Product Variety and Alcohol Purchases*

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August 28, 2023

Abstract

This study investigates the impact of product variety on alcohol purchasing patterns in the United States. Although per capita alcohol consumption declined between 1970 and 2000, it has gradually increased in the past two decades. By utilizing product-level and household scanner data, I provide evidence that increased product variety contributes to higher alcohol purchases. Using residential changes, I establish a causal link between product variety and purchases and find that the growth in product variety is a key driver of the recent shifts in alcohol consumption. I present a stylized model illustrating that heightened consumer health awareness may lead to a larger assortment of products, counterbalancing the effects of reduced purchases. Additionally, as predicted by theory, tax hikes encourage retailers to broaden their product offerings, which partially counteracts the intended impact on purchases. In conclusion, this research highlights that regulation of product entries represents an underexplored, yet potentially important, policy tool for curbing alcohol consumption.

Keywords: Risky Consumption, Product Variety, Alcohol, Excise Tax

JEL codes: D12, I12, L66

*I thank Enrico Maria Camarda, Richard Friberg, Ginger Zhe Jin, Florin Maican, Matilda Orth, Matthew Shapiro, and seminar participants at the Applied Micro workshop at the Singapore Management University, the Nordic workshop on Industrial Organization, the Asian Meeting of the Econometric Society, the Australasian Meeting of the Econometric Society, and the 50th Annual Conference of the European Association for Research in Industrial Economics for valuable feedback. Researcher's own analyses are 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 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.

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1 Introduction

Excessive alcohol consumption is a leading cause of preventable death in the United States, resulting in over 140,000 deaths annually (Centers for Disease Control and Prevention, 2022*c*). In addition, it negatively affects labor market outcomes (Böckerman et al., 2017; French et al., 2011) and educational achievements (DeSimone, 2010). Moreover, the harmful effects of excessive alcohol consumption are not limited to individual health and economic outcomes. Alcohol is a contributing factor in 40% of violent crimes and almost 40% of all traffic fatalities (National Council on Alcoholism and Drug Dependence (NCADD), 2015). Furthermore, prenatal exposure to alcohol can lead to long-term negative health and economic outcomes for children (Centers for Disease Control and Prevention, 2022*a*; Nilsson, 2017).

To reduce excessive drinking and its associated harms, policymakers have implemented various strategies such as alcohol taxes (Chaloupka et al., 2002; Cook and Moore, 2002; Griffith et al., 2019; Miravete et al., 2018; Wagenaar et al., 2009), changes in minimum legal drinking ages (Carpenter and Dobkin, 2009; Wagenaar and Toomey, 2002), restrictions on alcohol outlet densities (Campbell et al., 2009; Livingston et al., 2007; Marcus and Siedler, 2015), and general restrictions on alcohol sales (Bernheim et al., 2016; Carpenter and Eisenberg, 2009; Chamberlain, 2014; Hinnosaar, 2016; Kueng and Yakovlev, 2021; Norström and Skog, 2005; Seim and Waldfogel, 2013). Although these approaches have played a critical role in reducing alcohol consumption from its peak in the 1970s to the early 1990s, per capita alcohol consumption has gradually increased since the late 1990s (see Figure 1a). This increased consumption has received recent attention from the public (see for example, New York Times, 2021).[1] The increase, accounting for almost 15% of average alcohol consumption since the 1990s in the US, is particularly surprising given that public awareness of the health risks associated with alcohol has increased (American Institute for Cancer Research, 2019).

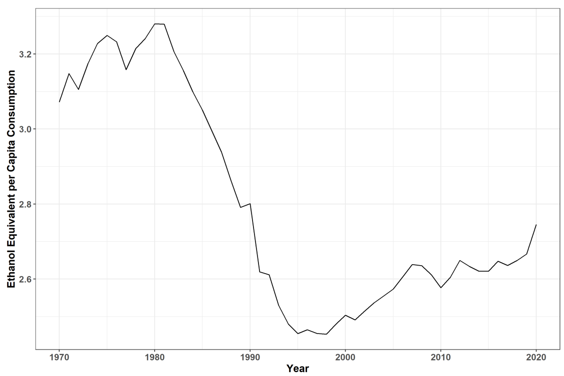
The growth in alcohol consumption has occurred against a backdrop of significantly increased product variety in the US alcohol market (Figure 1b).[2] Nielsen scanner data show a 40% increase in the variety of liquor products available between 2006 and 2019, indicating a shift toward niche consumption whereby households tend to explore different products rather than consistently consume best-selling products with a high market share (Neiman and Vavra, 2019). This trend has resulted in a decrease in market concentration of nearly 40% since 2006, as reflected in the

[1]Experts in the field mention expanded product variety as a specific reason for increased consumption. For example, David Jernigan, professor of health law, policy, and management at the Boston University School of Public Health stated that "Specific products and product categories were created primarily for females: sweeter, fizzier, and marketed as more 'feminine' drinks" (New York Times, 2021).

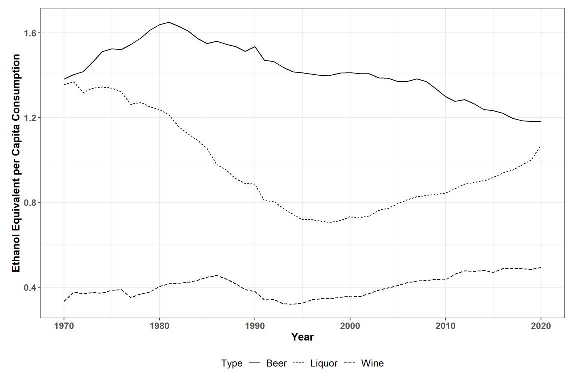
[2]Within this paper, I follow the general definition within the alcohol segment where one divides between beer, wine, and spirits/liquor (Slater and Alpert, 2022). Within each segment, I consider the proportion of ethanol for each beverage type. values are 0.045 for beer, 0.12 for wine, and 0.4 for liquor/spirits (Hinnosaar and Liu, 2022).

Herfindahl-Hirschman Index (HHI) for liquor products (Figure 1d).

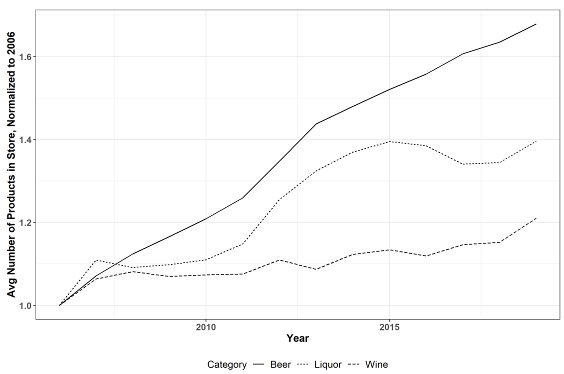
Figure 1: Developments in the US Alcohol Market



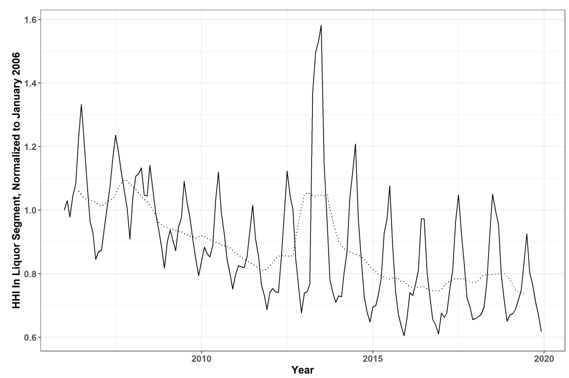
(a) Gallons of Ethanol per Capita



(b) Gallons of Ethanol per Capita by Type



(c) Product Variation across the United States



(d) HHI in the Liquor Market

Notes: The Figures show developments in the US alcohol market. Figure 1a uses data from the National Institute on Alcohol Abuse and Alcoholism (Slater and Alpert, 2022) and reports ethanol consumption in gallons per capita in the US since 1970. Figure 1b is based on the same data, differentiating between beer, liquor, and wine. Figure 1c uses Nielsen Scanner Data and shows the number of available products across the US between 2006 and 2019. Further, Figure 1d shows the Herfindahl-Hirschman Index (HHI) for liquor products within the US. The HHI is normalized to the level of 2006, with lower values relating to a less concentrated market.

The main objectives of this article are (1) to explore the relationship between product variety and the purchase of a good that carries health costs and (2) to address the puzzle of why higher consumption is occurring despite increased awareness of health risks. The article proceeds in three steps. First, I present a simple stylized model that highlights the mechanisms through which increased product variety leads to increased purchases. The model states that higher taxes and greater health awareness can lead to increased product variety, which may offset negative pressure on purchases and thus increase them. Second, I present correlative evidence using store-level and household-level scanner data to support the relationship between product variety and purchases.

The correlation is stable and independent of geographic variation or store-level variation. By analyzing residence changes of households, I further demonstrate that moving to an area with higher product variety increases purchases, even after I control for purchase levels in the new area of residence. Third, I conduct two policy experiments of increased prices due to tax hikes and demonstrate that higher taxes result in lower purchases due to higher prices. However, price increases also result in an increase in product variety, which has a positive impact on purchases.

To illustrate the fundamental mechanisms underlying the link between product variety and alcohol purchases, I present a Hotelling-style model in which consumers make decisions regarding whether to purchase a risky good and how much they wish to purchase. On the demand side, consumers have specific preferences, and their preference distance to the product, health costs, and price not only determine whether they consume but also how much they consume. On the supply side, a single- or multi-product firm selects its position on the taste spectrum. The model has two primary predictions: first, a larger assortment of products leads to increased aggregate purchases, and second, an exogenous increase in taxes or health costs reduces purchases while also increasing the incentive to expand the number of products.

To provide evidence of the positive relationship between product variety and the purchase of risky products, I first conduct an analysis at the store level. By examining data from 2006 to 2019 and taking advantage of differences in product variety across stores, I demonstrate a clear association between higher product variety and increased purchases in almost all US states. Using rich fixed effects and controlling for a wide range of factors, I present regression results that show a 1% increase in beer products is associated with a 1.06% increase in beer purchases. In contrast, a 1% increase in wine or liquor products is linked to 0.67% and 0.25% increases in purchases, respectively.

Finally, using household-level data, rich controls, and fixed effects to account for unobserved heterogeneity, I show that exposure to more alcohol products increases purchases. Specifically, a household exposed to 1% more beer products in a month increases its consumption by 0.03%; for wine and liquor, the effect size is 0.05%. Additionally, I show a positive effect on the external margin, which refers to the probability of making a purchase within a category. To demonstrate the robustness of the results, I analyze the impact of product exposure changes due to households moving to other areas with different levels of product variety. Controlling for destination-specific average alcohol consumption, I show that a 1% increase in product exposure due to a move increases liquor purchases by 0.10%. This finding suggests that the effect size approximately doubles relative to the previous analysis. Moreover, greater product variety also causes the probability of buying any liquor product to increase significantly.

In addition to providing evidence for the external margin, I demonstrate that consumers in the 5th to 10th highest percentiles of alcohol purchases primarily drive the impact estimates. Consequently, I conclude that individuals with particularly risky consumption patterns may be influenced by increased product variety. Notably, high consumption contributes to adverse health costs and negative externalities (Centers for Disease Control and Prevention, 2022*b*), making it a crucial factor in evaluating risky consumption behavior. Finally, although Conlon et al. (2022) show a correlation between sin tax burden and specific demographics, I observe no strong heterogeneity in the effect of product variety on consumption with respect to income, education, or household composition.

To explore the relation between prices, product variety, and purchases, I investigate quasi-experimental settings defined by two distinct state-specific policy changes: (1) the deregulation of liquor licenses in 2012 in Washington that came with an excise tax increase and (2) the large excise tax increase of liquor in Illinois in 2009. I show that both reforms increased product variety in stores that were already selling products before the policy change. Using an instrumental variable approach with states other than Washington and Illinois serving as a control group, I show that the increase in product availability brought about by the tax change caused purchases to rise. However, the increase in product availability is not immediate but delayed. Nevertheless, the results highlight the potential effects of tax-related price increases on product assortment.

This paper has two important implications for policymakers. First, I provide robust evidence that product variety is crucial in markets where consumption is associated with health risks. Increased customization of products enhances the value for individual households by better satisfying their unique preferences. However, without appropriate regulation, the proliferation of new products may lead to increased consumption, thereby exacerbating health concerns. To mitigate this risk, policymakers should consider implementing entry barriers that limit the number of products on the market. By doing so, households will still be more likely to choose products that suit their tastes but less likely to consume excessive amounts of alcohol.

Second, I demonstrate that although increased taxes and public health awareness campaigns can reduce alcohol consumption, they can also have unintended consequences. Specifically, they can inadvertently incentivize firms to increase product variety. This outcome can offset the intended effect of a policy by increasing the availability and appeal of other alcoholic products. Therefore, policymakers should consider supplementing tax and health awareness measures with market entry barriers to create a more effective policy approach. With limitations on the number of products on the market and increases in the perceived cost of alcohol consumption, households will be less likely to consume excessive amounts of alcohol, leading to improved public health outcomes.

This paper adds to multiple streams of the literature in health economics, industrial organization, and marketing. First, I add to the extensive literature that studies the impact of regulation and other factors on risky behavior. The most closely related research includes papers analyzing the impact of the Washington liquor deregulation and the impact of excise tax increases. In particular, I relate to Illanes and Moshary (2020), who study the Washington liquor deregulation and show that the deregulation increases liquor store outlets and expands product assortment and consumption. These findings are in line with the current article. However, I focus on quantifying the relationship between product variety and consumption, in the case of Washington, but also go beyond the quasi-experimental setting of the policy reform.[3] Considering excise tax increases, Gehrsitz et al. (2021) and Saffer et al. (2022) use the Illinois tax increase to show a high pass-through to consumer prices and a considerable negative impact on consumption. I extend the result by focusing on the exogenous effect of prices on product variety and the secondary effect on consumption.

Second, as my estimation strategy at the household level includes an analysis of residential changes, I relate to the literature on how moving affects behavior and consumption (Allcott et al., 2019; Bronnenberg et al., 2012; Hinnosaar and Liu, 2022; Hut, 2020).[4] The closest approach to the current paper is the work of Hinnosaar and Liu (2022), who use the same scanner data that I use to show that movers adapt to destination-specific alcohol consumption patterns. I show a potential mechanism that can explain the effect. Specifically, even after controlling for alcohol consumption at the destination, I observe a strong impact on consumption through product variety changes.

Finally, I add to the literature in marketing on product assortment and product variety. Generally, product assortment increases purchases and visiting frequency of customers in retail markets (Borle et al., 2005). Numerous papers estimate the impact of various factors on assortment planning, for example, Gaur and Honhon (2006) and Wang and Sahin (2018). Others focus on estimating the impact of higher product variety on sales and consumer welfare; see, for example, Brynjolfsson et al. (2003) and Sweeney et al. (2023). I add to the literature by using a novel approach that relates product variety to consumption when consumption of the product comes with health risks.

2 A Stylized Model of Product Variety and Risky Purchases

I present a concise, stylized Hotelling-type model (Hotelling, 1929) to demonstrate a potential relationship between product variety and the purchase of a product with detrimental health effects.

[3] Further, Huang et al. (2018) evaluate how the deregulation has affected price setting, while Seo (2019) studies the value for consumers and stores due to one-stop shopping. He (2022) estimates the impact of one-stop shopping on consumer behavior. Aguirregabiria et al. (2016) estimate the impact of the deregulation in the Ontario wine retail market. Yu et al. (2021) show that the increased product assortment leads to a decrease in price sensitivity. Lastly, Conlon and Rao (2023) study the impact of post-and-hold regulation.

[4] More generally, the paper also relates to the literature that estimates the impact of moving on health outcomes due to geographic variation in health care (Finkelstein et al., 2016), general drivers of mortality (Finkelstein et al., 2021), and opioid use (Finkelstein et al., 2018).

The model is designed to incorporate two essential features. First, in line with the conventional Hotelling model, the demand should account for an external choice between consumption and abstention.[5] Second, the model aims to ensure continuous demand that permits an internal margin, whereby consumers may either increase or decrease consumption as predicted by linear demand functions (e.g., see Amir et al., 2017; Bowley, 1924; or Singh and Vives, 1984). Models that combine both internal and external margins include, for example, those of Friberg et al. (2022), Rath and Zhao (2001), and Stahl (1982) and the structural estimation of Thomassen et al. (2017). The Hotelling-type model is the focal point of my analysis, as I investigate the influence of product variety on the internal and external consumption margins in the context of observable health costs associated with consumption.

Consider a number of individuals I with preferences for a good. The preference of an individual $i \in I$ for a product is denoted as $\rho_i \in [0,1]$. Thus, the preferences can be summarized by a location between two extremes, zero and one. Individuals are uniformly distributed in their preferences. A location $x_j \in [0.1]$ on the preference line can summarize a product j. Independent of preferences, individuals experience a health cost of h when consuming one unit of the product. Generally, health costs are the individual's perceived costs when consuming the product.

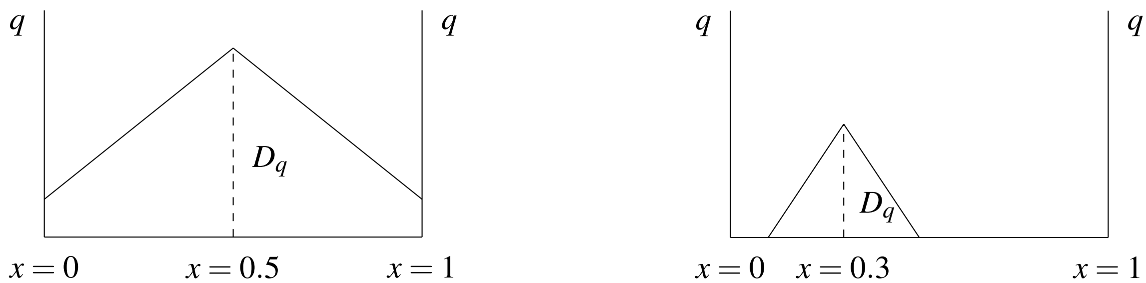
If an individual decides to consume a good, the utility decreases with the distance of their preferences from a product's location, $d_{ij} = |\rho_i - x_j|$. Further, consumption carries direct health and product costs. Thus, I formalize the utility function of consumer i consuming good j as $u_{ij} = (1 - d_{ij} - h_i - p_j)q_{ij} - bq_{ij}^2$, where an individual may purchase a continuous amount of q. $-bq_{ij}^2$ is a technical term that guarantees that the utility function is concave. However, the individual also has the choice to abstain from consumption, leading to a utility of $u_{i0} = 0$.

Further, if multiple products are available, an individual will always either prefer one product or be precisely indifferent. Thus, individuals do not have preferences such that utility increases with the mixed purchase of two goods. Consider two available goods $j \in \{1,2\}$, then $u_{i1}(q_{i1}) \geq u_{i2}(q_{i2})$ or $u_{i2}(q_{i2}) \geq u_{i1}(q_{i1})$. Intuitively, an individual always chooses the product closest to their preference. Given a specific product, maximizing the utility function yields an individual's demand as $q_{ij}^* = \frac{1-d_{ij}-h_i-p_j}{2b}$, where q_{ij}^* is positive if the utility is greater than zero.

Within this basic model, prices and health costs are given, and a single product firm chooses the location x_j given a concave cost function $C(D_q)$, where the resulting demand function is $D_q = \int \max\{q_{ij}^*, 0\}\, dd$ (i.e., summing over all consumers and their distance). The situation is exemplified in Figure 2a in which $x_j = 0.5$ is an equilibrium choice for a single-product firm. However, in Figure 2b, I show that there may be multiple equilibria for sufficiently high prices and/or health costs. Figure 2 also exemplifies that an increased price or health costs would reduce aggregate purchases of a consumer.

[5] Refer to Graitson (1982) or Lancaster (1990) for early literature reviews on this topic.

Figure 2: Single Product Equilibrium



(a) Low p_j and/or h

(b) High p_j and/or h

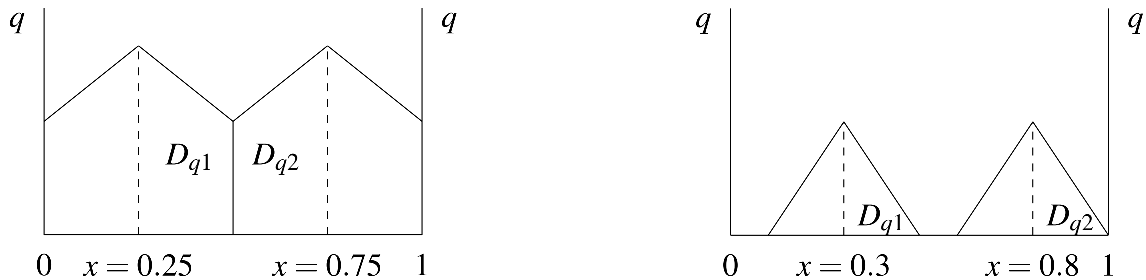
Notes: Two different single-product equilibria are shown. The x-axis refers to the location and preferences of consumers. Consumers are uniformly distributed along the x-axis . The y-axis refers to the quantity demanded by a single consumer. In Figure 2a, I show a situation with relatively low prices and health costs. A single product locates at $x = 0.5$, the unique equilibrium. The area under the function is the demand. All consumers consume a positive amount. In Figure 2b, multiple equilibria are possible as high prices or health costs. In this example, independent of the location, a firm cannot place the product such that all consumers have a positive demand. Thus, it may locate at $x = 0.3$.

Next, I consider a two-product firm, $j \in \{1,2\}$. The positioning on the preference location at $x_1 = 0.25$ and $x_2 = 0.75$ is an equilibrium choice for a two-product firm, independent of prices and health costs. I present the basic reasoning here and show the formal proof in online Appendix A.1. The greater the distance between a firm positioning and a consumer's preference, the lower the quantity purchased. A company has an incentive to differentiate products to the extent that allow it to avoid cannibalization. However, full differentiation to the extremes is nonoptimal. I show the case of a two-product equilibrium in Table 3. The result extends to a situation in which two firms compete. While positioning at $x_1 = 0.25$ and $x_2 = 0.75$ is always at an equilibrium, high health costs or prices may extend the possibilities of equilibria as shown in Figure 3b.

