

**ESTIMATING MARKUPS UNDER  
HORIZONTAL AND VERTICAL  
DIFFERENTIATION**

BY

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## Abstract

This thesis examines product differentiation in oligopolistic markets using the Berry-Levinsohn-Pakes (BLP) discrete choice demand estimation framework. We investigate both vertical differentiation (quality-based) and horizontal differentiation (variety-based) in the Kazakhstan beer market, utilizing a comprehensive panel dataset covering 45 products from 26 brands over 37 months (January 2020 - December 2021).

Our empirical analysis reveals several key findings: First, the market exhibits moderate concentration with a Herfindahl-Hirschman Index averaging 387, suggesting competitive but differentiated market structure. Second, we find evidence of both vertical and horizontal product differentiation, with consumers showing heterogeneous preferences for alcohol content (vertical attribute) and container sizes (horizontal attribute). Third, estimated own-price elasticities average -2.85, indicating relatively inelastic demand consistent with consumer loyalty and brand differentiation. Fourth, our nested logit estimates suggest significant within-nest correlation, supporting the presence of product segmentation along both quality and variety dimensions.

We estimate price-cost margins ranging from 25% to 45% across brands, with premium brands commanding higher markups due to vertical differentiation. Counterfactual simulations demonstrate that a hypothetical merger between the top two brands would lead to price increases of 8-12% and consumer welfare losses equivalent to 3.5% of market revenues. These findings have important implications for competition policy in differentiated product markets and demonstrate the power of the BLP methodology in understanding strategic firm behavior in oligopolistic settings.

**Keywords:** BLP estimation, product differentiation, discrete choice models, oligopoly, demand estimation, beer industry, Kazakhstan

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# Chapter 1

## Introduction

### 1.1 Background and Motivation

One of the most basic problems in the industrial organization is to understand consumer demand and market structure in differentiated product industries. In the presence of product differentiation on more than one dimension both in terms of quality (vertical differentiation) and in terms of variety (horizontal differentiation) then standard methods of demand estimation fail to elicit the complex substitution patterns that direct consumer choice and firm competition. To overcome this challenge, this thesis uses the Berry-Levinsohn-Pakes (BLP) discrete choice demand estimation model to estimate product differentiation in the beer market in Kazakhstan.

The beer industry offers a perfect environment to learn about product differentiation due to a number of reasons. First, beer products differ in a systematic manner on quantifiable vertical dimensions, most of which are alcohol content which most consumers tend to agree on as a measure of quality differences. Second, beer has high horizontal differentiation in form of beer size, packaging style and branding that attract various consumer groups without distinction of quality criteria. Third, the industry structure, which is moderate in the number of brands that compete on the variants of their products, provides a rich product positioning and pricing strategy that allows finding the demand parameters.

Although Kazakhstan beer market is comparatively under-researched in terms of Western European or Northern American market, it has a number of benefits when it comes to empirical research. The market experienced a great change in structure during 2020-2021 that offered a variation in market shares and competitive forces. Heterogeneity in product positioning strategies arises because of the presence of both domestic and international brands. In addition, the presence of complete sales information on 45 products and 26 brands during 37 months will

allow the strong determination of demand elasticities and substitution pattern.

Methodologically, the thesis is a contribution to the existing empirical industrial organization literature because it shows the use of BLP demand estimation in an emerging market setting. The BLP framework formulated by the Berry et al. (1995) was the first to transform empirical demand analysis by solving the endogeneity of price and the unobserved product characteristics by using a well-designed identification strategy. Although it is widely used in the markets of the developed economy, the performance of the methodology in emerging markets with other institutional frames and consumer behavior patterns has not been studied extensively.

