio.

Table 6. Simulation Results of Welfare Impacts of UPR

Scenarios	(1)	(2)	(3)	(4)	(5)
Mass merchandizers					
#UPCs removed	21	21	26	26	31
#UPCs added	0	0	5	5	10
θs	0.2, 0.2, 0.6	0.4, 0.4, 0.2	0.2, 0.2, 0.6	0.4, 0.4, 0.2	0.2, 0.2, 0.6
Price change	0%	0%	0%	0%	0%
Mean ΔCS (cents)	-4.49	-5.03	-4.81	-5.55	-4.76
S.D. ΔCS	0.01	0.01	0.02	0.02	0.02
Min ΔCS	-4.53	-5.06	-4.87	-5.59	-4.81
Max ΔCS	-4.46	-4.99	-4.76	-5.51	-4.63
Mean ΔCS/year per capita ($)	-0.82	-0.92	-0.88	-1.01	-0.87
Grocery stores w/o UPR-free peers					
#brands added	5	5	5	5	5
Price change	16%	16%	16%	16%	16%
θs	0.1, 0.1, 0.8	0.2, 0.2, 0.6	0.4, 0.4, 0.2	0.2, 0.5, 0.3	0.3, 0.4, 0.3
Mean ΔCS (cents)	-2.34	-2.37	-2.44	-2.42	-2.42
S.D. ΔCS	0.01	0.01	0.01	0.01	0.01
Min ΔCS	-2.36	-2.39	-2.46	-2.44	-2.45
Max ΔCS	-2.32	-2.35	-2.42	-2.40	-2.40
Mean ΔCS/year/per capita ($)	-0.45	-0.45	-0.47	-0.46	-0.46

Source: Authors' calculation based on Nielsen data.

Note: In the upper panel, the θs are weights of product style, type, and rank of prices, which are used to calculate the removal probability for each UPC. In the lower panel, the same number of existing UPCs due to the introduction of the new brands are removed. The removal probability is a weighted average of product flavor, style, and rank of price with weight. Please refer to footnote 6 for more details if interested.

Appendix 1. Construction of the Variety Code

To measure the number of yogurt product varieties offered by stores, it is necessary to construct the variety code for each UPC provided by stores first. We describe the steps of constructing the variety code in detail below:

Step 1: The RMS Dataset provides us flavor, type, and style information for most of the national brands. Each flavor, style, or type has a unique code. Due to a large number of flavors, we cannot use the Nielsen flavor code directly to create the variety code. Thus, in the first step, we create 12 flavor categories, which are plain flavor, vanilla flavor, six types of fruit flavors (1-strawberry, 2-berries, 3-cherries, banana, grape, 4-citrus, 5-apple, pear, peach, 6-tropical fruits), one vegetable-related flavor, one nut-related flavor, one spice-related flavor, one cake-related flavor. All the other flavors that cannot be categorized into these groups are defined as other flavor(s). We further group these 12 categories into 7 categories as shown in Table A2. We code these 7 categories from 1 to 7.

Step 2: We follow a similar method to obtain 14 categories of types and 14 categories of styles. Thus, the style code and type code are both from 1 to 14. Detailed information is in Table A3.

Step 3: We create a variety code for each UPC by combining flavor, type, and style codes. For example, a UPC with a flavor code of 3, a type code of 10, and a style code of 08 has a variety code of 31008. In the end, each UPC with flavor, type, and style information should have a 5-digit variety code

Table A1. Flavor, Style and Type information of UPCs.

	Flavor			
Code	Name	Definition	Share of UPCs (%)	Example
01	Plain	No added flavor	8.31	Plain
02	Vanilla	Pure vanilla flavor	9.90	Vanilla
03	Fruit, single	Containing only one type of fruit flavor	46.03	Blackberry
04	Fruit, multi	Containing two or more types of fruit flavors	14.54	Strawberry & Banana
05	Fruit mixed with other(s)	Fruit flavor(s) mixed with other flavor(s)	8.73	Blueberries & Cream
06	Other, single	Containing one of the following flavors: vegetable-related flavor, nut-related flavor, spice-related flavor, cake-related flavor, and other single flavors	11.17	Coffee
07	Other, mixed	Containing two or more of the following flavors: vegetable-related flavor, nut-related flavor, spice-related flavor, cake-related flavor, and other single flavors	1.32	Vanilla parfait & Granola

Table A1. Flavor, Style and Type information of UPCs, Continued.