Lemma 1: Increasing the number of products increases consumption. Further, conditional on sufficiently high health costs and prices, consumers who may abstain from consumption may start consuming.

I show formal proof of Lemma 1 in online Appendix A.1. The basic intuition is that increasing the number of products reduces the average distance of consumers to the product closest to their preference location. As a result, we observe a higher number of consumers with large quantity consumption. An additional effect is that some consumers start consuming in the case of large

Figure 3: Two-Product Equilibrium



(a) Low p_j and/or h

(b) High p_j and/or h

Notes: Two different multiple-product equilibria are shown. The x-axis refers to the location and preferences of consumers. Consumers are uniformly distributed along the x-axis. The y-axis refers to the quantity demanded by a single consumer. In Figure 3a, I show relatively low prices and health costs. The two products locate at $x = 0.25$ *and* $x = 0.75$*, the unique equilibrium. The area under the function is the demand. All consumers consume a positive amount. In Figure 3b, multiple equilibria are possible as high prices or health costs. In this example, independent of the location, a firm cannot locate the products such that all consumers have a positive demand. Thus, it may locate at* $x = 0.3$ *and* $x = 0.8$.

health costs and/or prices. This external margin is based on the possibility of not consuming. High health costs or prices mean that some people have a negative utility from consuming in the case of one single product at $x_j = 0.5$ in the market. Thus, they abstain. If two products are available, and $x_1 = 0.25$ and $x_2 = 0.75$, some consumers that would have abstained start purchasing a positive amount due to a shorter distance from their preference.[6]

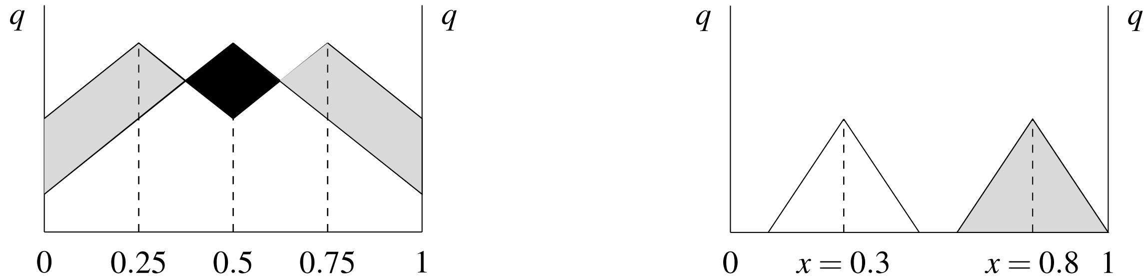
Figure 4 shows the extension. In Figure 4a, the product extension leads to an increase in aggregate demand, as most consumers now have a product closer to their preferences. However, a few consumers consume less (dark black area). There is no external margin whereby health costs and prices are so low that everyone consumes. In Figure 4b, health costs or prices are so high that the demand is not intersecting. As a result, aggregate demand increases and consumers that would not have consumed before start consuming.

Lemma 2: Increasing health costs or prices (without changing the margin) increases the incentive for product introduction.

I show formal proof of Lemma 2 in online Appendix A.2. The intuition is based on the visualization in Figure 4. The higher prices and/or health costs reduce not only the demand of a single

[6]The result is extendable to the situation in which two products are available and a third product is introduced, and so forth.

Figure 4: Incentive to Extend Product Assortment



(a) Low p_j and/or h

(b) High p_j and/or h

Notes: Two different changes due to a product launch are shown. The x-axis refers to the location and preferences of consumers. Consumers are uniformly distributed along the x-axis. The y-axis refers to the quantity demanded by a single consumer. In Figure 4a, I show relatively low prices and health costs. A single firm locates at $x = 0.5$, while the two products locate at $x = 0.25$ and $x = 0.75$, the unique equilibria. The gray area is the increased demand due to the product launch, while the black area is the demand from those consumers that consume in the one-product but not in the two-product equilibrium. The area under the function is the demand. All consumers consume a positive amount. In Figure 4b, multiple equilibria are possible as high prices or health costs. In this example, independent of the location, a firm cannot locate the products such that all consumers have a positive demand. Thus, it may locate at $x = 0.3$ and $x = 0.8$.

consumer but also the number of consumers. As a result, cannibalization due to a second product introduction is less likely. In Figure 4a, low prices and/or health costs lead to a mass of consumers that would have consumed the old product in the absence of the entry. The two products in Figure 4b have exclusive demand.

While an additional product will always increase aggregate demand, the share of cannibalization plays a role in the decrease in prices and health costs. Given the concave cost function, the per-unit profit offsets the higher cannibalization. As a result, firms have a higher incentive to extend the product portfolio if higher health costs or exogenous price components are present, holding everything else constant. Therefore, increased health awareness or increased prices due to taxes incentivizes firms to increase product variety.

3 Institutional Background

Based on the 21st Amendment to the United States Constitution, each state has the right to individually regulate alcoholic beverages, which includes enacting laws on alcohol sales (*Twenty-First Amendment*, 1933). For example, some states, such as California, permit the sale of beer, wine, and liquor in grocery stores, while others, such as Florida, only allow the sale of beer, wine, and low-alcohol liquor in supermarkets (California Legislative Information, 2021; Florida Department of Business and Professional Regulation, 2021). Meanwhile, in some states, such as Delaware, alcohol can only be purchased in a liquor store (State of Delaware, 2021). Furthermore, states have the power to regulate various aspects of the industry, such as the legal drinking age, taxes, distribution, and advertising (Jernigan and Ross, 2017). Despite the extensive regulation, the alcohol market remains an essential component of the retail industry. The market size for alcoholic beverages was 283.80 billion USD in 2023 and is projected to continue to grow (Statista Research, 2020). This article focuses on two specific regulatory changes at the state level that affect the availability of products in stores. Each change will be discussed in detail in the following sections.

Deregulation of Liquor Licenses in Washington State

In 2011, Washington state passed a law that ended the state's monopoly on selling liquor. Previously, only state stores and a limited number of private retail outlets were allowed to sell beer and wine (Sevigny et al., 2013). Under the new law, private retailers were allowed to sell spirits. The law also created a new system for licensing and regulating liquor sales and increased the excise tax by 17 percentage points. A license also requires a minimum store size of 10,000 square feet (Seo, 2019).

One of the immediate effects of the policy change was a surge in the number of retail outlets selling spirits. Prior to the law going into effect, the state had approximately 330 retail outlets; afterward, the number increased to over 1,500. Most of the new retailers were existing grocery stores that started selling liquor (Seo, 2019; Illanes and Moshary, 2020). In this paper, I focus on the effect on assortment in stores that sold liquor prior to deregulation and the increase in the excise tax.

Excise Tax Increase in Illinois

In 2009, the state of Illinois increased its excise tax on alcohol as part of the Illinois Jobs Now Act. The tax increase was intended to generate revenue for various state programs, especially infrastructure. The increase varied depending on the type of alcohol, but it generally resulted in higher prices for consumers (Gehrsitz et al., 2021). The excise tax on beer increased by $0.08 per gallon, while that on wine increased by $0.73 per gallon. The tax on distilled spirits had an especially steep increase, amounting to $4.50 per gallon. (Robinson et al., 2012).

The tax increase had a substantial impact on alcohol sales in the state, with sales volume decreasing across all types of alcohol (Gehrsitz et al., 2021). However, the effect was more pronounced for liquor sales than for beer sales (Robinson et al., 2012).[7]

4 Data

The article is based on NielsenIQ Retail Scanner data as well as the Nielsen Consumer Panel. The scanner data include weekly prices and sales of products in more than 90 retail chains accounting for over 35,000 stores nationwide. The data include large grocery and drug stores, as well as smaller liquor and convenience stores. The Nielsen Consumer Panel includes household data from 2004 onward for all purchases intended for in-home use in 40,000–60,000 households across the United States. I observe prices, quantities, detailed product categories, and other product information. Purchases are recorded at the household level, and households also report demographic data such as household size, composition, and income. Einav et al. (2010) and Zhen et al. (2019) show that research scanner data are reliable. A more specific concern about scanner data relates to alcohol consumption, as on-premise consumption, such as in bars or restaurants, is not recorded. Industry reports suggest that on-premise consumption is less than 25% of total consumption. Further, Conlon et al. (2022) show that Nielsen's Retail Scanner aligns well with governmental surveys in terms of distribution of household consumption.

For my research, I focus on the years 2006 to 2019.[8] With Nielsen's retail scanner, I first create a monthly store-level data set encompassing three alcohol categories: beer, wine, and liquor. I measure the sales and prices within each category. In addition, I calculate the total quantity of pure alcohol following the literature (see for example Hinnosaar and Liu, 2022), using the following conversions: 0.045 times the quantity of beer, 0.12 times the quantity of wine, and 0.4 times the quantity of liquor. Table 1, Panel A shows basic summary statistics at the store-month level for the three categories.

Using the retail scanner, I first identify the availability and assortment of products at the store level. As I observe all sales on a weekly basis but not the product availability, I assume that a product is available if it is sold at least once a year. Thus, I observe a yearly variation of variety across stores.[9] Table 1, Panel A shows the number of available products in the different categories across stores.

I then consider Nielsen's panel data and create a monthly panel of households, their purchases and expenditures in each alcohol category, and their exposure to products. In Table 1, Panel B, I

[7] The tax increase also led to increased cross-border shopping, with Illinois residents traveling to nearby states with lower tax rates to purchase alcohol (Gehrsitz et al., 2021).

[8] I exclude the first two years of the data, 2004 and 2005, as substantially fewer households are available. Further, I exclude the year 2020 due to strong changes in consumer behavior during the Covid-19 pandemic.

[9] An alternative specification would be to identify the existence of a product if it is purchased once a month. While such an approach would allow monthly rather than yearly variation of assortment, measurement may contain a bias if some products are still in the assortment but have not been sold.

show summary statistics. Throughout this article, I consider all households, controlling for household size as well as the presence of children. However, I also conduct robustness checks based on single-member households only.

Finally, I use moving households (i.e., households that relocate) as part of my identification strategy. I identify moving households that change their residential zip code, recorded in Nielsen's Consumer Panel on a yearly basis. As robustness checks, I also consider changes at the county or state level. As households solely report residence changes yearly, I exclude the year of the move from the analysis. Some households report multiple moves during their time in the panel. In the baseline analysis, I include only those households with a single move. However, I show robustness for multiple moves. Table 1, Panel C shows summary statistics considering moving households only.

5 The Relation of Product Variety and Volume

In this section, I investigate the correlation between product variety and consumption patterns, as illustrated in Lemma 1. I expect that an increase in product offerings will lead to higher consumption rates. This impact may be observed on two fronts: the internal margin, where existing consumers intensify their consumption, and the external margin, where previously inactive consumers become active consumers. To thoroughly examine this relationship, I begin with an analysis of aggregate store-level data and then explore household-level data. I conclude with a focused examination of consumption patterns among consumers who have recently relocated.

5.1 Store-Level Analysis

Consider a store s in year t selling a set of products with health costs, where sales are $\mathbf{y}_{st}$. Such products can be categorized as beer, wine, or liquor. In all three subcategories, the assortment increased between 2006 and 2018. To investigate and exemplify geographic variation in the changes in assortment and store-level consumption, I first show the following regression evidence. Consider store s in year t offering Num_{st} products of spirits, resulting in y_{st} liters of liquor, wine, or beer purchases. I run the following regressions for each US state between 2006 and 2018:

$$log(Num_{st}) = \alpha + \beta \cdot t + \rho_s + \varepsilon_{st} \tag{1}$$

$$log(y_{st}) = \alpha + \beta \cdot t + \rho_s + \varepsilon_{st}, \tag{2}$$

Table 1: Summary Statistics

	Beer	Wine	Liquor
	Panel A: Store Level Data		
Number of Stores	44,340	40,320	41,908
Number of Retailers	225	217	217
Average Purchases	424.73	287.2	455.19
	(531.72)	(443.54)	(879.48)
Average Number of Products	198.08	460.69	185.27
	(180.45)	(535.88)	(323.75)
Average Prices	9.73	8.31	9.44
	(3.99)	(3.03)	(5.31)
	Panel B: Household Level Data		
Number of Households	183,776	183,776	183,776
Number of Households with Purchase	101,913	103,947	97,653
Average Purchase	2	0.78	0.38
	(10.42)	(4.05)	(2.81)
Average Purchase cond. on Purchase	15.57	6.03	3.94
	(25.15)	(9.73)	(8.3)
Average Purchase of Single Households	1.33	0.65	0.31
	(8.01)	(3.63)	(3.32)
Average Costs	4.46	4.98	3.84
	(20.46)	(23.76)	(19.4)
Average Costs cond. on Purchase	34.61	37.82	40.35
	(46.99)	(55.54)	(49.76)
Average Number of Products Exposed to	327.46	806.34	307.53
	(249.57)	(729.56)	(418.52)
	Panel C: Moving Households		
Number of Households	11,540	11,540	11,540
Number of Households with Purchase	7,909	8,357	7,926
Average Purchase	2.04	0.91	0.38
	(10.17)	(4.31)	(2.2)
Average Purchase cond. on Purchase	15.14	6.23	3.8
	(23.88)	(9.67)	(5.91)
Average Purchase Before Move	2.25	0.95	0.4
	(10.89)	(4.45)	(2.16)
Average Purchase After Move	1.83	0.88	0.37
	(9.41)	(4.17)	(2.24)
Average Costs	4.7	5.85	4.09
	(20.89)	(25.33)	(19.73)
Average Costs Before Move	4.97	5.88	4.17
	(21.57)	(24.91)	(19.73)
Average Costs After Move	4.44	5.83	4.01
	(20.21)	(25.73)	(19.73)
Average Number of Products Exposed to	343.97	862.26	320.72
	(252.02)	(747)	(428.45)
Average Number of Products Exposed to, Before	307.72	828.33	292.92
	(222.55)	(738.39)	(401.79)
Average Number of Products Exposed to, After	380.52	896.47	348.76
	(273.77)	(754.05)	(452.02)

Notes: This table presents basic summary statistics for the three beverage categories: beer, wine, and liquor. Panel A displays monthly store-level statistics, while Panels B and C focus on household monthly data. Panel B includes all households, whereas Panel C is specific to households that have relocated across zip codes. Average purchase quantities are measured in liters, with price and cost variables expressed as cost per liter for each category. Standard deviations are provided in parentheses.

where ρ_s represents store-specific fixed effects. Thus, β measures how many more products or sales of liquor are observed at the store level in a year. Using logarithmic transformations of the number of products, $log(Num_{st})$, and the sales, $log(y_{st})$, $\hat{\beta} \cdot 100$ is the yearly percent change in both outcome variables at the store level.

In Figures 5 and 6, I show the estimates of $\hat{\beta}$ for each state-specific regression. Within Figure 5, Figure 5a shows the effect on liquor variety, and Figure 5b shows the effect on the purchases of liquor. In Figure 6, I show the same evidence within a heat map. First, note that the majority of states are characterized by an increase in liquor product variety. In most states, between 0% and 10% more products become available each year between 2006 and 2018. Second, purchases have also increased in most states. However, the increase in purchases at the store level is, on average, slightly lower than the increase in the assortment. Figure 6 indicates a correlation between the effect of increased variety and purchases, with stronger increases for both in the midwestern United States.

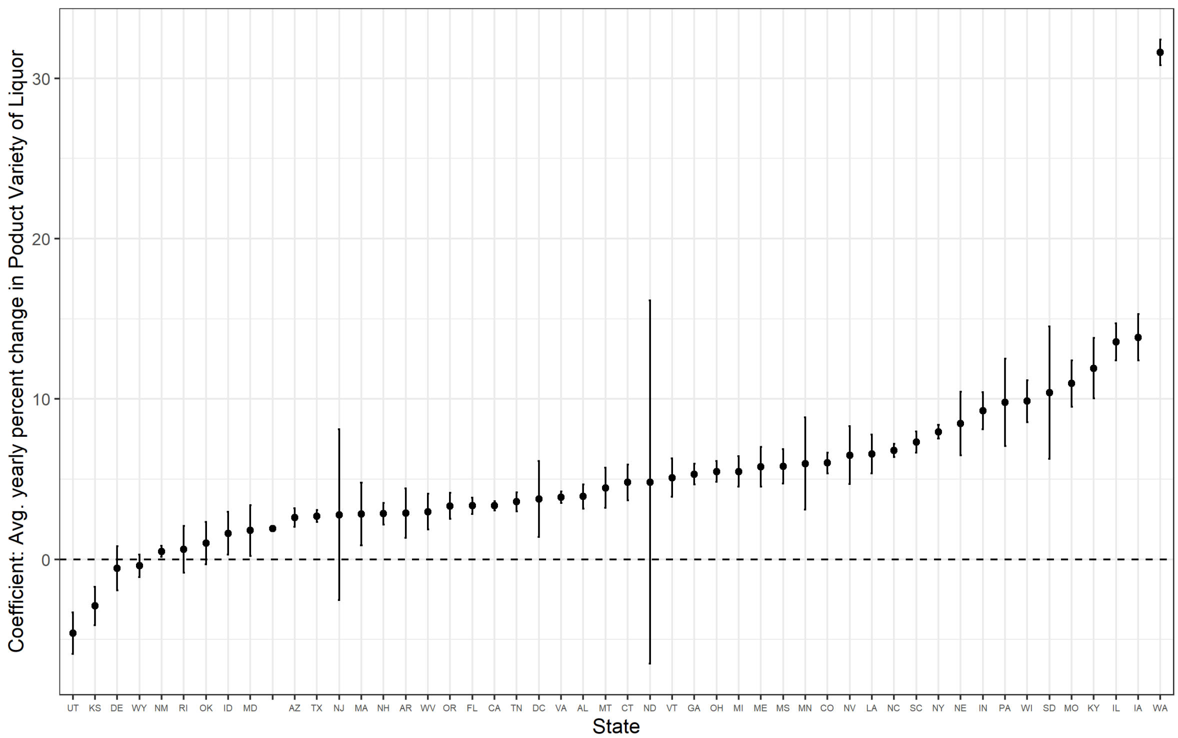
Note that we observe a clear outlier with the coefficients of Washington state. In detail, the variety of liquor increases by 30% per year at the store level, while the purchases of ethanol-equivalent liquor have increased by more than 20%. The effect may be explained by the liberalization of the liquor market in 2012. Two effects play a role. First, the data include retailers that obtained a license in 2012 or after; therefore, their sales and product assortment jumped suddenly. Second, following Illanes and Moshary (2020), I find that even retailers with liquor licenses before 2012 have increased their assortment, and consumers have increased their consumption. In section 6, I show additional evidence for the latter effect by solely considering retailers who already sold liquor before the liberalization.