## 1.2 Research Questions

This thesis addresses the following research questions:

1. **Vertical Differentiation:** What are the impacts of vertical product characteristics on the consumer demand and market positioning in the Kazakhstan beer market on the alcohol content of the product? Are higher alcohol content seen as more quality by the consumers, and how does this reflect back in the pricing power?
2. **Horizontal Differentiation:** How important is horizontal differentiation, in terms of variation in container size, in market segmentation? Is there a strong preference of certain package sizes by the consumers and does that affect the competitive landscape?
3. **Price Elasticities:** Which are the own-price and cross-price elasticities of demand of this market? but what are the differences in elasticities by the products, brands and quality segments? Are high-end products less price-elastic as compared to regular products?
4. **Market Power and Markups:** What are the levels of price-cost margins that the firms enjoy in this differentiated product market? What are the variations in markups with product positioning on vertical and horizontal dimensions?
5. **Competition Policy:** Welfare implication of hypothetical problem mergers or market consolidation? What would the changes under different market structure in terms of prices and consumer surplus be?

## 1.3 Main Findings

Our empirical analysis makes several important findings. First, we come up with an average own-price elasticity of about -2.85, substantially more elastic than would be suggested by the naive logit model but not inconsistent with substantial product differentiation. This finding suggests that although consumers are sensitive to helpful prices, strong brand allegiance and product differentiation mediate price sensitivity. Second, we find statistically significant coefficients on both vertical and horizontal product characteristics. The alcohol content coefficient implies that consumers place a high value on the alcohol content, although the relationship is non-linear with a diminishing marginal utility for alcohol content greater than 5-6% alcohol. Container size coefficients show that there are strong preferences for standard 450ml and 500ml format, with larger formats (900ml-1000ml) having a distinguished market segment. Third, our nested logit estimates reveal substantial within-nest correlation (with nesting parameters  $\lambda$  ranging from 0.45 to 0.68), confirming that products within quality/size segments are closer substitutes than products across segments. This serves to validate the conceptual distinction between the vertical and horizontal differentiation in this market. Fourth, estimated price-cost margins average 32% across all products, with significant heterogeneity. Premium brands command margins of 40-45%, while value brands operate with margins of 25-30%. This pattern is consistent with the vertical differentiation between strong and weak schools in quality of teacher, leading to quality leaders extracting higher rents. Finally, counterfactual merger simulations indicate that consolidation among market leaders would lead to price increases of 8-12% and consumer welfare losses equivalent to 3.5% of annual market revenues. These outcomes indicate active consideration for competition policy in this market is in order.

## 1.4 Contribution to Literature

This thesis makes several contributions to the empirical industrial organization literature:

**Methodological Contribution:** We show how BLP demand estimation is successfully applied in a developing economy setting taking into consideration the issues of data, and institutional specificities that are not paralleled in the more traditional developed economy applications. The way we instrumented the prices with cost-shifters in this market can offer the model direction to the future research in this context.

**Empirical Contribution:** Our report is the first extensive demand analysis

of Kazakhstan beer market, which addresses a research gap in the literature on consumer markets in Central Asia. This is because our estimates of elasticity and the findings of the market structure help us to learn how a differentiated product competition can work in the emerging economies.

**Policy Contribution:** Our merger simulation results provide concrete welfare estimates relevant for competition policy in Kazakhstan and similar markets. The finding that current market structure maintains consumer welfare through competitive pressure has immediate policy relevance.

**Theoretical Contribution:** We give an empirical confirmation on theoretical forecasts on vertical and horizontal differing in oligopoly. Multi-dimensional products space theory is backed by our results of having two independent dimensions of differentiation that have an independent effect on demand and the market outcomes.

## 1.5 Limitations and Scope

There are a few limitations which are worth mentioning. To begin with, our analysis will be on revealed preference data that lacks direct consumer demographic and psychographic data. Although the BLP shows that unobserved heterogeneity is captured in random coefficients, even more detailed consumer data can enable us to learn more about preference heterogeneity.

Second, we are not measuring the actual marginal costs, and therefore needs to estimate the latter using first-order conditions of profit maximization. Although this method is conventional in the BLP literature and can be proven common grounded on robustness checks, actual cost information would be more convincing in our markup estimates.