Style			*Type*		
Code	Name	Share of UPCs (%)	Code	Name	Share of UPCs (%)
01	Natural/Premium/ Organic	9.21	01	Fat-free	38.10
02	Natural/Organic Greek	3.40	02	Goat milk	0.5
03	Custard	0.50	03	Lactose-free	0.47
04	Greek	27.30	04	Low-fat	38.17
05	Greek kefir	0.06	05	Low-fat lactose-free	1.11
06	Israeli leben/Leben	0.09	06	Natural	0.82
07	Kefir	0.42	07	Non-fat lactose-free	0.23
08	Organic Bulgarian/Premiu m Bulgarian	0.03	08	Regular	17.19
09	Original/Regular/ Not stated	57.91	09	Sheep milk	0.26
10	Swiss	0.72	10	Whole milk/Whole milk natural	3.15
11	Swiss premium	0.33			
12	Try it frozen too	0.03			

Source: Authors' calculation based on Nielsen data.

Note: Total number of unique UPCs with flavor, style, and type information is 1,227. We first create 12 flavor categories, which are plain flavor, vanilla flavor, six types of fruit flavors (1-strawberry, 2-berries, 3-cherries, banana, grape, 4-citrus, 5-apple, pear, peach, 6-tropical fruits), one vegetable-related flavor, one nut-related flavor, one spice-related flavor, one cake-related flavor. All the other flavors that cannot be categorized into these groups are defined as other flavor. We further group these 12 categories into 7 categories as shown in the table.

Appendix 2. Construction of the Variety Uniqueness Index

After obtaining the variety code for each UPC, we are ready to construct the variety uniqueness index which measures the level of product differentiation within stores. The detailed steps are described as follows:

Step 1: For a specific store in a specific month, we aggregate the total sales of each variety for each brand. Name it as a.

Step 2: For a specific store in a specific month, we aggregate the total sales of each variety. Name it as b.

Step 3: For a specific store in a specific month, we obtain the complement set of each variety for each brand by subtracting a from b. A complement set of zero means that the variety can only be found in one brand, while a non-zero complement set indicates a non-unique variety of the brand. We assign 1 to the first case and 0 to the second case for each variety within a brand. Then we take the simple average of this 0-1 indicator within each brand for a store in a specific month. Call it c.

Step 4: After obtaining c for each brand, we take the simple average to obtain the variety uniqueness index for each sample store in all months.

Appendix 3. Summary of County-Level Demographic and Economic Statistics

Summary statistics of county-level variables are presented in Table A2. On average, border counties have an unemployment rate of 6.44% and a house value of $240,000. The average yearly median income is $61,500. The total population is 450,000-500,000 with a gender ratio of 0.95 after aggregating the data to monthly and yearly levels. These variables are included as controls for all regressions to control for any county-level factors that influence the adoption of UPR.

Table A2. County-Level Demographic and Economic Statistics

	Mean	Standard Deviation
Monthly county-level variables		
Unemployment rate (%)	6.4	2.2
House value (1,000 $)	239.7	75.6
Total population (million)	0.5	0.4
Gender ratio	0.95	0.04
Yearly county-level variables		
Median income (1k $)	61.5	13.5
House value (1k $)	253.6	78.8
Total population (million)	0.5	0.4
Gender ratio	0.95	0.04

Source: The house value index is from Zillow Inc's. County monthly unemployment rate is from the Local Area Unemployment database of the U.S. Bureau of Labor Statistics. County annual median income is from Small Area Income and Poverty Estimates datasets of the U.S. Census Bureau. The annual county population is from the U.S. Census Bureau.