To summarize the correlation between sales and the assortment of products, I show the following regression evidence:

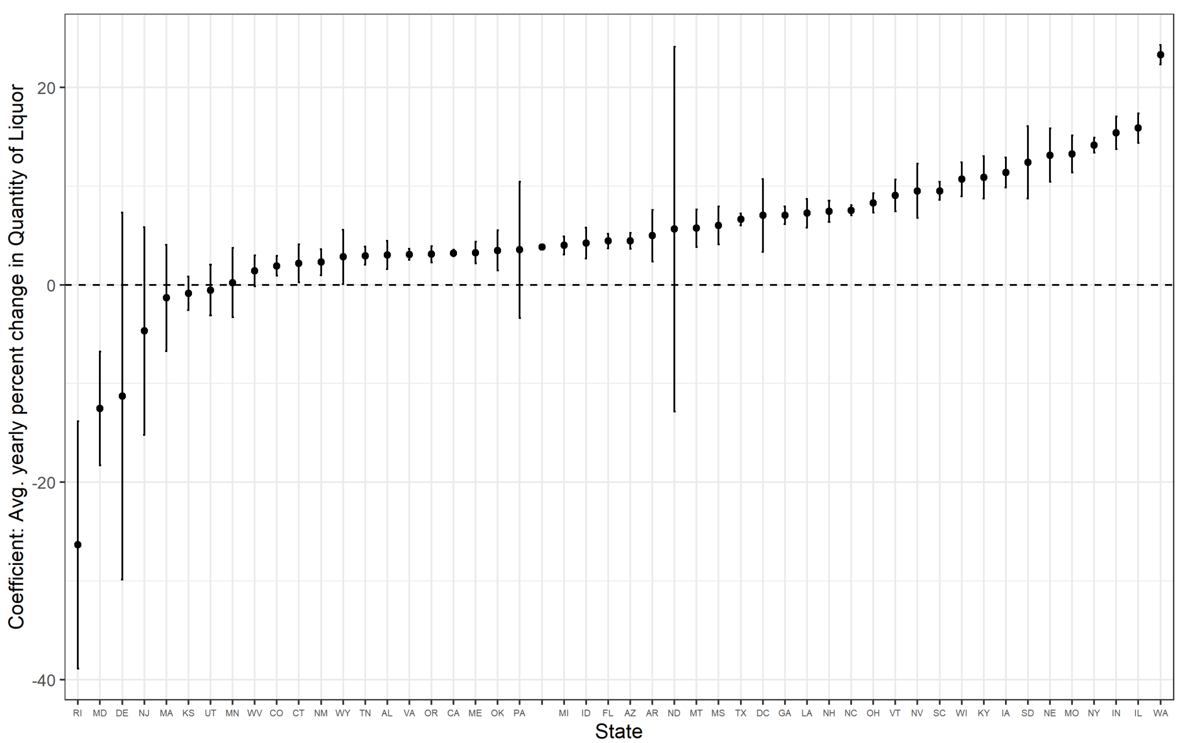
$$log(y_{skt}) = \alpha + \beta log(Num_{st}) + \rho_s + \mu_t \cdot state_k + \xi p_{st} + \varepsilon_{st}, \qquad (3)$$

where y_{skt} is the sales of three alcohol categories (beer, liquor, and wine) within a store s located in state k in a month t. Num_{st} is the product assortment within a category, measured as the number of available products within a year. Within the regressions, I use a logarithmic transformation of the outcomes and the product assortment to interpret $\hat{\beta}$ conveniently. In detail, a 1% change in the number of available products leads to $\hat{\beta}$ percent increase in sales. ρ_s and $\mu_t \cdot state_i$ are store and year-store fixed effects, respectively. Given differential alcohol policies within states, time-varying state fixed effects are essential controls. I further consider models with county-month fixed effects to further control for potential endogenous policy changes at the county level. Finally, I also control

Figure 5: Regression Evidence: Geographic Variation in Assortment and Sales of Liquor



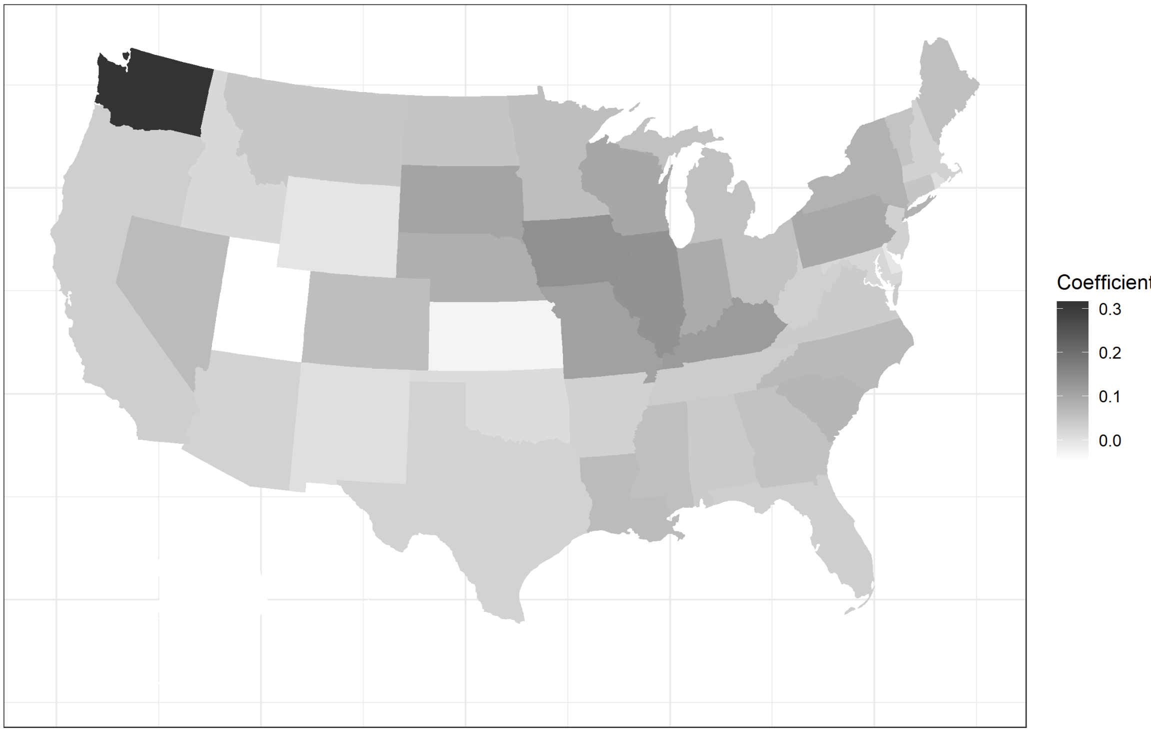
(a) Effect on Product variety across States



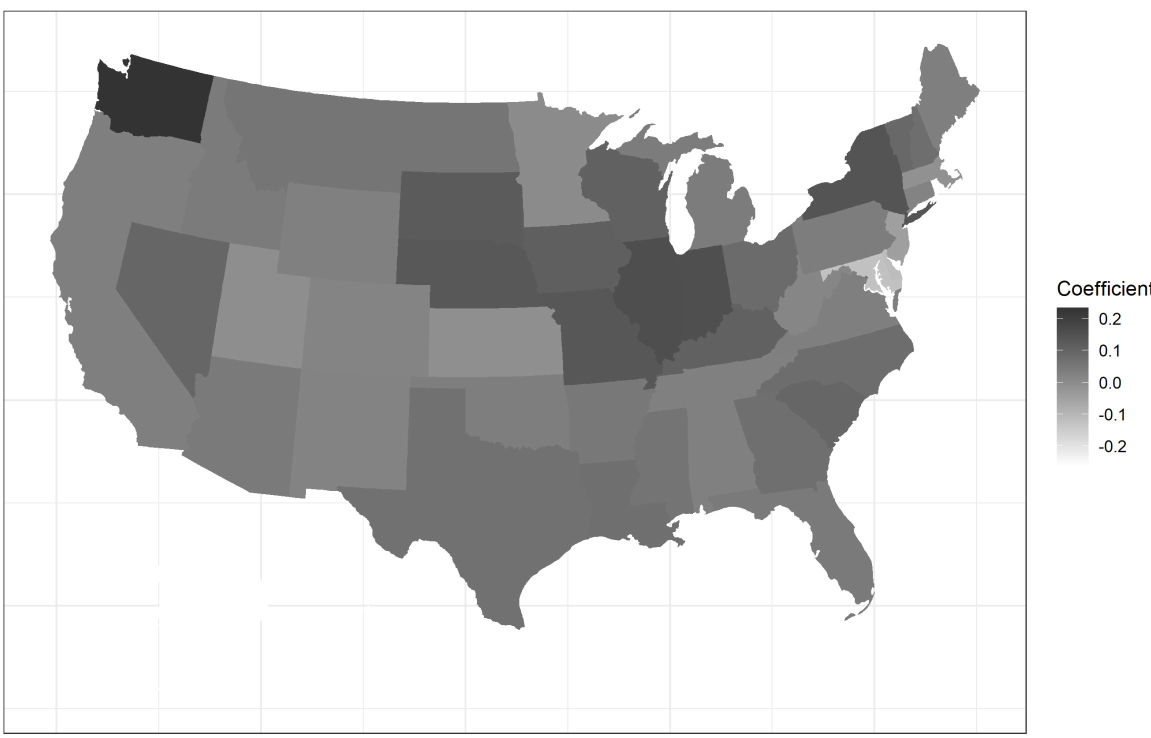
(b) Effect on Quantity across States

Notes: The figure shows the results of regression equations (1) and (2). Each regression is at the state level and shows the coefficient of an additional year on product variety and quantity sold using store-level fixed effects. In each regression, I include store-level fixed effects. I show 95% confidence intervals, based on standard errors that are clustered at the household level and adjusted for within-cluster correlation.

Figure 6: Regression Evidence in Heatmap: Geographic Variation in Assortment and Sales of Liquor



(a) Effect on Product variety across States



(b) Effect on Quantity across States

Notes: The heatmap shows the results of regression equations (1) and (2). Each regression is at the state level and shows the coefficient of an additional year (between 2006 and 2019) on product variety and quantity sold using store-level fixed effects. In each regression, I include store-level fixed effects. Standard errors are clustered at the household level and adjusted for within-cluster correlation.

for weighted average prices within a store, p_{st}. With the regression for each alcohol section run separately, β measures the effect of the product assortment (i.e., the number of products within a category) on the sales within a store. Note that the estimate solely represents a correlative estimate of the relation. Multiple factors that relate to sales may affect the number of products available. For example, a positive economic shock may relate to an increased assortment. Further, the economic shock could positively affect sales within a store through channels other than assortment.

Table 2 shows the results. I consider a logarithm of liters of beer, wine, and liquor as the outcome. Using store and county-month fixed effects, as well as price controls, I show that a 1% increase in the number of different beer products leads to a 1.06% increase in beer sales. For wines and liquor, the effect sizes are slightly lower. A 1% increase in the assortment of wines is correlated with an increase in sales by 0.67%, while an expansion of liquor products by 1% relates to a 0.25% increase in monthly sales.

Table 2: Correlation between Sales and Assortment

	log(Beer+0.1)			log(Wine+0.1)			log(Liquor+0.1)		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
log(N+0.1)	1.43***	1.07***	1.06***	1.23***	0.66***	0.67***	1.24***	0.28***	0.25***
	(0.00)	(0.01)	(0.01)	(0.00)	(0.01)	(0.01)	(0.00)	(0.01)	(0.01)
Constant	-1.92***			-2.25***			-0.52***		
	(0.02)			(0.02)			(0.01)		
Store FE	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
State × Month FE	No	Yes	No	No	Yes	No	No	Yes	No
County × Month FE	No	No	Yes	No	No	Yes	No	No	Yes
Price Controls	No	No	Yes	No	No	Yes	No	No	Yes
N	3,715,546	3,715,546	3,715,442	3,346,274	3,346,274	3,346,186	3,467,985	3,467,887	3,467,887
R^2	0.43	0.94	0.97	0.67	0.95	0.96	0.72	0.96	0.96

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Notes: The Table shows regression evidence for equation 3. One observation corresponds to a store within a month. The outcome variable is the logarithm of sales in liters in three categories. In the first three models, I consider beer sales, the second three models the sales of wine, and the final three models show results for sales of wine. To avoid zero sales, I transform the outcome variable to add 0.1 liters to each outcome. $log(N+0.1)$ is the number of beer, wine, or liquor products in a store. It varies across years. Given the log-log specification, a one percent change in the number of available products leads to $\hat{\beta}$ percent increase in sales. Store FE, State × Month FE, and County × Month FE indicate the inclusion of store, state-month, or county-month fixed effects. Price Controls shows if the model controls for the weighted average price of sales within a category. Standard errors are clustered at the store level, adjusted for within-cluster correlation, and reported in parentheses.

5.2 Household-Level Analysis

In this section, I move to the household-level analysis. I first show how the correlation between the variety of products that a household is exposed to and the household's consumption. Consider household i located in county c purchasing y_{it} liters within a category (beer, wine, or liquor) in month t. Within the following model, the correlation between purchases and the number of products a household is exposed to within a month is estimated as follows:

$$log(y_{it}) = \alpha + \beta log(Exposure_{it}) + \xi_i + \rho_{ct} + \phi_{ic} + \delta \mathbf{X}_{it} + \varepsilon_{it}, \quad (4)$$

where $Exposure_{it}$ is the number of products a household is exposed to within a month, and xi_i and δ_{ct} are household and month-county specific fixed effects, respectively. In part of the regression models, we use household-county instead of household fixed effects ϕ_{ic} to control for effects caused by changing residency. Further, I include household time-varying controls, such as household size or composition, in X_{it}. Thus, β measures the impact of being exposed to an additional alcohol product within a month. Given the log-log specification, a 1% change in exposure to products within a certain category leads to $\hat{\beta}$ percent increase in purchases of that category. As an additional outcome variable, I consider the external margin and create an indicator variable, $I(y_{it})$, that takes the value of one if the purchases in one alcohol category are positive. As a result, in those models, a 1% change in exposure to products of a category leads to $\hat{\beta}$ percentage points higher probability that a household purchases any alcohol from that category.

Note that the specification considers the sum of product exposure of a household across different stores within a month. As an alternative, a household's visit to a store may be considered with the variation measured at store and household levels. I show results for the alternative approach in online Appendix D.

I present the findings of the household-level regression in Table 3. Panel A displays results for the beer category, while Panels B and C show the results for the wine and liquor categories, respectively. The outcomes remain consistent across all specifications. An increase in exposure to products during shopping occasions significantly increases purchases. The effect size is smaller than in the aggregate regression of equation (3), with a 1% increase in product exposure raising beer purchases by 0.025%, wine purchases by 0.042% , and liquor purchases by 0.048% on average. This reduced effect size can be attributed to a considerable proportion of households abstaining from purchasing any alcoholic beverages, regardless of product availability.

Nevertheless, a significant positive impact of product exposure is observed on the external margin. Specifically, a 1% increase in product exposure heightens the probability of purchasing any beer product by 0.006 percentage points. This outcome remains consistent for wine products,

Table 3: Regression Evidence for Product Exposure on Alcohol Purchases on Household Level, Beer, Wine, and Liquor

Panel A: Beer					
	log(Beer)				I(Beer>0)
	(1)	(2)	(3)	(4)	(5)
$log(Exposure + 0.5)$	0.066***	0.028***	0.027***	0.025***	0.006***
	(0.002)	(0.001)	(0.001)	(0.001)	(0.000)
Constant	-1.987***				
	(0.008)				
Household FE	No	Yes	Yes	No	No
Year-Month FE	No	Yes	No	Yes	Yes
County × Year-Month FE	No	No	Yes	No	No
Household × County FE	No	No	No	Yes	Yes
Household Controls	No	No	No	Yes	Yes
N	6,878,525	6,878,525	6,878,525	6,419,004	6,419,004
R^2	0.004	0.523	0.527	0.530	0.445
Panel B: Wine					
	log(Wine)				I(Wine>0)
	(1)	(2)	(3)	(4)	(5)
$log(Exposure + 0.5)$	0.099***	0.051***	0.050***	0.042***	0.006***
	(0.002)	(0.002)	(0.002)	(0.001)	(0.000)
Constant	-1.987***				
	(0.008)				
Household FE	No	Yes	Yes	No	No
Year-Month FE	No	Yes	No	Yes	Yes
County × Year-Month FE	No	No	Yes	No	No
Household × County FE	No	No	No	Yes	Yes
Household Controls	No	No	No	Yes	Yes
N	6,878,525	6,878,525	6,878,525	6,419,004	6,419,004
R^2	0.010	0.469	0.473	0.478	0.424
Panel C: Liquor					
	log(Liquor)				I(Liquor>0)
	(1)	(2)	(3)	(4)	(5)
$log(Exposure + 0.5)$	0.103***	0.052***	0.050***	0.048***	0.005***
	(0.003)	(0.002)	(0.002)	(0.002)	(0.000)
Constant	-1.987***				
	(0.008)				
Household FE	No	Yes	Yes	No	No
Year-Month FE	No	Yes	No	Yes	Yes
County × Year-Month FE	No	No	Yes	No	No
Household × County FE	No	No	No	Yes	Yes
Household Controls	No	No	No	Yes	Yes
N	6,878,525	6,878,525	6,878,525	6,419,004	6,419,004
R^2	0.005	0.388	0.392	0.391	0.365

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Notes: This table presents regression results for equation 4, with each observation representing a household within a month. The outcome variable is the logarithm of household purchases in three categories: beer (Panel A), wine (Panel B), and liquor (Panel C). In the last model, the outcome is an indicator variable equal to one if a household purchases any beer, wine, or liquor product in a given month. To avoid zero sales, the outcome variable is transformed by adding half the minimum value of the sample beer, wine, and liquor purchases across observations with nonzero purchases, i.e., $log(Beer + 0.1035072)$, $log(Wineamount + 0.0015)$, *and* $log(Liquor + 0.000083)$. $log(Exposure + 0.5)$ *represents the number of products a household is exposed to in a month. In the log-log specification, a one percent change in the number of products leads to a* $\hat{\beta}$ *percent increase in purchases. Household FE, Year-Month FE, County × Year-Month FE, and Household × County FE indicate the inclusion of household, month, county-month, or household-county fixed effects. Household Controls signify if the model accounts for time-varying household characteristics such as income (income brackets), household size, composition (relation between household members), occupation of female and male household heads, employment status, education and age, marital status within a household, presence and age of children, and race. Standard errors are clustered at the household level, adjusted for within-cluster correlation, and reported in parentheses.*

although liquor products' external margin is slightly lower.

In summary, the household-level analysis aligns with Lemma 1, indicating that greater product exposure leads to increased purchases. The effect size is most pronounced for liquor. Furthermore, the internal and external margins are affected for all three product categories.

5.3 Movers

I now move to an additional identification strategy by using variation in product exposure due to residence changes. Initially, I consider the households that change their residency between two zip codes within a year.[10] Figure 7 shows some of the initial descriptive evidence on the relationship between product exposure of households and average changes in liquor purchases. In detail, Figure 7 considers ventiles ordered by the average difference in product exposure across moving households. I then show average changes in product purchases for each ventile of changes in product exposures. While Figure 7a includes all households, Figure 7b excludes households without any change in product exposure or liquor consumption. The results show a positive relationship. Therefore, exposure to more products after the move correlates with higher purchases.

I then use an instrumental variable approach to consider the variation due to moves. Consider a model similar to equation (4), where household i, residing in zip code area z purchases y_{it} liters from a category (beer, wine, or liquor) in month t:

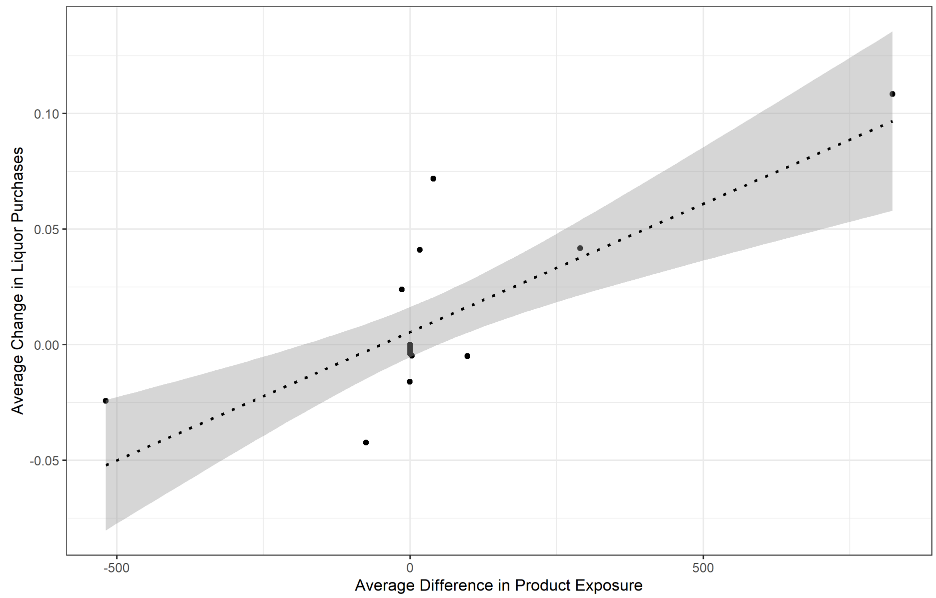
$$log(y_{it}) = \alpha + \beta log(Exposure_{it}) + \xi_i + \rho_t + \delta \mathbf{X}_{it} + \mu \bar{y}_{zt} + \varepsilon_{it}, \quad (5)$$

where $Exposure_{it}$ is the number of products within a category that a household is exposed to during all shopping trips within a month. In addition to household fixed effects (ξ_i), month fixed effects (ρ_t), and household varying control variables ($\mathbf{X}_{it}$), I control for average consumption of the category in a zip code ($\bar{y}_{zt}$). In this approach, I use the change in exposure of products of a categories for movers from before to after a move as an instrument. In detail, Z_{it} is the difference of $Exposure_{it}$ to the average exposed product the year before the move. Thus, Z_{it} is positive if a household is exposed to more products. Note that Z_{it} is only non-zero for moving households *after* a move.

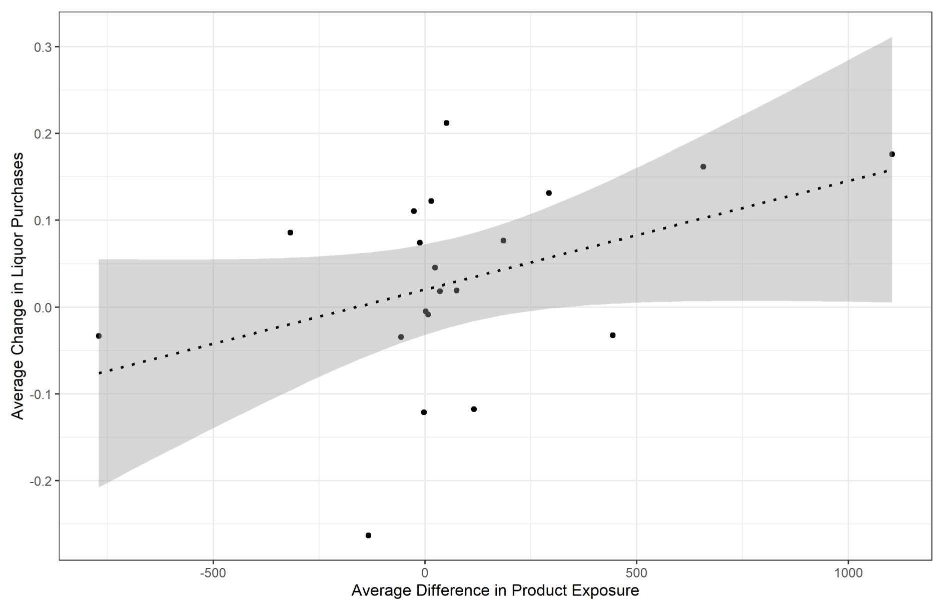
The exclusion restriction of the instrumental variable approach is that the exposure to new products in a new zip code is unrelated to factors affecting consumption, except for the exposure to assortment. The new control of average consumption of the category in a zip code ($\bar{y}_{zt}$) is essential in light of the identification strategy. Moving individuals may adapt to a new environment, for example, through spillover effects of behavior (e.g., see Hinnosaar and Liu (2022)). In this case,

[10] In online Appendix E, I explore robustness, using an alternative definition of moving.