Third, our analysis is limited to a certain time (2020-2021) where the COVID-19 pandemic might have influenced the consumption pattern. Although we incorporate the time fixed effects to adjust the impacts of aggregate shocks, there is a possibility that behavioral changes that are specific to the pandemic and affect our estimates.

Fourth, we target the formal retail channel and do not experience informal or on-premise consumption. The limitation is typical to scanner data studies and implies that our estimates of demand can only be applied to off-premise consumption.

Although these affect the final results of our analysis, we feel that we have strong and policy relevant information on product differentiation and competition in the beer market in Kazakhstan and by implication more broadly about oligopolistic competition in differentiated products.

# Chapter 2

## Literature Review

### 2.1 Introduction

The chapter is a review of three interdependent bodies of literature to our analysis, including the product differentiation theories, discrete choice demand estimation techniques, and application to beverage markets. We start with the theoretical background of vertical and horizontal differentiation, next, we will discuss the development of the demand estimation methods up to BLP, and lastly, we will overview the empirical research of the application of these methods to the case of beer and its markets.

### 2.2 Theories of Product Differentiation

#### 2.2.1 Horizontal Differentiation

The modern theory of horizontal product differentiation originates with Hotelling (1929)'s seminal spatial competition model. Hotelling illustrated the fact that in a world where the consumers have heterogeneous tastes about the qualities of the products, firms have reasons to differentiate their products in order to soften the price competition. In canonical Hotelling model, firms and consumers are located along a line that is associated with the space of preferences and consumers are distributed equally across the line. Even homogeneous costs of production lead to market power due to the transportation costs, which is the disutility of consuming a product far away the ideal point.

Salop (1979) linearized the model of Hotelling of a linear city to a circular city to permit over two firms, and to show that the number of firms in equilibrium was a function of both the trade-off between product differentiation benefits and entry fixed costs. This model was especially helpful in the case of free-entry oligopolistic competition.

Dixit and Stiglitz (1977) formulated a more manageable strategy of horizontal differentiation by the use of the love-of-variety CES utility. According to their model, consumers appreciate variety as such, and different companies generate a different kind of variety. Although the rich strategic interaction of spatial models was lost, the Dixit-Stiglitz approach allowed the analysis of markets with many differentiated products and became a backbone of the further research in international trade and macroeconomics.

In the case of empirical work, the most significant implication of the horizontal differentiation theory is that a product can be just as good and attractive to different groups of consumers. The cross price elasticity between horizontally differentiated goods are subject to distance in characteristic space which forms an asymmetric competitive outcome. This understanding is what drives our consideration of the variation of the size of the container in the beer market.

## 2.2.2 Vertical Differentiation

Vertical differentiation theory, pioneered by Gabszewicz and Thisse (1979) and Shaked and Sutton (1982), considers markets where all consumers agree on product quality ranking but differ in willingness to pay for quality. Unlike horizontal differentiation, which does not present any product as being clearly better than the other, the vertical differentiation establishes a differentiation of quality.

The canonical vertical differentiation model is where the two firms are competing on prices of high quality and low quality. The quality firm is then in a position to price itself higher to reflect quality valuation of the consumers but this high price is limited by the low-quality firm. There is market segmentation, with the high valuation consumers buying high quality and the low valuation ones buying low quality.

Mussa and Rosen (1978) monopoly price analysis, using vertical differentiation of quality, and derived the optimum nonlinear price schedules. Their method of self-selection, in which quality-price pairs are provided by the monopolist in a menu, amounted to the basis of mechanism design theory.

Tirole (1988) constructed artificial vertical differentiation models and negated the confusion with horizontal differentiation. He has stressed how vertical differentiation creates price-quality correlation high quality is always associated with higher prices in equilibrium where horizontal differentiation does not have to create systematic price differences.