Below are the web links of data sources:

Zillow Home Values: https://www.zillow.com/home-values/

Monthly unemployment rates: https://www.bls.gov/data/#

Yearly median income: https://www.census.gov/programs-surveys/saipe.html

Annual county population by gender: https://www.census.gov/data.html and

https://www.census.gov/data/tables/time-series/demo/popest/2010s-counties-detail.html

Table A3. Sensitivity Analyses

Dep. Var.	(1) Grocery stores	(2) Mass merchandizers	(3) Grocery stores	(4) Mass merchandizers
#UPC	-4.99	-24.44***	5.70	-33.10***
	(11.26)	(6.04)	(19.07)	(6.82)
R^2	0.76	0.88	0.83	0.93
#brands	-0.54	-2.19***	-2.30	-3.31***
	(0.90)	(0.71)	(1.93)	(0.81)
R^2	0.66	0.92	0.83	0.96
#packaging formats	-0.05	-1.92***	-0.81	-2.26***
	(0.48)	(0.70)	(1.38)	(0.64)
R^2	0.78	0.93	0.71	0.97
#varieties	-0.18	-3.17***	3.52	-4.46***
	(1.46)	(1.16)	(3.41)	(1.25)
R^2	0.73	0.92	0.88	0.96
Uniqueness index	-2.39	3.54	6.53***	9.63**
	(1.54)	(3.10)	(2.22)	(4.14)
R^2	0.40	0.91	0.63	0.95
County-pair indicators	Yes	Yes	Yes	Yes
County-specific yearly trend	Yes	Yes	Yes	Yes
Retail chain FE	Yes	Yes	Yes	Yes
Year and quarter FE	Yes	Yes	Yes	Yes
#Obs.	67,141	20,516	61,822	19,871

Note: Standard errors in parentheses are clustered at the state and border segment levels. ***Significant at 1% level, ** Significant at 5% level, * Significant at 10% level. Controlled variables include unemployment rate, log of house value, the number of local competitors, county population, and county gender ratio. In column 2, the number of observations for #varieties and uniqueness index equation is 20,510. In columns 1 and 2, the number of observations for log price equations are 66,419 and 20,219. In columns 3 and 4, the number of observations for log price equations are 61,816 and 19,444.

Appendix 4. Sample Selection, Demand Estimation and Welfare Analysis

We describe the sample construction, summary statistics, demand estimation, and the setup of counterfactual settings in detail. According to the different price and product portfolio strategies stores conduct, we analyze the UPR impact on consumer welfare for grocery stores with UPR-free peers and mass merchandizers separately. We describe the steps for grocery stores without UPR-free peers in detail. There are four steps. First, we choose all UPCs sold in grocery stores without UPR-free peers that are in the regulated and unregulated border counties each month from 2012 to 2013 to estimate the demand. The potential market size is defined as the total quantity (i.e., OZ) of yogurt consumption at the county-month level. Specifically, the market size is calculated by multiplying the average yogurt consumption per capita per month by the total population in a county. The outside market is defined as the difference between the market size and total yogurt consumption in the market. We then calculate the market share of each brand and the outside option.[8]

Second, we construct four household demographic variables from Nielsen HomeScan data to measure consumer preference for yogurt. Specifically, we select households who live in the sample border counties and keep their demographics including annual income, household size, household head age, and whether there are children under 18 in the household. In the raw data, household income is a categorical variable. Each category refers to a range of household income (e.g., 4 refers to an annual income between $5,000 and $7,999). We convert it into a continuous variable by averaging the two ends of each interval. We use $2,500 and $150,000 as the household income for those who have a total income under $5,000 and above $100,000, respectively. The household head age is the age of either the male or female household head. If both male and female

[8] For two counties, the quantity of yogurt consumption exceeds the total market size, which yields the negative outside option share. We drop these observations, which account for 4% of the total observations.

household heads exist, the average of their ages is computed. Household size is the total number of members that live in a family. Children variable equals 1 if there are children under 18 in the household, and 0 otherwise. For each household, we calculate the weight by dividing the number of trips to grocery stores by the total number of trips in a year. Then, the weighted averages of the four demographic variables for each county and year are obtained.