Figure 7: Change in Liquor Consumption by Difference in Product Exposure due to a Household Move



(a) Including Households Without Change in Product Exposure



(b) Excluding Households Without Change in Product Exposure or Liquor Consumption

Notes: The figure shows average changes in liquor purchases from before a move to afterward as a function of the change in product exposure. The average change in liquor purchases is calculated as the difference between average purchases and product exposure during the years before and after the change of residency. We exclude the year of the residence change. These average differences are grouped into ventiles based on the changes in average exposure. Thus for each ventile of the average differences of product exposure, the y-axis shows the corresponding change in liquor purchases, averaged within the ventile. I show an OLS using the 20 data points. Further, I report 95% confidence intervals.

the instrument Z_{it} is correlated to other factors of the environment. Thus, I control for the average monthly consumption within a zip code and thereby control whether the whole adaptation is solely due to the new environment. In addition, $\mathbf{X}_{it}$ controls for important household specific changes that may relate to the move, such as household income, occupations, etc. As a result, the coefficient $\hat{\beta}$ measures the impact of the exposure to products due to the move resulting in a higher assortment conditional on the destination's consumption.

I show results for liquor consumption in Table 4.[11] The OLS regression aligns with the instrumental variable approach in all specifications using this approach, yielding a higher coefficient consistently. For the full sample and all controls in model (6), a 1% increase in liquor product exposure due to moving increases liquor purchases by 0.08%. The external margin also increases. In detail, a 1% higher exposure to products increases the probability of purchasing a liquor product by 0.01 percentage points. Overall, the analysis of movers is in line with the general results.

Movers' Product Choices. The results of movers confirm Lemma 1. More product choices increase purchases, and new consumers start purchasing alcohol. Considering moving households in specific, we expect that the effect is driven by new, previously unavailable products rather than an increase in the volume of products that a household could have purchased in their purchasing trips before moving. In Figure 8, I show average liquor purchases and the fraction of those purchases that are due to new products for the sample of households that are exposed to more products after the move. In detail, I present evidence that over the years after the move up to more than 50% of liquor purchases can be accounted for new products that a household hasn't been exposed to before a move. Also, for the beer and wine segment, moving households that are exposed to more product variety purchase, especially products they haven't been exposed to in the past. From the first to sixth year after the move, new beer and wine products account for 22.4-47.8% and 33.2%-41.2% of purchases.

5.4 Heterogeneity

Purchase Distribution. This study investigates heterogeneity in household-level responses to product variety with respect to aggregate alcohol purchases. This analysis is essential for interpreting health costs and other externalities associated with alcohol consumption, particularly excessive alcohol use (Centers for Disease Control and Prevention, 2022*b*). The average effect of product assortment on purchases could be attributable to different household groups: (1) households with relatively low purchases that slightly increase their purchases; (2) households with a risky level

[11] Results for the beer and wine segments are displayed in C.

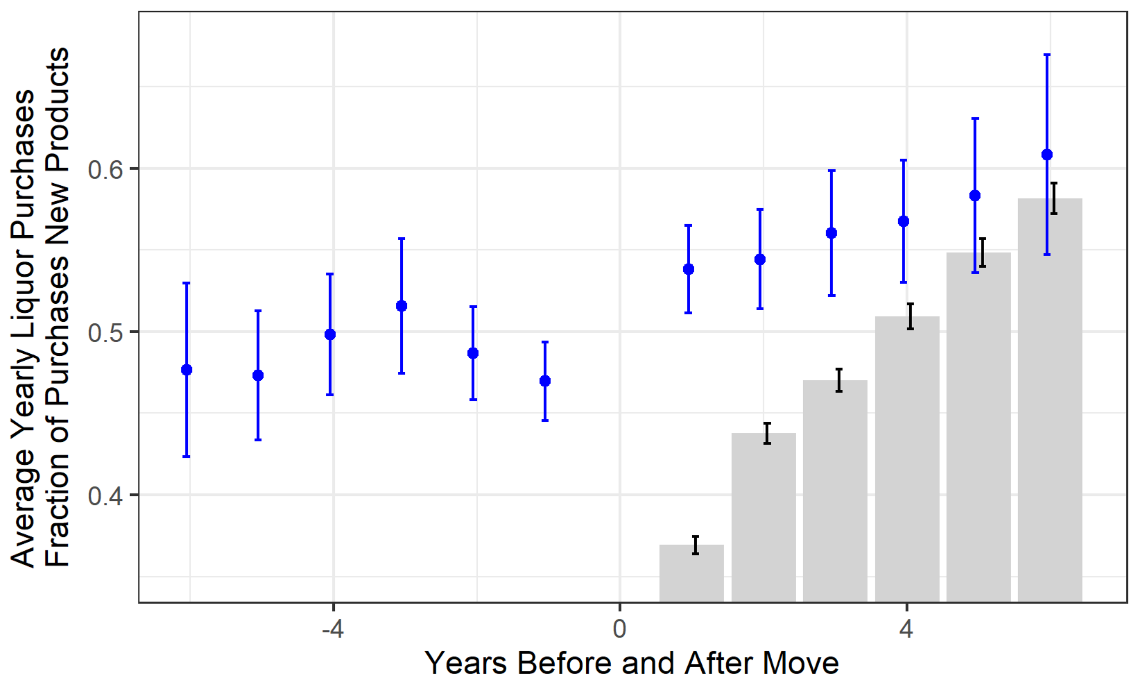
Table 4: Regression Evidence for Movers, Liquor Purchases

	log(Liquor)								I(Liquor>0)	
	Full Sample						Only movers		Full Sample	
	OLS	IV	OLS	IV	OLS	IV	OLS	IV	OLS	IV
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
log(Exposure)	0.103***	0.181***	0.050***	0.095***	0.045***	0.078***	0.049***	0.071***	0.005***	0.008***
	(0.003)	(0.026)	(0.002)	(0.013)	(0.002)	(0.013)	(0.005)	(0.012)	(0.000)	(0.001)
Constant	-8.752***	-9.088***								
	(0.011)	(0.110)								
Household FE	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year-Month FE	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Origin/Destination Controls	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes
Household Controls	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
N	6,471,996	6,471,996	6,471,996	6,471,996	6,047,883	6,047,883	597,584	597,584	6,047,883	6,047,883
R^2	0.005	0.002	0.391	0.391	0.413	0.413	0.396	0.396	0.381	0.381
F-Statistic First Stage		72,169		227,147		204,534		204,041		204,534

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Notes: This Table presents regression results for equation 5, with each observation representing a household within a month. The outcome variable is the logarithm of sales for liquor products and an indicator variable equal to one if a household purchases any liquor in a given month. The models alternate between OLS and instrumental variable regression. The instrument takes the value of the change in the exposure of products for moving households after the move in comparison to the average of the year before the move. Note that the instrument is zero for non-moving households and moving households before the move. Models 1-6 and 9-10 include the full sample, while models 7-8 only include households that moved during the sample period. To avoid zero sales, the outcome variable is transformed by adding half the minimum value of the sample liquor purchases across observations with nonzero purchases, i.e., $log(Liquor + 0.000083)$. $log(Exposure + 0.5)$ *represents the number of liquor products a household is exposed to in a month. In the log-log specification, a one percent change in the number of products leads to a* $\hat{\beta}$ *percent increase in liquor purchases. Household FE and Year-Month FE indicate the inclusion of household and year-month fixed effects. Origin/Destination Controls signifies if the model includes the zip code-specific average purchases of liters of liquor. Household Controls show if the model accounts for time-varying household characteristics such as income (income brackets), household size, composition (relation between household members), occupation of female and male household heads, employment status, education and age, marital status within a household, presence, and age of children, and race. F-Statistics First Stage refers to the F-statistics of the first stage in the instrumental variable approach, where the instrument consistently has a significant positive coefficient. Standard errors are clustered at the household level, adjusted for within-cluster correlation, and reported in parentheses.*

Figure 8: Change in Liquor Consumption by Difference in Product Exposure due to a Household Move



Notes: The blue coefficients show the average yearly liquor purchases in the years before and after a move of households that are on average exposed to 107 (highest 40% quantile) more liquor products after the move. The grey bars show the fraction of liquor purchases of the same households of new liquor products which a household has not been exposed to before the move. The errorbars correspond to the 95% confidence intervals.

of purchases that further exacerbate their risks by increasing purchases; and (3) households with extreme consumption that further augment their consumption, driving the average effect.

Figure 9 presents results from household-level correlations and the identification strategy using movers, considering samples of the top 25%, 10%, 5%, and 1% purchasers per person within a household.[12] The subsample choices are based on the observation that over 50% of the population never purchased alcohol products. While the identification strategy for movers becomes less potent when the sample is reduced to relatively fewer households, the results reveal a consistent pattern: the top 5% to 10% of households drive the estimate, not only the top 1% of households. Thus, among households with alcohol purchases, an inverted U-shaped response is observed in relation to assortment increases.

Importantly, the results for all three alcohol subsegments highlight the definite health effects on average. Increases in purchases are not solely driven by low purchasers or the external margin. Instead, households with relatively high purchases further increase their purchases. For example, the largest effect of liquor purchases is observed among households in the 90th to 95th percentile. These households purchase, on average, 0.94 liters of liquor per household member per month. Even when disregarding complementarity with other alcohol types, potential unequal distribution within a household, or non-recorded restaurant purchases, this consumption level is on the border of safe consumption guidelines according to the CDC (Centers for Disease Control and Prevention, 2022*c*).

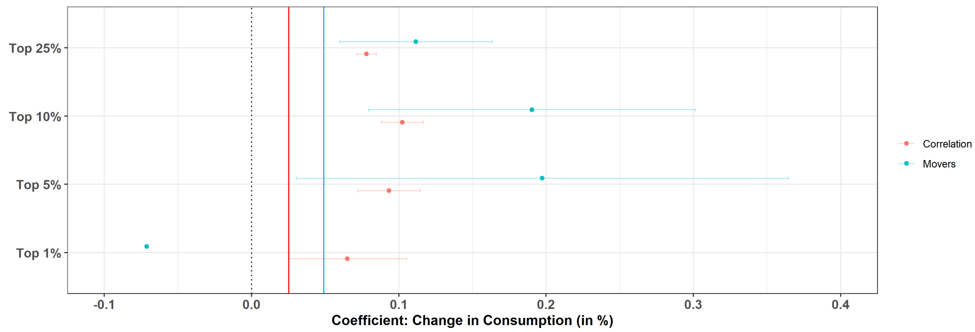
Overall, the distribution analysis emphasizes that the top 10% of purchasers primarily drive the effects of product variety on alcohol purchases. As these households are at high risk of binge drinking, product variety may impose aggregate health costs on society.

Demographics. In a secondary heterogeneity analysis, I present results contingent upon the demographics of households. Employing subsamples, Figure 10 illustrates the effects of product variety on liquor consumption for various demographic subgroups, using both the naive linear least square results and the identification based on movers.[13] Importantly, the power of some results based on movers is diminished due to the relatively small sample sizes. Nonetheless, a strong tendency across different subgroups is generally not observed. Distinct income groups exhibit highly similar results, and education does not exhibit a strong correlation with a heightened response to product variety. The only notable difference appears in a comparison of household composition, whereby single-male households demonstrate a more substantial response in purchases to

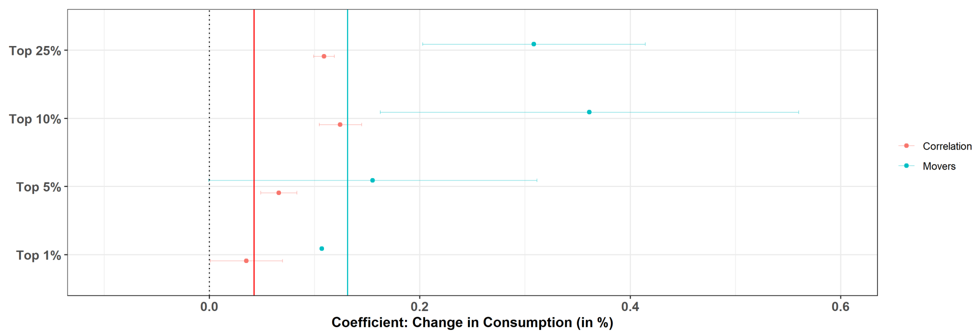
[12] In detail, I divide consumption by the number of household members. Consumption within a household is likely skewed. Moreover, the measure also includes children. Extended robustness analyses are provided in the Appendix, such as considering single-member households or making sophisticated assumptions about the number of children in a household.

[13] Results for beer and wine can be found in Appendix C.

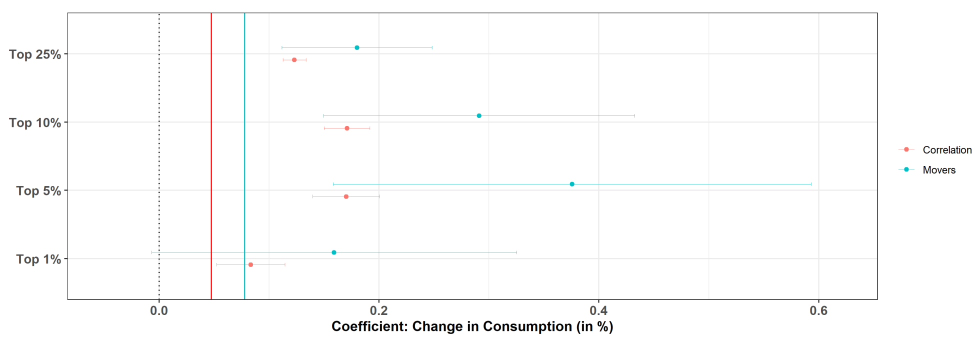
Figure 9: Impact of Product Variety on Household Purchases across Beverage Categories, Accounting for Heterogeneity in Aggregate Purchase Distribution.



(a) Impact on Beer Purchases



(b) Impact on Wine Purchases



(c) Impact on Liquor Purchases

Notes: This figure investigates the effects of product variety on purchases in three beverage categories: (a) beer, (b) wine, and (c) liquor. Heterogeneity in the distribution of aggregate purchases is taken into account, and each graph presents coefficients from both the regression equation (4) and the instrumental variable equation (5) that considers moving households. These coefficients represent the percentage effect of a 1% increase in product exposure on purchases within the corresponding category. The analysis covers household-level correlation and results obtained through identification using residence changes. The solid vertical red lines indicate the coefficient of $\hat{\beta}$ from column (4) of Table 1. Solid vertical blue lines denote the instrumental variable estimate of $\hat{\beta}$ of the full sample from column (6) of Table 4 (with Table C.1 and C.2 for other subcategories). Additional coefficients showcase results for subsamples, considering only households in the 75th, 90th, 95th, or 99th percentile of average monthly per-person purchases within a household. I use identical fixed effects as reported in the tables. Error bars represent the 95% confidence intervals. Considering subsegments of beer and wine, I exclude the confidence interval of the 99th percentile for visibility as they are very long. Standard errors are clustered at the household level and adjusted for within-cluster correlation.

increased product variety compared with single-female households.

6 Price Changes

In this section, I evaluate the impact of exogenous price changes on product assortment, guided by Lemma 2. I hypothesize that rising prices with constant markups may not only reduce consumption but also increase product assortment, which may in turn offset the effect of increased consumption.

Figure 5 demonstrates a substantial increase in product assortment within the liquor segment in Washington state, accompanied by a growth in liquor sales. This observation can be partially attributed to the liberalization of the liquor market in Washington. After the state permitted grocery stores to obtain licenses, an expansion in product assortment was recorded. Consequently, sales by grocery stores that had not previously sold liquor also increased. The relationship between assortment and sales is upwardly biased in a sample of grocery stores comprising some without a license before the 2012 reform.

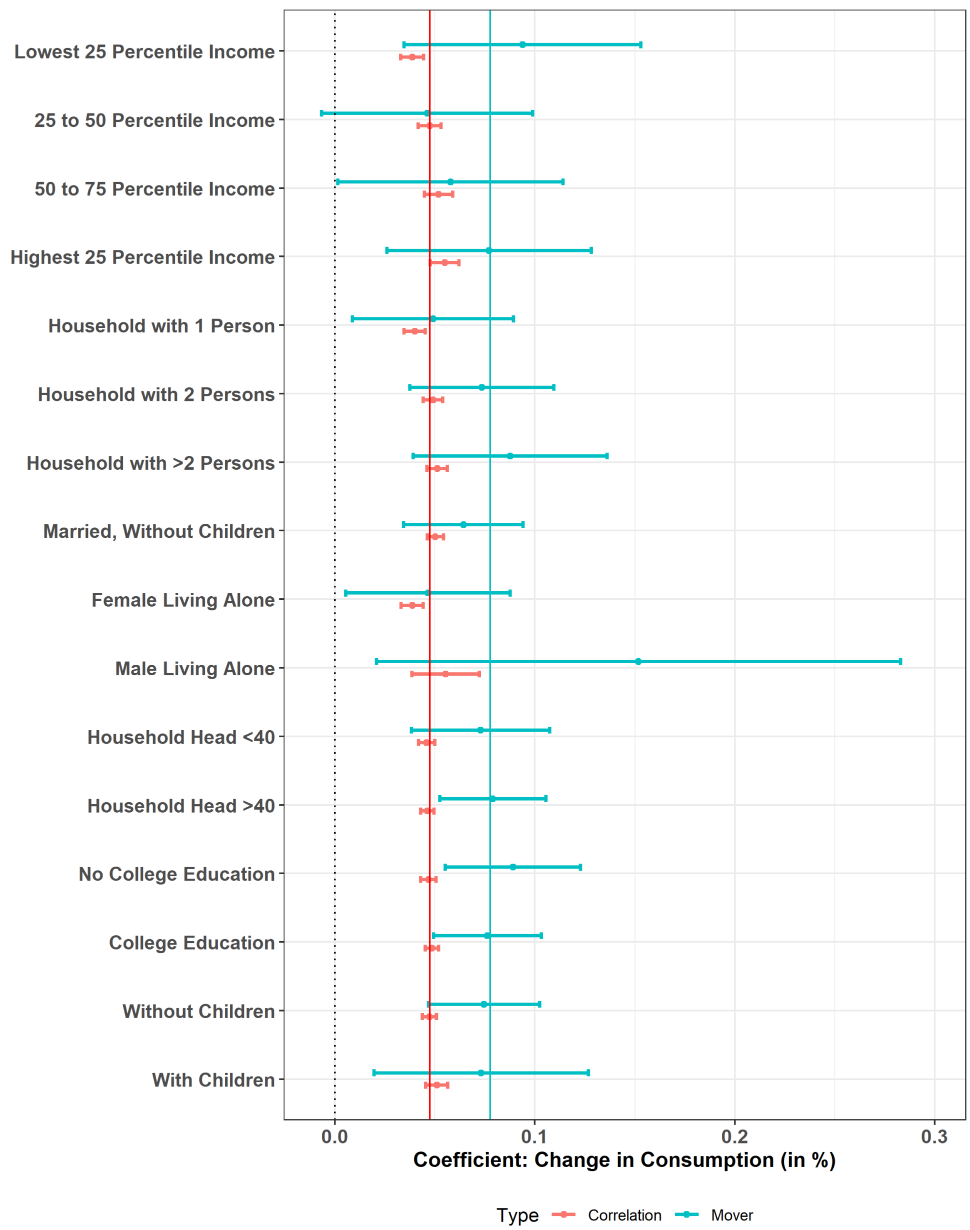
Nevertheless, the liberalization of the liquor market in Washington, along with the accompanying excise tax increase, provides additional opportunities for analysis. Studies by Illanes and Moshary (2020) and Yu et al. (2021) reveal that even stores with licenses prior to the liberalization significantly increased their assortments. While Illanes and Moshary (2020) investigate how the number of firms affects product prices and assortment, Yu et al. (2021) demonstrate that increased product assortment leads to reduced price sensitivity. I employ the proven increase in product assortment to assess if sales genuinely increase.

Beyond the deregulation of Washington's alcohol market, I examine the large and unanticipated excise change of liquor taxes in Illinois in 2009 to determine if price alterations through tax changes indeed enhance product variety and offset part of the negative consumption effect. Following the work of Gehrsitz et al. (2021), I investigate the Illinois excise tax changes, which reveal that a $1.00 price increase raises prices on average by .50 and reduces short-term consumption by approximately 3.5%. My primary focus is to address the question posed by Lemma 2: Does the increase in price have a second-order effect on consumption through greater product variety?

6.1 Store-Level Analysis

In the initial step to answer the question from Lemma 2, I show the relationship between each excise tax increase and prices, product assortment, and sales. For each of the two shocks, the deregulation of the liquor market in Washington and the excise tax increase in Illinois, I consider a sample of stores that sold liquor before 2012 and 2009, respectively, to ensure that I solely

Figure 10: Impact of Product Variety on Households' Liquor Purchases, Heterogeneity Analysis



Notes: This figure investigates the effects of product variety on purchases in the beverage category of liquor. Using subsamples dependent on demographics, the figure shows coefficients from both the regression equation (4) and the instrumental variable equation (5) that considers moving households. These coefficients represent the percentage effect of a 1% increase in product exposure on purchases within the corresponding category. The analysis covers household-level correlation and results obtained through identification using residence changes. The solid vertical red lines indicate the coefficient of $\hat{\beta}$ from column (4) of Table 1. Solid vertical blue lines denote the instrumental variable estimate of $\hat{\beta}$ of the full sample from column (6) of Table **??**. *I use identical fixed effects as reported in the tables. Error bars represent the 95% confidence intervals. For some subgroups, I exclude the confidence interval to increase visibility as they are very long. Standard errors are clustered at the household level and adjusted for within-cluster correlation.*

consider stores that already sold liquor before the shock.[14] Consider the following event study, which considers three outcome variables y_{st} of the store s in month t: (1) the number of liquor products, (2) the liters of liquor sold, and (3) the average price of a sold liter of liquor.

$$log(\mathbf{y}_{st}) = \alpha + \sum_{k=2019}^{k=2006} \beta \mathbf{I}(t) \cdot Treat_s + \gamma \mathbf{I}(t) + \rho_s (+\xi p_{st}) + \varepsilon_{st}, \tag{6}$$

where $\mathbf{I}(t)$ is a dummy variable for each year from 2006 to 2019, excluding the dummy for the year prior the shock due to multicollinearity. Further, $Treat_{st}$ is a treatment variable that takes the value of one if store s is located within a treatment state (i.e., Washington when considering the liquor deregulation or Illinois when considering the excise tax increase). Additionally, ρ_s represents store fixed effects, and when considering the outcome of sales, I control for weighted average prices of sales, p_{st}. Overall, the estimates of $\hat{\beta}$ show the yearly variation on the store level before and after each of the two shocks within a treatment state in comparison with the remaining untreated states.