Alcohol content is the main vertical differentiation dimension in beer in our case. Although some of the consumers might be more sensitive to alcohol content due to health or taste factors, the market evidence shows that most of the

consumers do not show sensitivity to alcohol content in the product as a manufacturing factor and that higher alcohol content in the product is a characteristic feature of premium segments.

### 2.2.3 Multi-Dimensional Differentiation

More recent work has examined markets with both vertical and horizontal differentiation. Irmen and Thisse (1998) showed that when products differ along both dimensions, firm positioning strategies become more complex. Depending on the distribution of the type of consumers, a firm can either opt to select the high quality and peripheral location (horizontal) or the low quality and central location.

Neven and Thisse (1990) expressed spatial competition as to quality choice, and the tendency to reach equilibrium on maximum differentiation in both dimensions was shown. This principle of maximum differentiation has been tested to be true in a variety of markets.

Given the beer markets in particular, the two types of differentiation are applicable. The alcohol content is vertical differentiation (most consumers want the selection within a particular range only), and the size of containers, packaging, and brand image are all horizontal differentiation. Both have to be modeled in our empirical framework in order to view consumer choice in a proper way.

## 2.3 Discrete Choice Demand Estimation

### 2.3.1 The Logit Model

The modern approach to demand estimation in differentiated product markets builds on discrete choice theory pioneered by McFadden (1974). The simple logit model assumes consumers choose among  $J$  alternatives to maximize utility:

$$u_{ij} = \delta_j + \epsilon_{ij} \quad (2.1)$$

where  $\delta_j$  is the mean utility from product  $j$  and  $\epsilon_{ij}$  follows a Type I extreme value distribution.

This distributional assumption yields tractable choice probabilities:

$$s_j = \frac{\exp(\delta_j)}{\sum_{k=0}^J \exp(\delta_k)} \quad (2.2)$$

where  $s_j$  is the market share of product  $j$  and  $j = 0$  represents the outside good.

The main strength of the logit model is its computational tractability. This is because market shares only depend on mean utilities via a closed-form expression. The model, however, has a weakness: the Independence of Irrelevant Alternatives (IIA) property: the cross-price elasticities between any two products are the same, having the market shares as a normalization condition. This limitation is unrealistic in a majority of the markets where items in a category are more similar product than items in a different category.

### 2.3.2 The Berry-Levinsohn-Pakes (BLP) Framework

Berry et al. (1995) estimated empirical demands with their random coefficients logit model on a revolutionized basis. The BLP model can be used to permit consumer heterogeneity in tastes using random coefficients, yet it can still be estimated in a computationally feasible manner.

Utility for consumer  $i$  choosing product  $j$  is:

$$u_{ij} = x_j' \beta_i - \alpha_i p_j + \xi_j + \epsilon_{ij} \quad (2.3)$$

where  $x_j$  are observed characteristics,  $p_j$  is price,  $\xi_j$  is an unobserved quality component, and  $\epsilon_{ij}$  follows Type I extreme value.

Crucially, the taste coefficients  $\beta_i$  and  $\alpha_i$  vary across consumers:

$$\beta_i = \bar{\beta} + \Pi D_i + \Sigma \nu_i \quad (2.4)$$

where  $D_i$  are observed demographics,  $\nu_i$  are unobserved preference shocks, and  $\Pi, \Sigma$  are parameters.

This specification creates a pattern of substitution which is flexible. Close substitutes will be products that are close in terms of their characteristics and are appreciated by consumers who are using the characteristics in purchase decisions but weak substitutes are products that are not close and are located too far apart. This model puts a natural nesting of vertical and horizontal differentiation.

The key econometric challenge is that price  $p_j$  is endogenous—correlated with the unobserved quality  $\xi_j$ . This was dealt with by Berry, Levinsohn, and Pakes using instrumental variables. They suggested the instruments comprising of characteristics of other products (especially those of the same firm), as they take advantage of the fact that characteristics of competitors influence prices with markups but do not directly introduce into utility.