Third, we use a simple logit demand model to estimate the demand for all yogurt products in the sample border counties. The key variables in the estimation are summarized in table A4. Due to the endogeneity of the product price, we construct the Hausman IV by calculating the average price for the same UPC sold in other states excluding the 9 sample states in the same month and year. The Hausman IV is assumed to affect the demand only through the exogenous shocks, and is not related to the demand shocks in the local market. We then use the 2SLS IV method to estimate the yogurt demand. The logit regression results are in table A5. Our first-stage result shows that the IV is highly correlated with the endogenous price with an F-statistics equals 5353. The mean own-price elasticity of yogurt brands is -1.25 with a standard deviation of 0.49, suggesting that the demand for yogurt products is elastic. The average cross-price elasticity is 0.001 with a standard deviation of 0.001, implying the yogurt products are weak substitutes.

Finally, we construct the representative set of yogurt products and set up several counterfactual scenarios through randomly adding yogurt brands but keeping the number of UPCs unchanged. The changes in CS are computed in each scenario. On average, grocery stores without UPR-free peers in unregulated counties provide 297 UPCs (see table 2). We rank the UPCs sold in the unregulated border-county market by the number of appearances in the stores in each year and month. The top 297 brands are selected to form the set. The CS_0 is computed accordingly. As the baseline results (see tables 3 and 5) show, grocery stores without UPR-free peers tend to offer

five more brands with a 16% price increase if UPR is in effect. We randomly select and add five brands that do not have UPCs in the representative set, and remove the same number of existing UPCs due to the introduction of new brands, to keep the number of UPCs fixed. From table A7, we find that UPCs that are non-plain flavor, niche style and cheap are more likely to be removed. We thus assign higher probability for products that have the three attributes, and generate the removal probability as a weighted average of the three probabilities. Specifically, we write the removal probability as $prbb = \theta_1 prbb_{flavor} + \theta_2 prbb_{style} + \theta_3 prbb_{rank(price)}$. We then create four counterfactual scenarios by varying the weights (θs). Under each circumstance, we calculate the CS_1 and obtain the average $\Delta CS = CS_1 - CS_0$ across counties and months. The mean ΔCS per year is then computed.

We now focus on mass merchandizers. First, we obtain the market share and outside option share for all UPCs sold in sample mass merchandizers each month during 2012 and 2013. Second, the weighted average household demographics are added to the estimation to proxy the preferences of consumers loyal to mass merchandizers. Third, we use the simple logit model and 2SLS IV method to estimate yogurt demand in mass merchandizers. Finally, we construct a representative pool including 55 UPCs (see table 2) sold by unregulated mass merchandizers most frequently.

Tables 3 and 5 show that regulated mass merchandizers provide 21 fewer UPCs and do not adjust the price significantly. Products with regular style, niche type, or higher price are more likely to be not carried (see table A7). We thus write the probability of removal as $prbb = \theta_1 prbb_{style} + \theta_2 prbb_{type} + \theta_3 prbb_{rank(price)}$. We consider the change in CS in the following scenarios: 1) 21 UPCs are removed with different θs; 2) 26 UPCs are removed and five are added with different θs; 3) 31 UPCs are removed and 10 are added. The mean ΔCS per year is computed for each scenario.

Table A4. Summary Statistics for Welfare Analysis

	Mean	S.D.	Min	Max
Grocery stores w/o UPR-free peers				
UPC share (%)	0.05	0.08	0	1.52
Outside share (%)	73.19	15.91	16.53	95.22
Price (cents/OZ)	16.89	6.60	1.92	65.90
UPC size (OZ)	12.08	9.82	4.00	72.00
Price IV (cents/OZ)	16.47	5.86	3.70	47.48
HH income (1k $)	46.24	11.11	23.59	72.13
HH head age	54.43	2.11	49.82	63.28
HH size	2.47	0.25	1.71	2.87
HH children (0-1)	0.23	0.08	0	0.37
Mass merchandizers				
UPC share (%)	0.02	0.02	0	0.33
Outside share (%)	73.72	18.31	1.44	99.99
Price (cents/OZ)	15.57	5.63	1.70	38.03
UPC size (OZ)	12.70	9.87	4	18
Price IV (cents/OZ)	15.57	5.58	3.68	36.40
HH income (1k $)	46.84	11.18	15.28	92.59
HH head age	53.14	1.92	41.25	61.18
HH size	2.56	0.29	1.88	3.63
HH children (0-1)	0.26	0.08	0	0.65

Source: Author's calculation based on Nielsen data.