Figure 11 shows the regression results for the deregulation in Washington, while Figure 12 presents the results of the excise tax increase in Illinois. For each figure, three panels present regression evidence for different outcome variables: Figures 11a and 12a consider the number of liquor products available within a store, Figures 11b and 12b show results for the sales of liquor, and Figures 11c and 12c present effects on the weighted average price of the sold liquor products. Each coefficient corresponds to the year-specific effect within a treatment state compared with a control state to control for store-fixed effects.

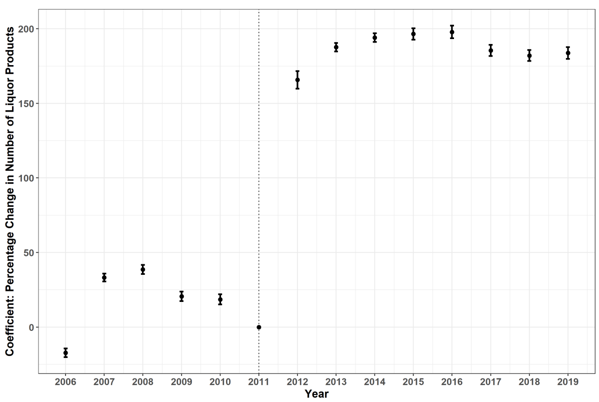
With regard to the liquor deregulation in Washington, the regulation resulted in a strong increase in the number of products following the deregulation. The coefficients show a strong and sudden increase in products in 2012, the year of the liquor market liberalization. The results may be rationalized with the reasoning in existing literature (e.g., Illanes and Moshary, 2020) that argues that the availability of wholesalers and competitive power led to increased assortment pressure. For the aggregate sales at the store level, we see a decrease prior to the deregulation followed by an increase. Finally, prices increase drastically with the deregulation as it also came with a price increase.

In comparison with the deregulation in Washington, the excise tax hike in Illinois has an immediate positive effect on prices and a negative effect on sales, but a delayed and positive effect on the number of products. Further, the delayed increase in the number of products aligns with an increase in sales. Overall, the policy changes show similar behavior in different time horizons. The deregulation as well as the excise tax indeed increases the product assortment, and this increase in product assortment may further affect sales positively.

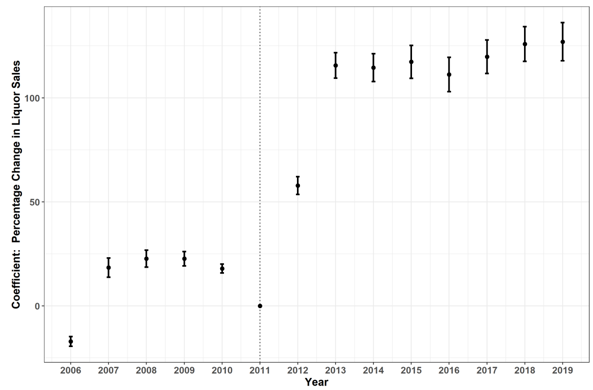
[14] In detail, I only consider stores that had more than 100 different liquors in stock before new licenses came on the market.

Figure 11: Event Study, Liquor Deregulation in Washington

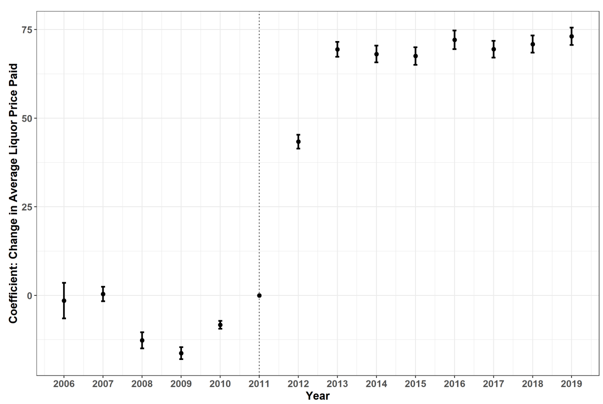
(a) Number of Products



(b) Sales



(c) Prices



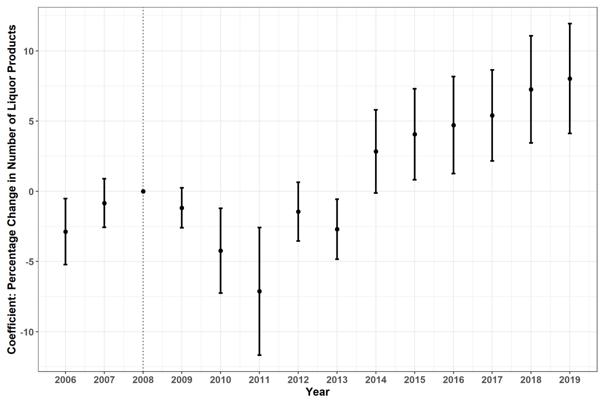
Notes: Results of the event study in equation (6) at the store level. Each regression solely includes stores that sold liquor products prior to the deregulation in 2012. The graphs show the coefficients $\hat{\beta}_d \times 100$*, the yearly variation of three outcome variables in percentage in Washington in comparison with the remaining states. The three graphs correspond to three different outcome variables: the number of liquor products available, the sales, and the weighted average price of liquor sales. Each regression includes store fixed effects, and when considering the outcome of sales, I control for weighted average prices of sales,* p_{st}*. The reference level is the year 2011, the year prior to the deregulation of liquor in Washington. The error bars represent 95% confidence intervals. Standard errors are clustered at the store level and adjusted for within-cluster correlation.*

To generalize the result, I use an instrumental variable approach to evaluate the effect of the two policy changes on store-level sales. Consider a model similar to the one in equation (3) when only considering the outcome of liquor sales of store s in month t:

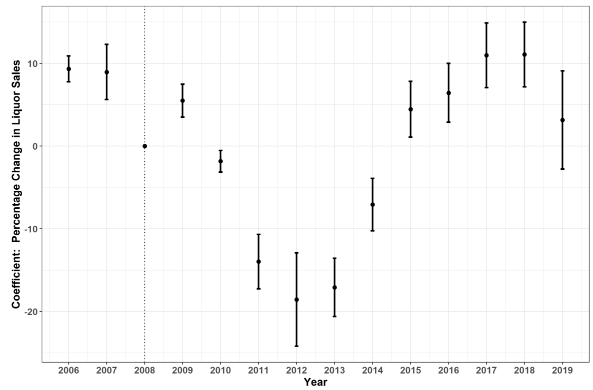
$$y_{st} = \alpha + \beta Num_{st} + \rho_s + \mu_t + \xi p_{st} + \varepsilon_{st}, \tag{7}$$

Figure 12: Event Study, Excise Tax Increase for Liquor

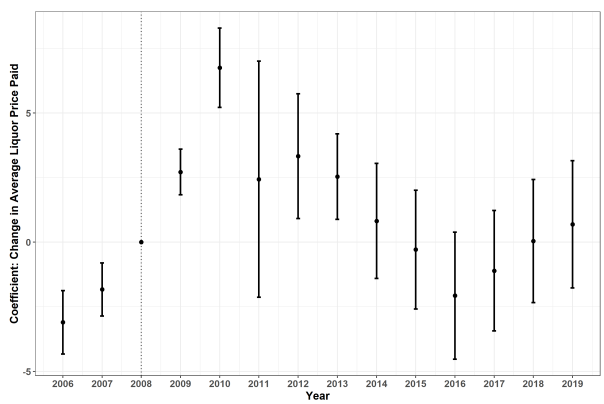
(a) Number of Products



(b) Sales



(c) Prices



Notes: Note: Results of the event study in equation (6) at the store level. Each regression solely includes stores that sold liquor products prior to the excise increase in 2009. The Figures show the coefficients $\hat{\beta}_d \times 100$, the yearly variation of three outcome variables in percentage in Illinois in comparison with the remaining states. The three graphs correspond to three different outcome variables: the number of liquor products available, the sales, and the weighted average price of liquor sales. Each regression includes store fixed effects, and when considering the outcome of sales, I control for weighted average prices of sales, p_{st}. The reference level is the year 2008, the year prior to the deregulation of liquor in Illinois. The error bars represent 95% confidence intervals. Standard errors are clustered at the store level and adjusted for within-cluster correlation.

where $\mathbf{y}_{st}$ is the sales of liquor within a store s in month t. Num_{st} is the product assortment within a store's liquor category, and ρ_s and μ_t are store and month fixed effects. Further, p_{st} represents the weighted average price of sold liquor products. In the following approach, I use the liberalization of the Washington liquor market and the Illinois excise tax increase as potential exogenous variations on the assortment to evaluate the effect on consumption. Consider an instrument Z_{st}. When I consider the liquor store liberalization, Z_{st} takes the value of one *after* the liberalization for stores with a liquor license in Washington before the liberalization in August 2012. Therefore, the treatment group is only the stores that sold liquor before the liberalization. When I use the excise tax increase in Illinois, Z_{st} takes the value of one for stores in Illinois after September 2009.

Instrumenting Num_{st} with Z_{st} evaluates the impact of the increase in assortment on the store level that correlates with periods after the liberalization. At the same time, the remaining states serve as control states. The exclusion restriction of the approach is that the deregulation and the excise tax increase do not affect the consumption of liquor products through channels other than the number of products. The exclusion restriction in the case of deregulation in Washington may be violated. For example, the deregulation could have affected the general perception of liquor and therefore increased consumption. However, the identification strategy offers further evidence on the potential effects of product assortment on consumption through the lens of liberalization and a tax hike, two policies that increased prices for consumers.

I show the results of the instrumental variable regression in Table 5. In the upper panel of Table 5, I show the result of the first stage. The outcome variable is the logarithm of the number of liquor products in a store. The instrument is a dummy that takes the value of one if a store lies within a treatment state after the policy change. I limit the control states to comparable neighboring states in models 3 and 7.[15] Further, in models 3 and 8, I delay the treatment time by two and a half years to allow for delayed treatment effects. Considering the first stage of the deregulation in Washington, the instrument is strong through all models. For the excise tax, the model is only sufficiently strong when a delayed treatment effect is considered. This result is consistent with the graphical evidence shown in Figure 12a.

In the lower panel of Table 5, I show results for the second stage, the impact of the number of products in the liquor category on consumption. Results are consistent, positive, and significant. The coefficients are slightly higher when estimates are compared with the linear least square results in Table 2. For example, model (2) indicates that owing to the deregulation in Washington, a 1% increase in liquor products increases the consumption of liquor products by 0.309%. Overall, the analysis of the reforms shows similar results to the general correlation analysis: An increase in products is related to more consumption at the store level.

6.2 Household-Level Analysis

Finally, I apply the same instrumental variable strategy as in equation (6) at the household level to investigate liquor purchases. The instrument Z_{it} is assigned a value of one if a household is located in a treatment state following the policy change. For the deregulation of liquor sales in Washington, the treatment state is Washington, and the treatment period begins in August 2012.

[15] For Washington, I follow Gehrsitz et al. (2021) and use Oregon as the only control state, while I use Wisconsin as the control state for Illinois.

Table 5: Impact of Excise Taxes on Aggregate Purchases through Increased Product Variety: Instrumental Variable Regression Analysis

First Stage

Outcome Variable: Number of Liquor Products

	Deregulation in Washington				Excise Tax Increase in Illinois			
	All	All	Control: Neighbors	Delay	All	All	Control: Neighbors	Delay
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Z_{st}	0.297***	1.010***	1.451***	0.704***	0.216***	−0.029**	0.459*	0.081***
	(0.014)	(0.037)	(0.123)	(0.028)	(0.031)	(0.013)	(0.258)	(0.012)
Constant	6.135***				6.093***			
	(0.009)				(0.009)			
Store FE	No	Yes	Yes	Yes	No	Yes	Yes	Yes
Month FE	No	Yes	Yes	Yes	No	Yes	Yes	Yes
Price Controls	No	Yes	Yes	Yes	No	Yes	Yes	Yes
F-statistics	216	3275.6	3838.5	1768.3	24	145	3.1	149
N	789,381	789,381	16,279	789,381	687,225	687,225	44,794	687,225
R^2	0.001	0.905	0.926	0.902	0.005	0.884	0.871	0.884

Second Stage

Outcome Variable: log(Liquor Sales)

	Deregulation in Washington				Excise Tax Increase in Illinois			
	All	All	Control: Neighbors	Delay	All	All	Control: Neighbors	Delay
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$log(N+0.5)$	1.200***	0.309***	0.682***	0.332***	1.752***	3.263***	0.985***	0.436**
	(0.150)	(0.058)	(0.051)	(0.067)	(0.130)	(1.106)	(0.350)	(0.177)
Constant	−0.484				−3.849***			
	(0.922)				(0.794)			
Store FE	No	Yes	Yes	Yes	No	Yes	Yes	Yes
Month FE	No	Yes	Yes	Yes	No	Yes	Yes	Yes
Price Controls	No	Yes	Yes	Yes	No	Yes	Yes	Yes
N	789,381	789,381	16,279	789,381	687,225	687,225	44,794	687,225
R^2	0.530	0.891	0.906	0.893	0.182	0.520	0.917	0.892

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Notes: This table presents regression results for equation 7, with each observation representing a store within a month. The first panel displays the first-stage results, where the outcome variable is $log(N+0.5)$, representing the number of liquor products in a store. The instrument Z_{st} is a dummy variable equal to one if a store is located in a treatment state following the policy change. Models 1-3 consider Washington as the treatment state, with treatment beginning in August 2012, while models 5-7 examine Illinois as the treatment state, with treatment starting in September 2009. Models 3 and 8 incorporate a 2.5-year treatment delay. Additionally, the samples in models 3 and 7 are limited to treatment and a comparable neighboring state, using Oregon as a control state in model 3 and Wisconsin in model 7. The second panel of the table shows the second stage of the instrumental variable approach, with the outcome variable being the logarithm of sales in the liquor category. To avoid zero sales, 0.1 liters are added to each outcome. In the log-log specification, a one percent change in the number of available products results in a $\hat{\beta}$ percent increase in sales. Store FE and Month FE indicate the inclusion of store and month fixed effects, while Price Controls signify if the model accounts for the weighted average price of sales within a category. Standard errors are clustered at the store level, adjusted for within-cluster correlation, and reported in parentheses.

When I employ the instrument for the excise tax hike in Illinois, the instrument variable value is one if a household resides in Illinois after September 2009. Similar to the store-level regression, instrumenting product exposure with Z_{ist} assesses the impact of the increased assortment at the individual level, corresponding to the periods after liberalization. Untreated households concurrently serve as controls.

The results of the instrumental variable regression are presented in Table 6. The upper panel displays the first-stage results, while the lower panel reveals the second-stage outcomes. When the deregulation and tax increase in Washington are examined, the estimates exhibit growth. The instrument significantly influences product exposure, leading to increased purchases by households and attracting new consumers. The point estimate of product exposure rises to 0.237.

For the Illinois tax increase, the findings are more varied. As observed in the aggregate analysis in section 6.1, the impact on product variety is not immediate but delayed. Owing to this delay, the first-stage results are insignificant and weak, except when treatment is delayed. Consequently, the second-stage outcomes for non-delayed treatment may be unreliable. Upon incorporating the treatment delay in the IV regression, the excise tax increase in Illinois demonstrates more robust effects, with a point estimate of 0.7. However, the results are less definitive due to the weaker instrument.

7 Conclusion

This paper explores the relationship between product assortment and alcohol consumption in the United States. It finds that higher product variety in retail settings increases purchases, which may help to explain the gradual increase in alcohol consumption over the past two decades. The decrease in alcohol consumption during the 1980s and 1990s could be attributed to increased health awareness about the risks of alcohol, but this decrease also led to firms and retailers customizing their product portfolios to appeal to different types of consumers and thus increase their sales. This customization offsets the negative effect of health awareness on consumption, similar to the impact of taxes.

This paper provides evidence that higher excise taxes increase product variety, which in turn increases consumption. Policymakers looking to reduce alcohol consumption could consider using entry regulations, such as licensing requirements for new alcohol products, in conjunction with tax increases or public health awareness campaigns.

Table 6: Impact of Excise Taxes on Household Purchases through Increased Product Variety: Instrumental Variable Regression Analysis

	First Stage									
	Outcome Variable: Number of Liquor Products									
	Deregulation in Washington					Excise Tax Increase in Illinois				
	All	All	Control: Neighbors	Delay	I(Liquor>0)	All	All	Control: Neighbors	Delay	I(Liquor>0)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Z_{it}	2.257***	1.557***	1.672***	0.844***	1.557***	1.718***	-0.020	-0.189**	0.122***	-0.020
	(0.012)	(0.024)	(0.043)	(0.027)	(0.024)	(0.018)	(0.028)	(0.080)	(0.031)	(0.028)
Constant	4.236***					4.207***				
	(0.007)					(0.007)				
Household FE	No	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
County × Year-Month FE	No	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
Price Controls	No	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
Household Controls	No	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
F-Statistic	97,666	95,996	26,345	12,626	475,411	133,990	7	59	334	1,105
N	6,445,788	6,047,883	274,675	6,047,883	6,047,883	6,445,788	6,047,883	426,353	6,047,883	6,047,883
R^2	0.015	0.809	0.804	0.808	0.809	0.020	0.807	0.591	0.807	0.807

	Second Stage									
	Outcome Variable: log(Liquor)									
	Deregulation in Washington					Excise Tax Increase in Illinois				
	All	All	Control: Neighbors	Delay	I(Liquor>0)	All	All	Control: Neighbors	Delay	I(Liquor>0)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
$log(Exposure+0.5)$	0.193***	0.184***	0.202***	0.237***	0.024***	0.164***	-0.068	-1.067	0.700*	0.006
	(0.026)	(0.027)	(0.062)	(0.061)	(0.003)	(0.021)	(2.186)	(0.723)	(0.375)	(0.017)
Constant	-9.132***					-9.009***				
	(0.111)					(0.091)				
Household FE	No	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
County × Year-Month FE	No	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
Price Controls	No	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
Household Controls	No	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
N	6,445,788	6,047,883	274,675	6,047,883	6,047,883	6,445,788	6,047,883	426,353	6,047,883	6,047,883
R^2	0.001	0.018	0.386	0.390	0.364	0.004	0.393	0.290	0.351	0.365

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Notes: This table presents instrumental variable regression analysis examining the impact of excise taxes on alcohol consumption through increased product variety. Each observation represents a household within a specific month. The upper panel displays first-stage results, with the instrument being a dummy variable equal to one for households in treatment states post-policy change. The lower panel presents second-stage results, where the outcome variable is the logarithm sales of liquor products and an indicator variable equal to one if a household purchases any liquor in a given month. Models 1-5 report IV regression results for the Washington deregulation and excise tax increases, while models 6-10 use the Illinois excise tax increase as the instrument. Treatment begins in August 2012 for Washington and September 2009 for Illinois. In models 3 and 8, the sample is limited to treatment and a neighboring state (Oregon for Washington treatment, Wisconsin for Illinois treatment). Models 4 and 9 incorporate a 2.5-year treatment delay. Models 5 and 10 focus on the external margin, with the outcome being an indicator variable equal to one if a household purchases any liquor product within the month. To avoid zero sales, the outcome variable is transformed with $log(Liquor+0.000083)$. $log(Exposure+0.5)$ *represents the number of liquor products a household is exposed to in a month. In the log-log specification, a one percent change in the number of products leads to a* $\hat{\beta}$ *percent increase in liquor purchases. Household FE, Month FE, and County × Month FE indicate the inclusion of household, month, county-month, or household-county fixed effects. Household Controls signifies if the model accounts for time-varying household characteristics such as income, size, composition, occupation, employment status, education, age, marital status, presence and age of children, and race. F-Statistics First Stage refers to the first-stage F-statistics in the IV approach. Standard errors are clustered at the household level, adjusted for within-cluster correlation, and reported in parentheses.*

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Online Appendix

A Proofs

A.1 Lemma 1

I proof Lemma 1 in four steps:

1. I show that $x_1 = 0.5$ is always an equilibrium for single product firms.

2. I show that $x_1 = 0.25$ and $x_2 = 0.75$ is always an equilibrium for a two-product firm.

3. I show that aggregate consumption from the single product to the two-product firm always increases.

4. I show that for sufficiently high health costs or prices, new consumer starts consuming with more firms.

Before proving Lemma 1, we solve the optimal-positioning problem for n products in a Hotelling model using induction. Let $q_j^* = \frac{1-(h_j+p_j)-|x_j-x|}{2b}$ denote the quantity of good x_j consumed by consumer $x \in [k_1, k_2]$ with $(h_j + p_j) \in [0,1]$ denoting the sum of health cost and price. In the following proof, we assume homogenous costs across products, $h_j + p_j = h + p$. We begin by solving the problem for 1 product and then generalising to n products.

Single product

In the case of a single product, the problem of the firm is:

$$\max_{x_1} D(x_1) = \int_{k_1}^{k_2} \left[\frac{1-(h+p)-|x_1-x|}{2b} \right]^+ dx$$

There are two sources of discontinuities in the function, the nonnegativity constraint and the absolute value operator.

We address the nonnegativity constraint by identifying the domain of values of x over which the integrand is nonnegative:

$$\frac{1-(h+p)-|x_1-x|}{2b} \geq 0$$

Considering the two cases separately where $x_1 > x$ and $x > x_1$

$$\implies \underbrace{x_1 - (1-(h+p))}_{x_1^*} \leq x \leq \underbrace{x_1 + (1-(h+p))}_{x_2^*}$$

However, $[x_1^*, x_2^*]$ only apply in place of the respective limits of integration $[k_1, k_2]$ when $x_1^* > k_1$ or $x_2^* < k_2$.

		Lower limit	Upper limit
$x_1^* \leq k_1$	$x_2^* \geq k_2$	k_1	k_2
$x_1^* \leq k_1$	$x_2^* < k_2$	k_1	x_2^*
$x_1^* > k_1$	$x_2^* \geq k_2$	x_1^*	k_2
$x_1^* > k_1$	$x_2^* < k_2$	x_1^*	x_2^*

Table A.1: Summary of the limits of integration

Hence, $D(x_1) = \dfrac{1}{2b}\displaystyle\int_{k_1}^{k_2} [1-(h+p)-|x_1-x|]^+ \, dx$ is a piecewise function where the conditions on the limits of the integral are summarised in Table A.1. Integrating the function with respect to the given limits

$$D(x_1) = \begin{cases} \dfrac{1}{2b}\left[(1-(h+p))(k_2-k_1) - \left(x_1^2 + \dfrac{1}{2}(k_1^2+k_2^2) - x_1(k_1+k_2)\right)\right] & \text{if } (x_1^* \leq k_1) \wedge (x_2^* \geq k_2) \\ \dfrac{1}{2b}\left[(1-(h+p))(x_2^*-k_1) - \left(x_1^2 + \dfrac{1}{2}(k_1^2+(x_2^*)^2) - x_1(k_1+x_2^*)\right)\right] & \text{if } (x_1^* \leq k_1) \wedge (x_2^* < k_2) \\ \dfrac{1}{2b}\left[(1-(h+p))(k_2-x_1^*) - \left(x_1^2 + \dfrac{1}{2}((x_1^*)^2+k_2^2) - x_1(x_1^*+k_2)\right)\right] & \text{if } (x_1^* > k_1) \wedge (x_2^* \geq k_2) \\ \dfrac{1}{2b}\left[(1-(h+p))(x_2^*-x_1^*) - \left(x_1^2 + \dfrac{1}{2}((x_1^*)^2+(x_2^*)^2) - x_1(x_1^*+x_2^*)\right)\right] & \text{if } (x_1^* > k_1) \wedge (x_2^* < k_2) \end{cases}$$

and then simplifying

$$D(x_1) = \begin{cases} \dfrac{1}{2b}\left[(1-(h+p))(k_2-k_1) - \left(x_1^2 + \dfrac{1}{2}(k_1^2+k_2^2) - x_1(k_1+k_2)\right)\right] & \text{if } k_2-(1-(h+p)) \leq x_1 \leq k_1+(1-(h+p)) \\ \dfrac{1}{2b}\left[\dfrac{1}{2}h^2 + h(k_1+p-x_1) + \dfrac{1}{2}(p^2-k_1^2-x_1^2) + k_1(p+x_1) + x_1(1-p) - (h+k_1+p) + \dfrac{1}{2}\right] & \text{if } k_1 \leq x_1 < \min[k_1+(1-(h+p)), k_2-(1-(h+p))] \\ \dfrac{1}{2b}\left[\dfrac{1}{2}h^2 + h(x_1+p-k_2) + \dfrac{1}{2}(p^2-k_2^2-x_1^2) + k_2(x_1-p) - x_1(1-p) + (k_2-h-p) + \dfrac{1}{2}\right] & \text{if } \max[k_1+(1-(h+p)), k_2-(1-(h+p))] < x_1 \leq k_2 \\ \dfrac{1}{2b}[1-(h+p)]^2 & \text{if } k_1+(1-(h+p)) \leq x_1 \leq k_2-(1-(h+p)) \end{cases}$$

The first case in the piecewise function is only applicable when $k_2 - k_1 \leq 1$. The last case is conversely applicable when $k_2 - k_1 > 1$. The min and max operators are used to define the boundary curves accordingly. We can now use the first-order condition to find the function's extrema.

$$D'(x_1) = \begin{cases} \dfrac{1}{2b}[-2x_1+k_1+k_2] & \text{if } k_2-(1-(h+p)) \leq x_1 \leq k_1+(1-(h+p)) \\ \dfrac{1}{2b}[k_1+1-(h+p)-x_1] & \text{if } k_1 \leq x_1 < \min[k_1+(1-(h+p)), k_2-(1-(h+p))] \\ \dfrac{1}{2b}[k_2-(1-(h+p))-x_1] & \text{if } \max[k_1+(1-(h+p)), k_2-(1-(h+p))] < x_1 \leq k_2 \\ 0 & \text{if } k_1+(1-(h+p)) \leq x_1 \leq k_2-(1-(h+p)) \end{cases}$$

If $k_2 - k_1 > 1$, from the bottom 3 cases we can devise that $x^{OPT} \in \underbrace{[k_1+1-(h+p), k_2-(1-(h+p))]}_{D^*}$

is a set of extrema of the function with a common demand $D(x^{OPT})$. If $k_2 - k_1 \leq 1$, case 1 from the top yields $x^{OPT} = \frac{k_1+k_2}{2}$ while cases 2 and 3 from the top yield inadmissible extrema for the domain on which x is defined in those cases. We note that $\frac{k_1+1-(h+p)+k_2-(1-(h+p))}{2} = \frac{k_1+k_2}{2} \in D^*$. Using the second-order condition, it is evident that D* contains all the maxima of the demand function.

$$D''(x_1) = \begin{cases} \frac{1}{2b}[k_1+k_2-2] & \text{if } k_2-(1-(h+p)) \leq x_1 \leq k_1+(1-(h+p)) \\ \frac{1}{2b}[k_1+1-(h+p)] & \text{if } k_1 \leq x_1 < \min[k_1+(1-(h+p)), k_2-(1-(h+p))] \\ \frac{1}{2b}[k_2-(1-(h+p))] & \text{if } \max[k_1+(1-(h+p)), k_2-(1-(h+p))] < x_1 \leq k_2 \\ 0 & \text{if } k_1+(1-(h+p)) \leq x_1 \leq k_2-(1-(h+p)) \end{cases}$$

Therefore, independent of k_1, k_2, h and $p, x^{OPT} = \frac{k_1+k_2}{2}$ is a solution to the problem of the firm. In other words, the middle point of the domain $[k_1, k_2]$ is always an optimal for a single-product Hotelling problem.

Two products

In the case of two products, the firm's problem can be represented as the following.

$$\max_{x_2,x_2} D(x_1,x_2) = \begin{cases} \int_{k_1}^{\frac{x_1+x_2}{2}} \left[\frac{1-(h+p)-|x_1-x|}{2b}\right]^+ dx & \text{for } k_1 \leq x < \frac{x_1+x_2}{2} \\ \int_{\frac{x_1+x_2}{2}}^{k_2} \left[\frac{1-(h+p)-|x_2-x|}{2b}\right]^+ dx & \text{for } \frac{x_1+x_2}{2} \leq x \leq k_2 \end{cases}$$

The 2 product problem can be viewed as a single product optimisation problem with a constrained domain. In other words, the optimal set of both x_1 and x_2 will contain the middle-point of their respective domains. Hence, we can solve for x_1^{OPT}, x_2^{OPT} simultaneously where

$$x_1^{OPT} = \frac{k_1 + \frac{x_1+x_2}{2}}{2} = \frac{3}{4}k_1 + \frac{1}{4}k_2$$
$$x_2^{OPT} = \frac{\frac{x_1+x_2}{2} + k_2}{2} = \frac{1}{4}k_1 + \frac{3}{4}k_2$$

We can also show that the boundary between the two products is the same as the middle point of the unrestricted domain.

$$\frac{x_1^{OPT} + x_2^{OPT}}{2} = \frac{k_1+k_2}{2}$$

This yields the Cournot equilibrium between 2 firms which compete over positioning of their singular products. Successive positioning choices between the firms to reach their individual optimal positions given their competitor's positioning choice will yield the stable, symmetric equilibrium derived above.

N products

In the case where the firm has $j+1$ products. The problem of the firm becomes:

$$\max_{x_i, i\in[1,j+1]} D(x_i) = \begin{cases} \int_{k_1}^{\frac{x_1+x_2}{2}} \left[\frac{1-(h+p)-|x_1-x|}{2b}\right]^+ dx & \text{for } k_1 \leq x < \frac{x_1+x_2}{2} \\ \int_{\frac{x_1+x_2}{2}}^{\frac{x_2+x_3}{2}} \left[\frac{1-(h+p)-|x_2-x|}{2b}\right]^+ dx & \text{for } \frac{x_1+x_2}{2} \leq x < \frac{x_2+x_3}{2} \\ \vdots \\ \int_{\frac{x_{j-1}+x_j}{2}}^{\frac{x_j+x_{j+1}}{2}} \left[\frac{1-(h+p)-|x_j-x|}{2b}\right]^+ dx & \text{for } \frac{x_{j-1}+x_j}{2} \leq x < \frac{x_j+x_{j+1}}{2} \\ \int_{\frac{x_j+x_{j+1}}{2}}^{k_2} \left[\frac{1-(h+p)-|x_{j+1}-x|}{2b}\right]^+ dx & \text{for } \frac{x_j+x_{j+1}}{2} \leq x \leq k_2 \end{cases}$$

Assume that the firm has already optimised the positioning of $j-1$ products. The firm now only has to choose the position of the $j+1$ product i.e. the problem transforms into a two product optimisation problem with a variable lower bound.

$$\max_{x_j, x_{j+1}} D = \begin{cases} \int_{\frac{x_{j-1}+x_j}{2}}^{\frac{x_j+x_{j+1}}{2}} \left[\frac{1-(h+p)-|x_j-x|}{2b}\right]^+ dx & \text{for } \frac{x_{j-1}+x_j}{2} \leq x < \frac{x_j+x_{j+1}}{2} \\ \int_{\frac{x_j+x_{j+1}}{2}}^{k_2} \left[\frac{1-(h+p)-|x_{j+1}-x|}{2b}\right]^+ dx & \text{for } \frac{x_j+x_{j+1}}{2} \leq x \leq k_2 \end{cases}$$

Therefore, the optimal sets of positions for all n products include the respective midpoints over $\frac{1}{n}$ constrained domains. We can utilise the symmetry of the problem due to homogenous health costs and price to derive a general solution for the optimal position of product x_j in an n product problem. From here, we set $k_1 = 0$ and $k_2 = 1$ to simplify the algebra.

$$\begin{aligned} x_j^{OPT} &= \frac{1}{2n} + \frac{j-1}{n}, \forall x_j^{OPT} \in \{x_j\}_{j=1}^n \\ &= \frac{2j-1}{2n} \end{aligned}$$

Given $x = x_j, q(x, x_j) = \frac{1-(h+p)}{2b} (\forall x_j)$ and the general formula for the optimal position of product x_j, we can derive demand as a function of n assuming all products are optimally positioned. Since there is a nonnegativity constraint on demand, demand as a function of n is also piecewise with a split at $n = \frac{1}{2(1-h-p)}$.

$$\because q\left(x=0, x_1^{OPT} = \frac{1}{2n}\right) = \frac{1-h-p-\frac{1}{2n}}{2b}$$

is the y-intercept of $q^*(x, x_1)$. Setting it to zero

$$\frac{1-h-p-\frac{1}{2n}}{2b} = 0$$
$$\implies n = \frac{1}{2(1-h-p)}$$

Now we use the geometric symmetry of the problem to derive demand as a function of n.

Given $0 \leq n < \frac{1}{2(1-h-p)}$, we can first find the x-intercepts where $q_j^*(n) = \frac{1-h-p-|\frac{2j-1}{2n}-x|}{2b} = 0$. Let x-intercept $x_j^1 < \frac{2j-1}{2n}$ and $x_j^2 > \frac{2j-1}{2n}$:

$$\frac{1-h-p-\frac{2j-1}{2n}+x_j^1}{2b} = 0$$
$$\implies x_j^1 = \frac{2j-1}{2n} + h + p - 1$$
$$\frac{1-h-p+\frac{2j-1}{2n}-x_j^2}{2b} = 0$$
$$\implies x_j^2 = 1-h-p+\frac{2j-1}{2n}$$
$$x_j^2 - x_j^1 = 2(1-h-p)$$

The demand is now just the sum of the area of n triangles formed by the optimally-positioned products.[1]

$$D_-(n) = \frac{1}{2} \cdot \frac{1-h-p}{2b} \sum_{j=1}^{n} 2(1-h-p)$$
$$= \frac{(1-h-p)^2}{2b} n$$

[1]Strictly speaking, all x_j such that $x_j^1 \geq x_{j-1}^2$ and $x_j^2 \leq x_{j+1}^1$ are optimal positions for product j since they do not reduce consumption of other products. However, the derived $x_j^{OPT} = \frac{2j-1}{2n}$ remains the optimal when $n \geq \frac{1}{2(1-h-p)}$. Hence, we only consider x_j^{OPT} as the optimal going forward for the sake of simplicity.

Given $\frac{1}{2(1-h-p)} < n$,

$$D_+(n) = \frac{1-h-p-\frac{1}{2n}}{2b} + \frac{1}{2}\left(\frac{1}{n} \cdot \frac{1-h-p-(1-h-p-\frac{1}{2n})}{2b} + \frac{2n-n}{n} \cdot \frac{1}{4nb} + \ldots + \frac{n-(n-1)}{n} \cdot \frac{1}{4nb}\right)$$

$$= \frac{1-h-p-\frac{1}{2n}}{2b} + \frac{1}{8nb}$$

In the function, the first term is the area of the rectangle $[(0,0),(1,0),(0,q(0,x_j^{OPT}))]$ and the second term is the area of the congruent triangles formed at the optimally-positioned products. We can simplify and rewrite the complete demand function as follows.

$$D(n) = \begin{cases} \frac{(1-h-p)^2}{2b} n & \text{for } 0 \leq n < \frac{1}{2(1-h-p)} \\ \frac{1-h-p}{2b} - \frac{1}{8nb} & \text{for } \frac{1}{2(1-h-p)} \leq n \end{cases}$$

The proof from Lemma 1 follows from $D'(n)$:

$$D'(n) = \begin{cases} \frac{(1-h-p)^2}{2b} & \text{for } 0 \leq n < \frac{1}{2(1-h-p)} \\ \frac{1}{8bn^2} & \text{for } \frac{1}{2(1-h-p)} \leq n \end{cases}$$

$D(n)$ is an increasing function in n over its entire domain. Hence, given products are optimally positioned, a higher number of products will always lead to an increase in consumption.

Proof of External Margin

We can also show that when $h+p$ is high, consumers which previously refrained from consumption can be captured by increasing product offering (n) without any decrease in demand for existing products. We provide two proofs. First, we show that the increase in demand from an increase in n in the high $h+p$ case equals the area of $\triangle[(x_{j+1}^1,0)(x_{j+1},q(x_{j+1},\frac{1-h-p}{2b})(x_{j+1}^2,0)]$ which represents the demand from previously refraining consumers. Second, we show that the consumption of other optimally positioned products remains unaffected.

$$
\begin{aligned}
\text{Area of } \triangle &= \frac{1}{2}(x^2_{j+1} - x^1_{j+1}) \cdot \frac{1-h-p}{2b} \\
&= \frac{1}{2} \cdot 2(1-h-p) \cdot \frac{1-h-p}{2b} \\
&= \frac{(1-h-p)^2}{2b} \\
&= D'(n) \text{ given } 1 - \frac{1}{2n} < h+p \leq 1
\end{aligned}
$$

Hence, given that n is sufficiently low or $h+p$ are sufficiently high, the increase in consumption from an increase in n is driven by consumers which previously refrained from consumption.

We can also strengthen this result by showing that in this case, an increase in n has no effect on the demand for other optimally-positioned products. Below we derive the demand function for an optimally-positioned product under the high $h+p$ and low n case.

$$
\begin{aligned}
F(x_j) &= \int_{x_j^1}^{x_j^2} \frac{1-h-p-|x-x_j|}{2b} dx \\
&= \frac{1}{2b}\left[(1-h-p)(x_j^2 - x_j^1) - \left(\int_{x_j^1}^{x_j} x_j - x dx + \int_{x_j}^{x_j^2} x - x_j dx\right)\right] \\
&= \frac{1}{2b}\left[2(1-h-p)^2 - \left(\left[x_j x - \frac{x^2}{2}\right]_{x_j^1}^{x_j} + \left[\frac{x^2}{2} - x_j x\right]_{x_j}^{x_j^2}\right)\right] \\
&= \frac{1}{2b}\left[2(1-h-p)^2 - \left((x_j)^2 - x_j(x_j^2 + x_j^1) + \frac{1}{2}\left((x_j^1)^2 + (x_j^2)^2\right)\right)\right] \\
&= \frac{(1-h-p)^2}{2b}
\end{aligned}
$$

We can note that the function is equivalent to the demand function in the one product case under the respective domain. It is easy to observe that $F'(n) = 0 \implies$ When health costs or prices are high, product diversification does not reduce consumption of existing products.

A.2 Lemma 2

We can define the profit function for a firm operating in such a market as $\pi(n) = D(n) - C_n(n)$ where $C_n(n) = \sum_{i=1}^{n} C_q(q_i)$ and q_i represents the total quantity consumed of good i. We assume that cost as a function of quantity consumed of a single product, $C_q(q)$ is increasing and concave in $q \implies C_q'(q) > 0$ and $C_q''(q) < 0$.

We assume all products have a homogenous cost function and restrict our attention to the case where all products are optimally positioned such that $(\forall i) q_i = q$ and $C_q(q_i) = C_q(q) \implies C_n(n) = nC_q(q)$. We can also derive $q(n)$ using $D(n)$ since we know that when optimally positioned, the quantity demanded for all n products is equal.

$$\implies q(n) = \begin{cases} \dfrac{(1-h-p)^2}{2b} & \text{for } 0 \leq n < \dfrac{1}{2(1-h-p)} \\ \dfrac{1-h-p}{2bn} - \dfrac{1}{8bn^2} & \text{for } \dfrac{1}{2(1-h-p)} \leq n \end{cases}$$

Substituting $q(n)$ into $C_n(n)$ and using the chain-rule

$$\begin{aligned} C_n(n) &= nC_q(q(n)) \\ \implies C_n'(n) &= C_q(q(n)) + nC_q'(q(n))q'(n) \end{aligned}$$

$$\implies C_n'(n) = \begin{cases} C_q(q(n)) & \text{for } 0 \leq n < \dfrac{1}{2(1-h-p)} \\ C_q(q(n)) - nC_q'(q(n))\left(\dfrac{1-h-p}{2bn^2} - \dfrac{1}{4bn^3}\right) & \text{for } \dfrac{1}{2(1-h-p)} \leq n \end{cases}$$

We can then define the incentive for the firm to increase product diversification by deriving the profit function w.r.t n.

$$\pi'(n) = D'(n) - C_n'(n)$$

We can now determine how incentive to increase product diversification: $\pi'(n)$ changes w.r.t $h+p$ by differentiating $\pi'(n)$ w.r.t $h+p$.

For $0 \leq n < \frac{1}{2(1-h-p)}$:

$$\begin{aligned} \frac{\partial}{\partial(h+p)}\pi'(n) &= -\frac{1-h-p}{b} + C_q'(q)\frac{1-h-p}{b} \\ &= \frac{1-h-p}{b}\left(C_q'(q) - 1\right) \end{aligned}$$

Here, $C_q'(q) \leq 1$. Otherwise, $C_n'(n) > D_n'(n) \implies$ the firm's marginal cost from increasing n exceeds its marginal revenue for a given quantity q sold across all its products. Hence, it would be incentivised to reduce n. In this situation, the firm would scale n until the quantity q of each product sold equals its cost of production $C_q(q)$. Therefore, in the case where health costs and prices are relatively high, increasing them further reduces the incentive to diversify products.

For $\frac{1}{2(1-h-p)} \leq n:$

$$\begin{aligned}\frac{\partial}{\partial(h+p)}\pi'(n) &= \frac{C_q'(q)}{2bn} + \left(-\frac{nC_q''(q)}{2bn}\left(\frac{1-h-p}{2bn^2} - \frac{1}{4bn^3}\right) - \frac{nC_q'(q)}{2bn^2}\right) \\ &= \frac{1}{2bn}\left(C_q'(q) - nC_q''(q)\left(\frac{1-h-p}{2bn^2} - \frac{1}{4bn^3}\right) - C_q'(q)\right) \\ &= -\frac{C_q''(q)}{2b}\left(\frac{1-h-p}{2bn^2} - \frac{1}{4bn^3}\right)\end{aligned}$$

In the case where n is high relative to health costs, $n \geq \frac{1}{2(1-h-p)} \implies \frac{1-h-p}{2bn^2} \geq \frac{1}{4bn^3}$. Since $C_q''(q) < 0$, an increase in health costs or prices causes the incentive to diversify product offering to rise.

B Model Extensions

C Additional Tables and Figures

Table C.1: Regression Evidence for Movers, Beer Purchases

	log(Beer)								I(Beer>0)	
	Full Sample						Only movers		Full Sample	
	OLS	IV	OLS	IV	OLS	IV	OLS	IV	OLS	IV
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
log(Exposure)	0.066***	0.029*	0.027***	0.050***	0.024***	0.037***	0.031***	0.035***	0.006***	0.009***
	(0.002)	(0.017)	(0.001)	(0.008)	(0.001)	(0.008)	(0.003)	(0.008)	(0.000)	(0.002)
Constant	-1.988***	-1.794***								
	(0.008)	(0.087)								
Household FE	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year-Month FE	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Origin Controls	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes
Household Controls	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
N	6,471,996	6,471,996	6,471,996	6,471,996	6,047,883	6,047,883	597,584	597,584	6,047,883	6,047,883
R^2	0.004	0.003	0.528	0.528	0.556	0.555	0.526	0.526	0.460	0.460
F-Statistic First Stage		75,487		186,731		168,617		206,735		168,617

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Notes: This table presents regression results for equation 5, with each observation representing a household within a month. The outcome variable is the logarithm of sales for beer products and an indicator variable equal to one if a household purchases any beer in a given month. The models alternate between OLS and instrumental variable regression. The instrument takes the value of the change in the exposure of products for moving households after the move in comparison to the average of the year before the move. Note that the instrument is zero for non-moving households and moving households before the move. Models 1-6 and 9-10 include the full sample, while models 7-8 only include households that moved during the sample period. To avoid zero sales, the outcome variable is transformed by adding half the minimum value of the sample beer purchases across observations with nonzero purchases, i.e., $log(beer + 0.1035072)$. $log(Exposure + 0.5)$ represents the number of beer products a household is exposed to in a month. In the log-log specification, a one percent change in the number of products leads to a $\hat{\beta}$ percent increase inbeer purchases. Household FE and Year-Month FE indicate the inclusion of household and year-month fixed effects. Origin Controls signify if the model includes the zip code-specific average purchases of liters of beer. Household Controls show if the model accounts for time-varying household characteristics such as income (income brackets), household size, composition (relation between household members), occupation of female and male household heads, employment status, education and age, marital status within a household, presence and age of children, and race. F-Statistics First Stage refers to the F-statistics of the first stage in the instrumental variable approach, where the instrument consistently has a significant positive coefficient. Standard errors are clustered at the household level, adjusted for within-cluster correlation, and reported in parentheses.