Note: HH refers to the household. There is a two-year lag in the income reported by households in the Nielsen data. We hence use the income reported in 2014 and 2015 in the demand estimation to refer to the income in 2012 and 2013, respectively. The yogurt consumption per capita in 2012 and 2013 is 14 pounds and 14.9 pounds, respectively (https://www.ers.usda.gov/data-products/dairy-data/).

Table A5. Results of Logit Demand Regressions (2SLS IV Method)

Dependent variable: $Log(share) - Log(outside)$	(1) Grocery stores w/o peers	(2) Mass merchandizers
Price	-0.07***	-0.10***
	(0.01)	(0.01)
Package size	0.01***	0.01***
	(0.002)	(0.002)
Log(HH income)	1.03	1.80***
	(1.08)	(0.30)
Log(HH head age)	-2.86**	-3.44***
	(1.44)	(0.74)
HH size	0.10	-0.71***
	(1.30)	(0.42)
HH children	2.24	-1.73
	(1.90)	(1.07)
Controls for flavor, style and type	Yes	Yes
Brand FE	Yes	Yes
Retailer FE	Yes	Yes
Quarter FE	Yes	Yes
First-stage F-stat.	3314.56	53354.15
No. Obs.	169,000	81,332

Note: Standard errors in parentheses are clustered at the county levels. ***Significant at 1% level, ** Significant at 5% level, * Significant at 10% level.

Appendix 5. Assortment Mechanism

We conduct logit regressions to investigate the type of products that are more likely to be offered in either regulated or unregulated areas compared to common UPCs for mass merchandizers. This is a way to understand the mechanism for stores' adding and dropping products when facing UPR. The observation is at the UPC-month-borderline level. The logit regression is specified below:

(9) $y_{ibt} = \alpha_0 + Price_{i-bt} + MS_{i-bt} + UPCsize_i + Flavor + Type + Style + \varepsilon_{ibt}$

where y_{ibt} is 1 if UPC i in borderline b in month t is unique and 0 otherwise. We incorporate the price and market share of the same UPC offered by stores of inner counties in the same state which are $Price_{i-bt}$ and MS_{i-bt} in the equation to avoid the situation that UPC uniqueness is highly correlated with its own price and market share in the local market. We also include product flavor, type and style dummies mentioned in section 3.2 to investigate the attributes of unique UPCs (see Appendix 1).

Table A7 presents the results of the logit regressions of unique UPCs sold by mass merchandizers and grocery stores without UPR-free peers in regulated and unregulated areas. The results show that unique UPCs are more likely to be those products with a small market share. This is reasonable because unique UPCs are only sold by stores on one side of the border. They are more likely to be some niche or high-end products that are not popular in the local market.

For mass merchandizers, the unique UPCs in unregulated areas are more likely to have higher prices and larger sizes, whereas unique and common UPCs in regulated areas are indifferent in price and package size. This implies that the unique products offered by mass merchandizers in UPR states are relatively cheaper. Mass merchandizers under UPR also tend to offer more yogurt products with niche style and regular type. For grocery stores without UPR-free peers, the unique UPCs in unregulated areas tend to have relatively lower prices and larger sizes compared to

common UPCs. The unique and common UPCs in regulated areas, however, are not significantly different in price and package size. Yogurt products with plain flavor and regular style tend to be uniquely provided in states with UPR.