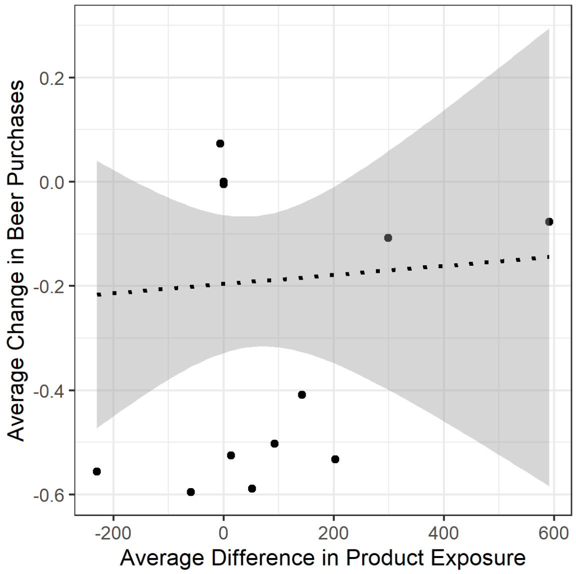
Table C.2: Regression Evidence for Movers, Wine Purchases

	log(Wine)								I(Wine>0)	
	Full Sample						Only movers		Full Sample	
	OLS	IV	OLS	IV	OLS	IV	OLS	IV	OLS	IV
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
log(Exposure)	0.099***	0.121***	0.047***	0.110***	0.041***	0.093***	0.061***	0.090***	0.006***	0.013***
	(0.002)	(0.026)	(0.002)	(0.011)	(0.001)	(0.011)	(0.005)	(0.011)	(0.000)	(0.001)
Constant	-5.901***	-6.018***								
	(0.011)	(0.136)								
Household FE	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year-Month FE	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Origin Controls	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes
Household Controls	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
N	6,471,996	6,471,996	6,471,996	6,471,996	6,047,883	6,047,883	597,584	597,584	6,047,883	6,047,883
R^2	0.010	0.010	0.472	0.472	0.499	0.499	0.492	0.492	0.438	0.438
F-Statistic First Stage		46,868		277,127		253,012		231,194		253,012

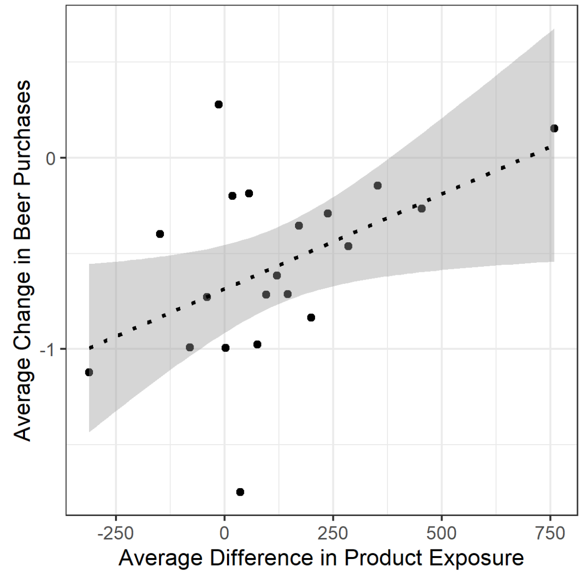
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Notes: This table presents regression results for equation 5, with each observation representing a household within a month. The outcome variable is the logarithm of sales of wine products and an indicator variable equal to one if a household purchases any wine in a given month. The models alternate between OLS and instrumental variable regression. The instrument takes the value of the change in the exposure of products for moving households after the move in comparison to the average of the year before the move. Note that the instrument is zero for non-moving households and moving households before the move. Models 1-6 and 9-10 include the full sample, while models 7-8 only include households that moved during the sample period. To avoid zero sales, the outcome variable is transformed by adding half the minimum value of the sample wine purchases across observations with nonzero purchases, i.e., $log(wine+0.0015)$. $log(Exposure+0.5)$ represents the number of wine products a household is exposed to in a month. In the log-log specification, a one percent change in the number of products leads to a $\hat{\beta}$ percent increase in wine purchases. Household FE and Year-Month FE indicate the inclusion of household and year-month fixed effects. Origin Controls signify if the model includes the zip code-specific average purchases of iters of wine. Household Controls show if the model accounts for time-varying household characteristics such as income (income brackets), household size, composition (relation between household members), occupation of female and male household heads, employment status, education and age, marital status within a household, presence and age of children, and race. F-Statistics First Stage refers to the F-statistics of the first stage in the instrumental variable approach, where the instrument consistently has a significant positive coefficient. Standard errors are clustered at the household level, adjusted for within-cluster correlation, and reported in parentheses.

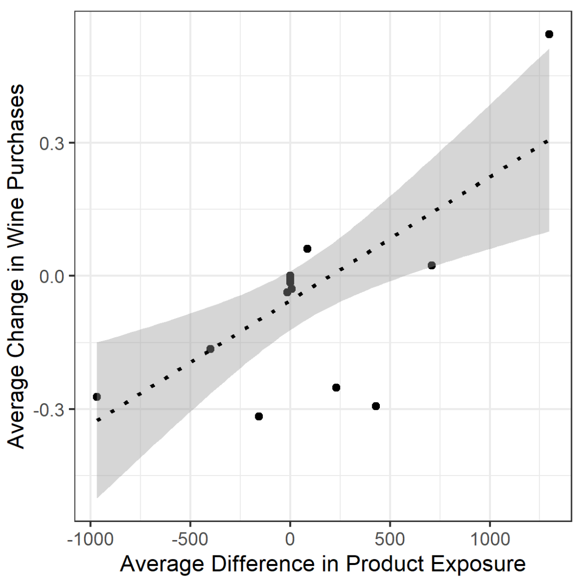
Figure C.1: Change in Beer and Wine Consumption by Difference in Product Exposure due to Movement



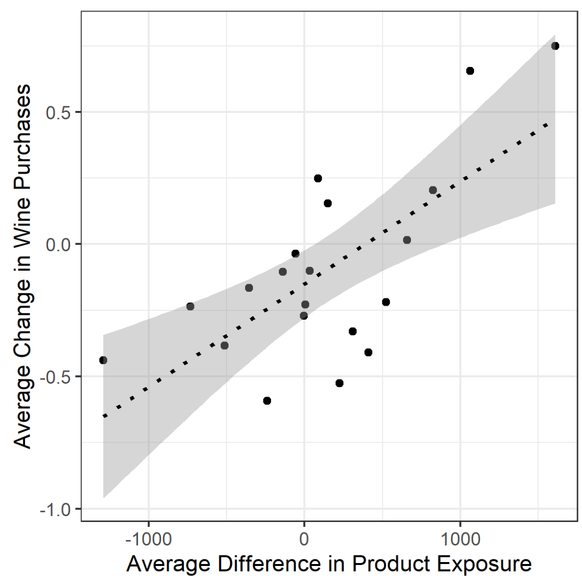
(a) Beer: Including Households Without Change in Product Exposure



(b) Beer: Excluding Households Without Change in Product Exposure or Liquor Con- sumption



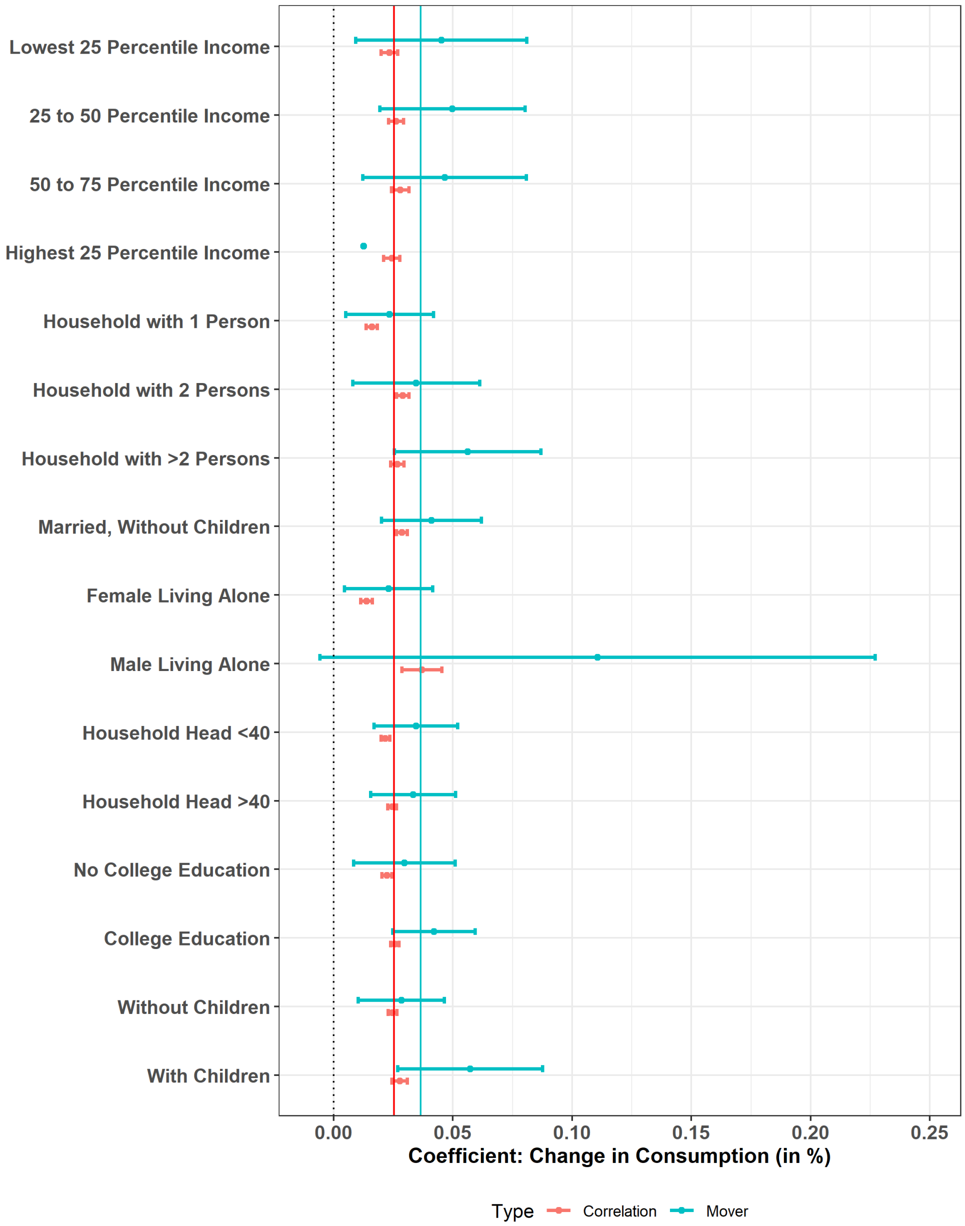
(c) Wine: Including Households Without Change in Product Exposure



(d) Wine: Excluding Households Without Change in Product Exposure or Liquor Con- sumption

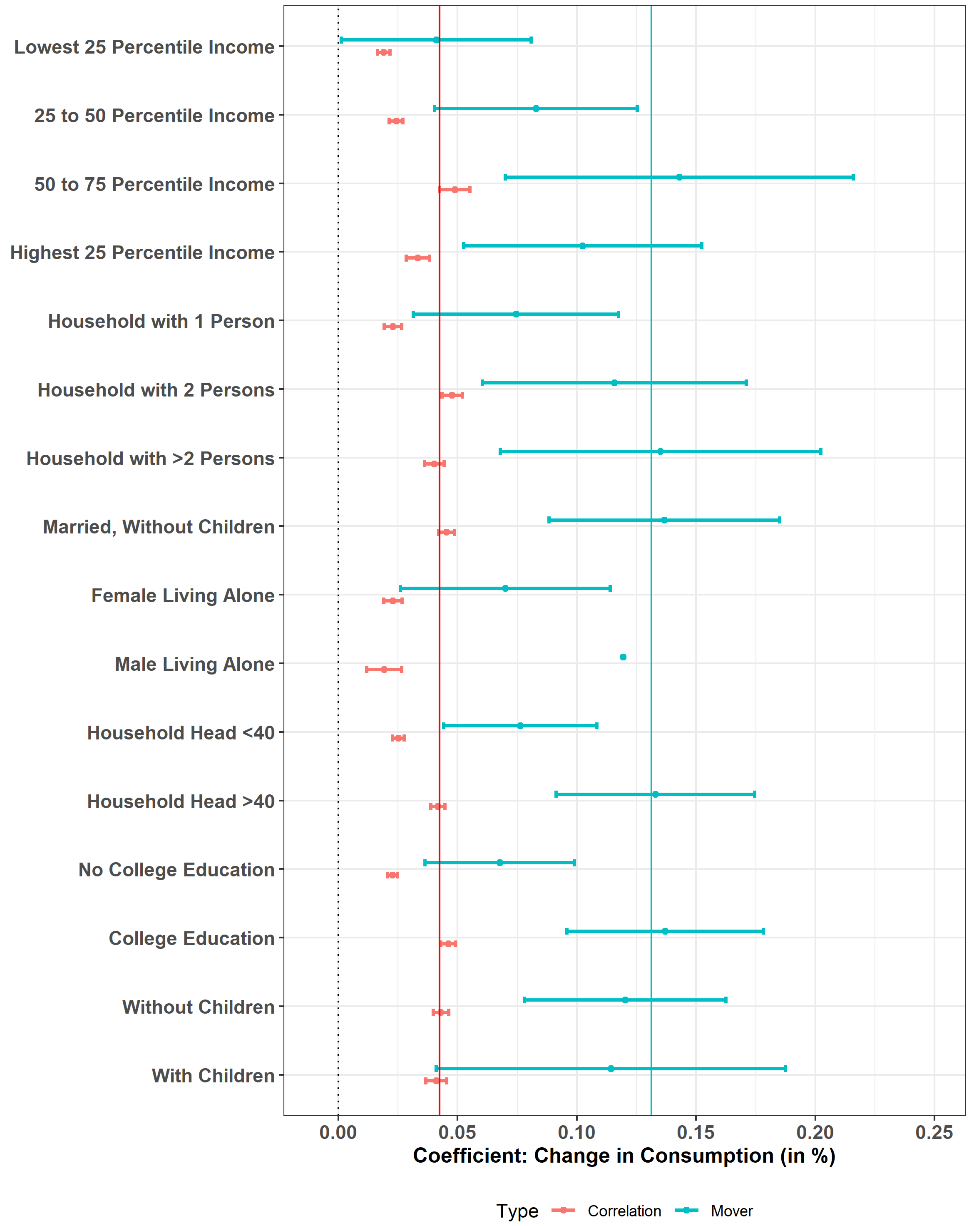
Notes: The Figure shows average changes in beer and wine purchases from before to after a move as a function of the change in product exposure. The average change in beer or wine purchases is calculated as the difference between average purchases and product exposure during the years before and after the change of residency. We exclude the year of the residence change. These average differences are grouped into ventiles considering the changes in average exposure. Thus, for each ventile of the average differences of product exposure, the y-axis shows the corresponding change in beer or wine purchases, averaged within the ventile. I show an OLS using the 20 data points. Further, I report 95% confidence intervals

Figure C.2: Impact of Product Variety on Households' Beer Purchases, Heterogeneity Analysis



Notes: This figure investigates the effects of product variety on purchases in the beverage category of beer. Using subsamples dependent on demographics, the figure shows coefficients from both the regression equation (4) and the instrumental variable equation (5) that considers moving households. These coefficients represent the percentage effect of a 1% increase in product exposure on purchases within the corresponding category. The analysis covers household-level correlation and results obtained through identification using residence changes. The solid vertical red lines indicate the coefficient of $\hat{\beta}$ from column (4) of Table 1. Solid vertical blue lines denote the instrumental variable estimate of $\hat{\beta}$ of the full sample from column (6) of Table **??**. *I use identical fixed effects as reported in the tables. Error bars represent the 95% confidence intervals. For some subgroups, I exclude the confidence interval to increase visibility as they are very long. Standard errors are clustered at the household level and adjusted for within-cluster correlation.*

Figure C.3: Impact of Product Variety on Households' Wine Purchases, Heterogeneity Analysis



Notes: This figure investigates the effects of product variety on purchases in the beverage category of wine. Using subsamples dependent on demographics, the figure shows coefficients from both the regressionequation (4) and the instrumental variable equation (5) that considers moving households. These coefficients represent the percentage effect of a 1% increase in product exposure on purchases within the corresponding category. The analysis covers household-level correlation and results obtained through identification using residence changes. The solid vertical red lines indicate the coefficient of $\hat{\beta}$ from column (4) of Table 1. Solid vertical blue lines denote the instrumental variable estimate of $\hat{\beta}$ of the full sample from column (6) of Table **??***. I use identical fixed effects as reported in the tables. Error bars represent the 95% confidence intervals. For some subgroups, I exclude the confidence interval to increase visibility as they are very long. Standard errors are clustered at the household level and adjusted for within-cluster correlation.*

D Alternative Specification of Household Level Regressions

We now consider extensions of the models on the household models. First, we explore a structure on the monthly household-store level, meaning we observe household i in month t purchasing in-store s. Thus we allow variation between stores. We then evaluate how exposure to products within a store affects purchases within an alcohol category. Thus, consider the following regression model

$$log(y_{ist}) = \alpha + \beta Exposure_{ist} + \xi_{is} + \rho_{ct} + \delta \mathbf{X}_{it} + \varepsilon_{ist},$$

where the outcome $log(y_{ist})$ is the logarithm of purchases in liters by household i in store s in month t. Accordingly, $log(Exposure_{ist})$ is the logarithm of the number of alcohol products available in a store at the time of visit. ξ_{is} are store $\times$ household fixed effects (I also show results using household and store fixed effects separately) and ρ_{ct} are county $\times$ year-month fixed effects (I also show results only using month fixed effects. Finally, I also consider households' time-varying control variables, $\mathbf{X}_{it}$. Within the regression, a one percent change in exposure to products of a category within a store lead to $\hat{\beta}$ percent increase in purchases of that category. I also show results of the instrumental variable regression that is aligned to the analysis in section 6.2. Therefore, I analyze the impact of product variety changes through excise tax increases in Washington and Illinois.

I initially present the findings of the general correlation between store-specific exposure and purchases in Table D.1, which closely resemble the outcomes of our primary analysis. Subsequently, Table D.2 demonstrates the impact of product variety on purchases in relation to excise tax increases. Consistently, the results align with the main analysis: there is an immediate effect of the excise tax increase on product variety in Washington, leading to higher liquor purchases. Conversely, the influence of the excise tax hike on product variety in Illinois manifests with a delay, causing a robust first stage only in the postponed treatment only and yielding significant estimates in the second stage.

Table D.1: Regression Evidence for Product Exposure on Alcohol Purchases on Household × Store Level, Beer, Wine, and Liquor

Panel A: Beer							
	log(Beer)						I(Beer>0)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
$log(Exposure+0.5)$	0.058***	0.051***	0.012***	0.012***	0.011***	0.011***	0.003***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)
Constant	-2.344***						
	(0.002)						
Household FE	No	Yes	Yes	No	No	No	No
Store FE	No	No	Yes	No	No	No	No
Year-Month FE	No	Yes	Yes	Yes	No	No	No
Household × Store FE	No	No	No	Yes	Yes	Yes	Yes
County × Year-Month FE	No	No	No	No	Yes	Yes	Yes
Household Controls	No	No	No	No	No	Yes	Yes
N	11,509,995	11,509,995	11,509,995	11,509,995	11,509,995	10,798,561	10,798,561
R^2	0.013	0.315	0.338	0.461	0.463	0.462	0.404
Panel B: Wine							
	log(Wine)						I(Wine>0)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
$log(Exposure+0.5)$	0.074***	0.074***	0.023***	0.024***	0.022***	0.022***	0.003***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)	(0.000)
Constant	-6.554***						
	(0.002)						
Household FE	No	Yes	Yes	No	No	No	No
Store FE	No	No	Yes	No	No	No	No
Year-Month FE	No	Yes	Yes	Yes	No	No	No
Household × Store FE	No	No	No	Yes	Yes	Yes	Yes
County × Year-Month FE	No	No	No	No	Yes	Yes	Yes
Household Controls	No	No	No	No	No	Yes	Yes
N	11,509,995	11,509,995	11,509,995	11,509,995	11,509,995	10,798,561	10,798,561
R^2	0.018	0.269	0.289	0.406	0.409	0.412	0.376
Panel C: Liquor							
	log(Liquor)						I(Liquor>0)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
$log(Exposure+0.5)$	0.084***	0.073***	0.018***	0.020***	0.017***	0.016***	0.002***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)
Constant	-9.488***						
	(0.002)						
Household FE	No	Yes	Yes	No	No	No	No
Store FE	No	No	Yes	No	No	No	No
Year-Month FE	No	Yes	Yes	Yes	No	No	No
Household × Store FE	No	No	No	Yes	Yes	Yes	Yes
County × Year-Month FE	No	No	No	No	Yes	Yes	Yes
Household Controls	No	No	No	No	No	Yes	Yes
N	11,509,995	11,509,995	11,509,995	11,509,995	11,509,995	10,798,561	10,798,561
R^2	0.017	0.212	0.232	0.344	0.346	0.343	0.327

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Notes: This table presents regression results for the impact of product exposure on household purchases at the household-store level. Each observation represents a household visiting a store within a month. The outcome variable is the logarithm of household purchases of alcohol in three categories within a store: beer (Panel A), wine (Panel B), and liquor (Panel C). In the last model, the outcome is an indicator variable equal to one if a household purchases any beer, wine, or liquor product in a given month. To avoid zero sales, the outcome variable is transformed by adding half the minimum value of the sample beer, wine, and liquor purchases across observations with nonzero purchases, i.e., $log(Beer+0.1035072)$, $log(Wineamount+0.0015)$, *and* $log(Liquor+0.000083)$. $log(Exposure+0.5)$ *represents the number of products a household is exposed to in a month. In the log-log specification, a one percent change in the number of products leads to a* $\hat{\beta}$ *percent increase in purchases. Household FE, Store FE, Year-Month FE, Household × Store FE, and County × Year-Month FE indicate the inclusion of household, store, year-month, household-store combination, or county-year-month fixed effects. Household Controls signifies if the model accounts for time-varying household characteristics such as income (income brackets), household size, composition (relation between household members), occupation of female and male household heads, employment status, education and age, marital status within a household, presence and age of children, and race. Standard errors are clustered at the household level, adjusted for within-cluster correlation, and reported in parentheses.*

Table D.2: Impact of Excise Taxes on Household Purchases through Increased Product Variety: Instrumental Variable Regression Analysis

	First Stage									
	Outcome Variable: Number of Liquor Products									
	Deregulation in Washington					Excise Tax Increase in Illinois				
	All	All	Control: Neighbors	Delay	I(Liquor>0)	All	All	Control: Neighbors	Delay	I(Liquor>0)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Z_{it}	2.242***	1.677***	1.727***	0.908***	0.004**	1.430***	-0.052***	-0.219***	0.276***	-0.002
	(0.011)	(0.019)	(0.043)	(0.021)	(0.002)	(0.015)	(0.015)	(0.059)	(0.021)	(0.001)
Constant	3.762***					3.746***				
	(0.006)					(0.006)				
Household × Store FE	No	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
County × Year-Month FE	No	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
Household Controls	No	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
F-statistics	201,282	354,784	84,971	82,545	82,545	174,888	241	277	8919	241
N	11,477,397	10,798,561	614,206	10,798,561	34,027,193	11,477,397	10,798,561	782,308	10,798,561	34,027,193
R^2	0.017	0.954	0.943	0.952	0.330	0.015	0.952	0.935	0.952	0.330

	Second Stage									
	Outcome Variable: log(Liquor)									
	Deregulation in Washington					Excise Tax Increase in Illinois				
	All	All	Control: Neighbors	Delay	I(Liquor>0)	All	All	Control: Neighbors	Delay	I(Liquor>0)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
$log(Exposure+0.5)$	0.100***	0.132***	0.140***	0.092***	0.009***	0.092***	0.797*	-0.682*	0.026	0.077*
	(0.010)	(0.015)	(0.030)	(0.026)	(0.003)	(0.010)	(0.440)	(0.371)	(0.064)	(0.043)
Constant	-9.547***					-9.515***				
	(0.039)					(0.037)				
Household × Store FE	No	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
County × Year-Month FE	No	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
Household Controls	No	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
N	11,477,397	10,798,561	614,206	10,798,561	34,027,193	11,477,397	10,798,561	782,308	10,798,561	34,027,193
R^2	0.016	0.342	0.276	0.343	0.326	0.016	0.274	0.312	0.343	0.260

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Notes: This table presents instrumental variable regression analysis examining the impact of excise taxes on alcohol consumption through increased product variety on household exposure on the store level. E Each observation represents a household visiting a store within a month. The upper panel displays first-stage results, with the instrument being a dummy variable equal to one for households in treatment states post-policy change. The lower panel presents second-stage results, where the outcome variable is the logarithm of liters of liquor products and an indicator variable equal to one if a household purchases any liquor in a given month during a store visit. Models 1-5 report IV regression results for the Washington deregulation and excise tax increases, while models 6-10 use the Illinois excise tax increase as the instrument. Treatment begins in August 2012 for Washington and September 2009 for Illinois. In models 3 and 8, the sample is limited to treatment and a neighboring state (Oregon for Washington treatment, Wisconsin for Illinois treatment). Models 4 and 9 incorporate a 2.5-year treatment delay. Models 5 and 10 focus on the external margin, with the outcome being an indicator variable equal to one if a household purchases any liquor product within the month in a store. To avoid zero sales, the outcome variable is transformed with $log(Liquor+0.000083)$. $log(Exposure+0.5)$ represents the number of liquor products a household is exposed to in a month within a store. In the log-log specification, a one percent change in the number of products leads to a $\hat{\beta}$ percent increase in liquor purchases. Household × Store FE and County × Year-Month FE indicate the inclusion of household-store and county-year-month fixed effects. Household Controls signify if the model accounts for time-varying household characteristics such as income, size, composition, occupation, employment status, education, age, marital status, presence and age of children, and race. F-Statistics First Stage refers to the first-stage F-statistics in the IV approach. Standard errors are clustered at the household level, adjusted for within-cluster correlation, and reported in parentheses.

E Alternative Definition of Residency Change

In Section 5.3 of the primary manuscript, I investigate the influence of product variety on consumer purchases by employing residential relocation as a source of variation. A residential relocation is defined as a household changing its zip code of residence. Additionally, I exclude households with multiple residential relocations. In this section, I will demonstrate the robustness of my findings by considering (1) residential relocations across states and (2) incorporating multiple relocations in the analysis.

The results of the instrumental variable approach, utilizing state-level residential relocations, are presented in Tables E.1 (for liquor), E.2 (for beer), and E.3 (for wine). When examining residential relocations across states, households that relocate within the same state are not considered as treated, resulting in their instrument having a value of zero. Moreover, since I do not exclude observations during the year of the relocation within a state, the overall sample size experiences a marginal increase in comparison to the table illustrating zip code-dependent residential relocations in the main manuscript. As I observe fewer relocations the power of the first stage decreases but is still high. Overall the results are similar to the ones in the main analysis.

Including multiple relocations. In a second robustness check, I examine zip code-level relocations without excluding households that have experienced multiple moves. In this analysis, I consider the initial relocation as the relevant one. Although the sample size experiences a modest increase, the results remain consistent. The outcomes of the instrumental variable regression are displayed in Tables E.4 (for liquor), E.5 (for beer), and E.6 (for wine).

Table E.1: Regression Evidence for Movers, Liquor Purchases, Cross State Residence Changes

	log(Liquor)								I(Liquor>0)	
	Full Sample						Only movers		Full Sample	
	OLS	IV	OLS	IV	OLS	IV	OLS	IV	OLS	IV
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
log(Exposure) log(N_Liquor + 0.5)	0.103***	0.209***	0.051***	0.105***	0.047***	0.080***	0.061***	0.075***	0.005***	0.008***
	(0.003)	(0.038)	(0.002)	(0.016)	(0.002)	(0.016)	(0.008)	(0.016)	(0.000)	(0.002)
Constant	-8.750***	-9.205***								
	(0.011)	(0.161)								
Household FE	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year-Month FE	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Origin/Destination Controls	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes
Household Controls	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
N	6,768,170	6,768,170	6,768,170	6,768,170	6,316,271	6,316,271	214,974	214,974	6,316,271	6,316,271
R^2	0.005	0.000	0.389	0.388	0.388	0.388	0.360	0.360	0.362	0.362
F-Statistic First Stage		32,413		160,383		141,565		99,054		141,565

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Notes: This Table presents regression results for equation 5, with each observation representing a household within a month. In this table, I show results if a residence change is defined as the change of residency across two different states. The outcome variable is the logarithm of sales for liquor products and an indicator variable equal to one if a household purchases any liquor in a given month. The models alternate between OLS and instrumental variable regression. The instrument takes the value of the change in the exposure of products for moving households after the move in comparison to the average of the year before the move. Note that the instrument is zero for non-moving households and moving households before the move. Models 1-6 and 9-10 include the full sample, while models 7-8 only include households that moved during the sample period. To avoid zero sales, the outcome variable is transformed by adding half the minimum value of the sample liquor purchases across observations with nonzero purchases, i.e., $log(Liquor + 0.000083)$. $log(Exposure + 0.5)$ *represents the number of liquor products a household is exposed to in a month. In the log-log specification, a one percent change in the number of products leads to a* $\hat{\beta}$ *percent increase in liquor purchases. Household FE and Year-Month FE indicate the inclusion of household and year-month fixed effects. Origin/Destination Controls signifies if the model includes the zip code-specific average purchases of liters of liquor. Household Controls show if the model accounts for time-varying household characteristics such as income (income brackets), household size, composition (relation between household members), occupation of female and male household heads, employment status, education and age, marital status within a household, presence, and age of children, and race. F-Statistics First Stage refers to the F-statistics of the first stage in the instrumental variable approach, where the instrument consistently has a significant positive coefficient. Standard errors are clustered at the household level, adjusted for within-cluster correlation, and reported in parentheses.*

Table E.2: Regression Evidence for Movers, Beer Purchases, Cross State Residence Changes

	log(Beer)								I(Beer>0)	
	Full Sample						Only movers		Full Sample	
	OLS	IV	OLS	IV	OLS	IV	OLS	IV	OLS	IV
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
log(Exposure)	0.066***	0.050**	0.027***	0.065***	0.025***	0.041***	0.034***	0.026**	0.006***	0.011***
	(0.002)	(0.025)	(0.001)	(0.012)	(0.001)	(0.012)	(0.006)	(0.012)	(0.000)	(0.003)
Constant	-1.988***	-1.902***								
	(0.008)	(0.130)								
Household FE	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year-Month FE	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Origin Controls	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes
Household Controls	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
N	6,768,170	6,768,170	6,768,170	6,768,170	6,316,271	6,316,271	214,974	214,974	6,316,271	6,316,271
R^2	0.004	0.004	0.525	0.524	0.527	0.527	0.476	0.476	0.442	0.442
F-Statistic First Stage		33,367		113,096		97,707		92,812		97,707

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Notes: This Table presents regression results for equation 5, with each observation representing a household within a month. In this table, I show results if a residence change is defined as the change of residency across two different states. The outcome variable is the logarithm of sales for beer products and an indicator variable equal to one if a household purchases any beer in a given month. The models alternate between OLS and instrumental variable regression.The instrument takes the value of the change in the exposure of products for moving households after the move in comparison to the average of the year before the move. Note that the instrument is zero for non-moving households and moving households before the move. Models 1-6 and 9-10 include the full sample, while models 7-8 only include households that moved during the sample period. To avoid zero sales, the outcome variable is transformed by adding half the minimum value of the sample beer purchases across observations with nonzero purchases, i.e., $log(beer + 0.1035072)$. $log(Exposure + 0.5)$ *represents the number of beer products a household is exposed to in a month. In the log-log specification, a one percent change in the number of products leads to a* $\hat{\beta}$ *percent increase in beer purchases. Household FE and Year-Month FE indicate the inclusion of household and year-month fixed effects. Origin Controls signify if the model includes the zip code-specific average purchases of liters of beer. Household Controls show if the model accounts for time-varying household characteristics such as income (income brackets), household size, composition (relation between household members), occupation of female and male household heads, employment status, education and age, marital status within a household, presence and age of children, and race. F-Statistics First Stage refers to the F-statistics of the first stage in the instrumental variable approach, where the instrument consistently has a significant positive coefficient. Standard errors are clustered at the household level, adjusted for within-cluster correlation, and reported in parentheses.*

Table E.3: Regression Evidence for Movers, Wine Purchases, Cross State Residence Changes

	log(Wine)								I(Wine>0)	
	Full Sample						Only movers		Full Sample	
	OLS	IV	OLS	IV	OLS	IV	OLS	IV	OLS	IV
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
log(N_Wine + 0.5)	0.099***	0.214***	0.048***	0.145***	0.042***	0.120***	0.077***	0.112***	0.006***	0.016***
	(0.002)	(0.035)	(0.001)	(0.013)	(0.001)	(0.014)	(0.008)	(0.014)	(0.000)	(0.002)
Constant	-5.899***	-6.504***								
	(0.010)	(0.183)								
Household FE	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year-Month FE	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Origin Controls	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes
Household Controls	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
N	6,737,280	6,737,280	6,737,280	6,737,280	6,289,946	6,289,946	839,647	839,647	6,289,946	6,289,946
R^2	0.010	-0.004	0.470	0.469	0.475	0.474	0.472	0.471	0.422	0.421
F-Statistic First Stage		31,611		253,132		210,225		115,790		210,225

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Notes: This Table presents regression results for equation 5, with each observation representing a household within a month. In this table, I show results if a residence change is defined as the change of residency across two different states. The outcome variable is the logarithm of sales of wine products and an indicator variable equal to one if a household purchases any wine in a given month. The models alternate between OLS and instrumental variable regression. The instrument takes the value of the change in the exposure of products for moving households after the move in comparison to the average of the year before the move. Note that the instrument is zero for non-moving households and moving households before the move. Models 1-6 and 9-10 include the full sample, while models 7-8 only include households that moved during the sample period. To avoid zero sales, the outcome variable is transformed by adding half the minimum value of the sample wine purchases across observations with nonzero purchases, i.e., $log(wine + 0.0015)$. $log(Exposure + 0.5)$ represents the number of wine products a household is exposed to in a month. In the log-log specification, a one percent change in the number of products leads to a $\hat{\beta}$ percent increase in wine purchases. Household FE and Year-Month FE indicate the inclusion of household and year-month fixed effects. Origin Controls signify if the model includes the zip code-specific average purchases of iters of wine. Household Controls show if the model accounts for time-varying household characteristics such as income (income brackets), household size, composition (relation between household members), occupation of female and male household heads, employment status, education and age, marital status within a household, presence and age of children, and race. F-Statistics First Stage refers to the F-statistics of the first stage in the instrumental variable approach, where the instrument consistently has a significant positive coefficient. Standard errors are clustered at the household level, adjusted for within-cluster correlation, and reported in parentheses.

Table E.4: Regression Evidence for Movers, Liquor Purchases, Including Multiple Residence Changes

	log(Liquor)								I(Liquor>0)	
	Full Sample						Only movers		Full Sample	
	OLS	IV	OLS	IV	OLS	IV	OLS	IV	OLS	IV
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
log(Exposure)	0.103***	0.163***	0.051***	0.093***	0.046***	0.082***	0.052***	0.073***	0.005***	0.008***
	(0.003)	(0.021)	(0.002)	(0.011)	(0.002)	(0.010)	(0.004)	(0.010)	(0.000)	(0.001)
Constant	-8.747***	-9.004***								
	(0.011)	(0.091)								
Household FE	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year-Month FE	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Origin/Destination Controls	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes
Household Controls	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
N	6,737,280	6,737,280	6,737,280	6,737,280	6,289,946	6,289,946	839,647	839,647	6,289,946	6,289,946
R^2	0.005	0.004	0.389	0.389	0.411	0.411	0.392	0.392	0.380	0.380
F-Statistic First Stage		96,567		337,214		302,503		278,825		302,503

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Notes: This Table presents regression results for equation 5, with each observation representing a household within a month. These current results also consider a household with repeated residence changes. In detail, for households with repeated residence changes, I consider the initial residence change as a relevant one. The regression evidence in the main paper excluded households with multiple movements. The outcome variable is the logarithm of sales for liquor products and an indicator variable equal to one if a household purchases any liquor in a given month. The models alternate between OLS and instrumental variable regression. The instrument takes the value of the change in the exposure of products for moving households after the move in comparison to the average of the year before the move. Note that the instrument is zero for non-moving households and moving households before the move. Models 1-6 and 9-10 include the full sample, while models 7-8 only include households that moved during the sample period. To avoid zero sales, the outcome variable is transformed by adding half the minimum value of the sample liquor purchases across observations with nonzero purchases, i.e., $log(Liquor + 0.000083)$. $log(Exposure + 0.5)$ *represents the number of liquor products a household is exposed to in a month. In the log-log specification, a one percent change in the number of products leads to a* $\hat{\beta}$ *percent increase in liquor purchases. Household FE and Year-Month FE indicate the inclusion of household and year-month fixed effects. Origin/Destination Controls signifies if the model includes the zip code-specific average purchases of liters of liquor. Household Controls show if the model accounts for time-varying household characteristics such as income (income brackets), household size, composition (relation between household members), occupation of female and male household heads, employment status, education and age, marital status within a household, presence, and age of children, and race. F-Statistics First Stage refers to the F-statistics of the first stage in the instrumental variable approach, where the instrument consistently has a significant positive coefficient. Standard errors are clustered at the household level, adjusted for within-cluster correlation, and reported in parentheses.*

Table E.5: Regression Evidence for Movers, Beer Purchases, Including Multiple Residence Changes

	log(Beer)								I(Beer>0)	
	Full Sample						Only movers		Full Sample	
	OLS	IV	OLS	IV	OLS	IV	OLS	IV	OLS	IV
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
log(Exposure)	0.066***	0.017	0.028***	0.046***	0.024***	0.037***	0.029***	0.034***	0.006***	0.009***
	(0.002)	(0.014)	(0.001)	(0.007)	(0.001)	(0.007)	(0.003)	(0.006)	(0.000)	(0.001)
Constant	-1.987***	-1.734***								
	(0.008)	(0.073)								
Household FE	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year-Month FE	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Origin Controls	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes
Household Controls	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
N	6,737,280	6,737,280	6,737,280	6,737,280	6,289,946	6,289,946	839,647	839,647	6,289,946	6,289,946
R^2	0.004	0.002	0.525	0.525	0.553	0.553	0.514	0.514	0.458	0.458
F-Statistic First Stage		98,479		266,281		238,294		269,300		238,294

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Notes: This table presents regression results for equation 5, with each observation representing a household within a month. These current results also consider a household with repeated residence changes. In detail, for households with repeated residence changes, I consider the initial residence change as a relevant one. The regression evidence in the main paper excluded households with multiple movements. The outcome variable is the logarithm of sales for beer products and an indicator variable equal to one if a household purchases any beer in a given month. The models alternate between OLS and instrumental variable regression. The instrument takes the value of the change in the exposure of products for moving households after the move in comparison to the average of the year before the move. Note that the instrument is zero for non-moving households and moving households before the move. Models 1-6 and 9-10 include the full sample, while models 7-8 only include households that moved during the sample period. To avoid zero sales, the outcome variable is transformed by adding half the minimum value of the sample beer purchases across observations with nonzero purchases, i.e., $log(beer + 0.1035072)$. $log(Exposure + 0.5)$ represents the number of beer products a household is exposed to in a month. In the log-log specification, a one percent change in the number of products leads to a $\hat{\beta}$ percent increase in beer purchases. Household FE and Year-Month FE indicate the inclusion of household and year-month fixed effects. Origin Controls signify if the model includes the zip code-specific average purchases of liters of beer. Household Controls show if the model accounts for time-varying household characteristics such as income (income brackets), household size, composition (relation between household members), occupation of female and male household heads, employment status, education and age, marital status within a household, presence and age of children, and race. F-Statistics First Stage refers to the F-statistics of the first stage in the instrumental variable approach, where the instrument consistently has a significant positive coefficient. Standard errors are clustered at the household level, adjusted for within-cluster correlation, and reported in parentheses.

Table E.6: Regression Evidence for Movers, Wine Purchases, Including Multiple Residence Changes

	log(Wine)								I(Wine>0)	
	Full Sample						Only movers		Full Sample	
	OLS	IV	OLS	IV	OLS	IV	OLS	IV	OLS	IV
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
log(Exposure)	0.099***	0.112***	0.050***	0.106***	0.043***	0.094***	0.065***	0.091***	0.006***	0.013***
	(0.002)	(0.021)	(0.002)	(0.008)	(0.001)	(0.009)	(0.004)	(0.009)	(0.000)	(0.001)
Constant	-5.896***	-5.963***								
	(0.010)	(0.111)								
Household FE	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year-Month FE	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Origin Controls	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes
Household Controls	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
N	6,471,996	6,471,996	6,471,996	6,471,996	6,047,883	6,047,883	597,584	597,584	6,047,883	6,047,883
R^2	0.010	0.010	0.470	0.470	0.497	0.497	0.480	0.479	0.436	0.436
F-Statistic First Stage		65,781		394,199		356,189		295,566		356,189

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Notes: This table presents regression results for equation 5, with each observation representing a household within a month. These current results also consider a household with repeated residence changes. In detail, for households with repeated residence changes, I consider the initial residence change as a relevant one. The regression evidence in the main paper excluded households with multiple movements. The outcome variable is the logarithm of sales of wine products and an indicator variable equal to one if a household purchases any wine in a given month. The models alternate between OLS and instrumental variable regression. The instrument takes the value of the change in the exposure of products for moving households after the move in comparison to the average of the year before the move. Models 1-6 and 9-10 include the full sample, while models 7-8 only include households that moved during the sample period. To avoid zero sales, the outcome variable is transformed by adding half the minimum value of the sample wine purchases across observations with nonzero purchases, i.e., $log(wine+0.0015)$. $log(Exposure+0.5)$ represents the number of wine products a household is exposed to in a month. In the log-log specification, a one percent change in the number of products leads to a $\hat{\beta}$ percent increase in wine purchases. Household FE and Year-Month FE indicate the inclusion of household and year-month fixed effects. Origin Controls signify if the model includes the zip code-specific average purchases of iters of wine. Household Controls show if the model accounts for time-varying household characteristics such as income (income brackets), household size, composition (relation between household members), occupation of female and male household heads, employment status, education and age, marital status within a household, presence and age of children, and race. F-Statistics First Stage refers to the F-statistics of the first stage in the instrumental variable approach, where the instrument consistently has a significant positive coefficient. Standard errors are clustered at the household level, adjusted for within-cluster correlation, and reported in parentheses.