Table A7. Logit Regression of Unique UPCs of Mass Merchandizers in Regulated and Unregulated Areas

	(1)	(2)	(3)	(4)
	Grocery stores w/o UPR-free peers		Mass merchandizers	
Dependent variables:	Unique in unregulated areas (1=yes)	Unique in regulated areas (1=yes)	Unique in unregulated areas (1=yes)	Unique in regulated areas (1=yes)
Log price	-1.31**	0.74*	0.16***	-0.11
	(0.64)	(0.43)	(0.01)	(0.43)
UPC size	0.04***	-0.02***	0.03	-0.005
	(0.01)	(0.001)	(0.02)	(0.02)
UPC volume share (%)	-21.14***	-17.06***	-2358.31***	-295.26***
	(0.03)	(1.99)	(927.14)	(21.80)
Flavor-Plain (base)				
Flavor-Others	-0.09	-0.61*	-1.15*	-0.51***
	(0.52)	(0.36)	(0.65)	(0.09)
Style-Regular (base)				
Style-Niche	0.05	-0.11*	-0.74***	0.74***
	(0.07)	(0.06)	(0.20)	(0.15)
Type-Regular (base)				
Type-Niche	-0.01	-0.05	-0.07	-0.57***
	(0.11)	(0.07)	(0.11)	(0.09)
No. Obs.	73,275	73,275	22,616	22,616

Note: Standard errors in parentheses are clustered at the borderline level. ***Significant at 1% level, ** Significant at 5% level, * Significant at 10% level.

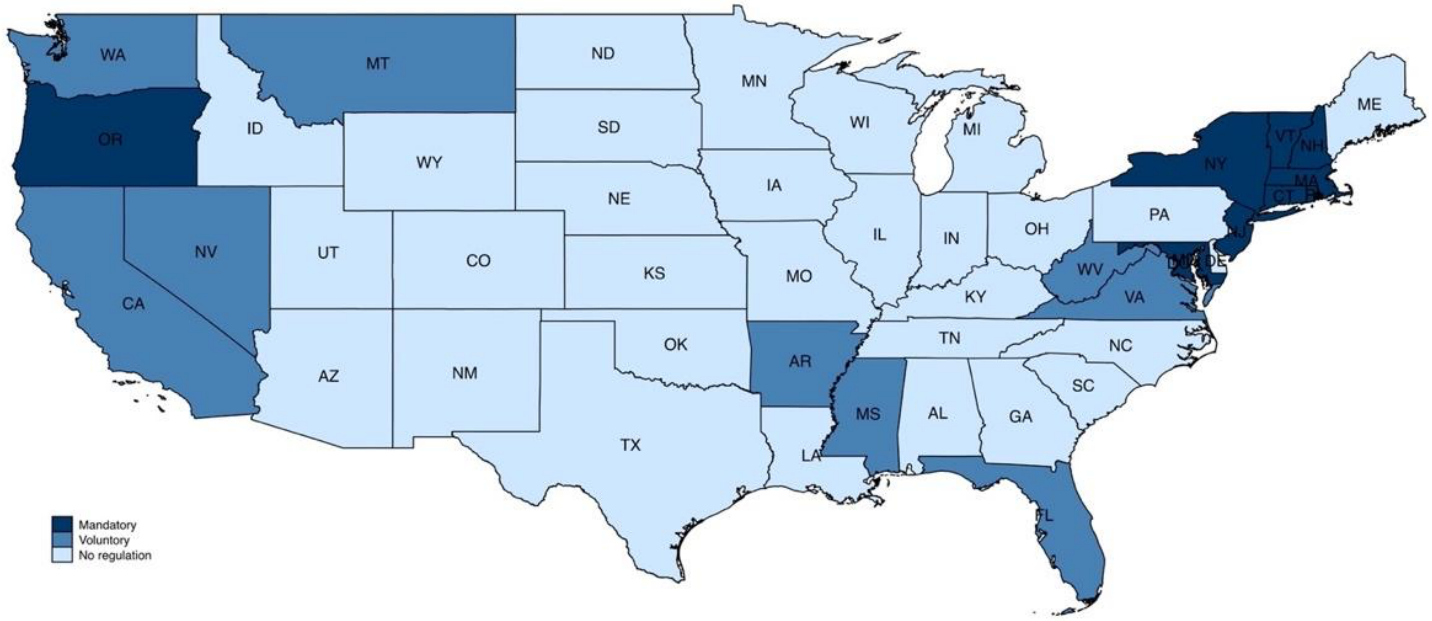

Figure A1. Unit Pricing Regulation in the United States

Source: NIST Handbook 130, 2020.