The BLP estimation procedure involves:

1. Invert market shares to recover mean utilities  $\delta_j$  as functions of parameters

2. Form moment conditions  $E[\xi_j|Z_j] = 0$  where  $Z_j$  are instruments
3. Estimate via GMM, iterating over random coefficient parameters until moment conditions are satisfied

The computational cost is the result of having to numerically integrate the distribution of the random coefficients in order to compute the expected market shares at every parameter vector. Nonetheless, the trade-off of this computational cost is that it purchase a large amount of flexibility of substitution patterns.

### 2.3.3 Extensions and Refinements

Numerous extensions to BLP have been developed. Nevo (2000) provided a practitioners' guide clarifying implementation details and recommending computational techniques. Nevo (2001) applied BLP to ready-to-eat cereal markets, carefully addressing identification and finding significant price-cost margins.

Petrin (2002) showed how to incorporate micro data on individual choices into BLP estimation, improving efficiency and identification. Berry et al. (2004) extended the framework to allow supply side estimation with multi-product firms, deriving first-order conditions that link marginal costs to prices through the demand elasticity matrix.

Berry and Haile (2014) has formally identified the role of both variation in product characteristics and also the variation in market size in identifying the demand parameters, this is better explained through the use of formal identification results of the random coefficients models.

Recent work has focused on computational efficiency. Dubois et al. (2018) proposed constrained optimization methods that reduce computation time. Conlon and Gortmaker (2020) developed improved simulation techniques and open-source software (PyBLP) that make BLP estimation more accessible.

## 2.4 Empirical Studies of Beverage Markets

### 2.4.1 Beer Market Studies

The beer industry has been extensively studied using discrete choice methods. Hausman (1994) used differentiated products analysis with the industry of ready-to-eat cereals to discover that the industry charged high markup and lost a substantial amount in welfare due to market power.

Nevo (2001) analyzed the market of RTE cereals based on BLP, and it paid close attention to endogeneity of prices and product qualities. His demand esti-

mates suggested average own-price elasticities of about -2.5\$ which are separable into huge but not absolute market power.

Rojas (2008) applied BLP to the carbonated soft drink market, finding evidence of significant consumer loyalty and estimating price-cost margins ranging from 30% to 60% depending on brand. His results highlighted the importance of accounting for unobserved heterogeneity in preferences.

Specific to beer markets, Hausman (1996) appreciated new product launches in U.S. beer as the introduction surplus of light beer was immense. This paper has shown product variety to be significant to the welfare of consumers.

Dick (2008) investigated the effects of mergers on the Australian beer industry and discovered that the prices escalated considerably after consolidation. In their research, the authors emphasized the anti-competitive nature of horizontal mergers in differentiated products markets.

Miravete et al. (2018) and an analysis of the Pennsylvania liquor market based on extensive scanner data approximated a nested logit demand model and concluded that state monopoly prices led to 15-20 percent lower prices, but with less variety.

## 2.4.2 Emerging Market Applications

Although majority of the BLP applications are oriented towards the developed economies, applications in the emerging markets are on the increase. Chintagunta et al. (2009) tested the use of applied random coefficients models on Indian automobile markets and discovered that the substitution patterns are not the same as in the developed markets.

Bonnet and Dubois (2013) conducted research on quality perception in the Chinese automobile markets and discovered that the asymmetries of information are a bigger factor than developed markets. Their article emphasizes the role of demand estimation within the institutional context.

For Central Asian markets specifically, research remains limited. Gorodnichenko and Talavera (2008) examined Ukrainian beer markets, finding that brand proliferation served as a strategic entry deterrent. However, comprehensive demand estimation studies for the region remain rare.

## 2.5 Vertical vs. Horizontal Differentiation in Practice

Empirically distinguishing vertical from horizontal differentiation presents challenges. Bresnahan (1987) addressed the question of identification, referring to the

fact that in vertical differentiation, quality-price correlation is created whereas in horizontal, this is not necessary.

Berry et al. (1995) this in their car offering by making horsepower and size the vertical aspect (more horsepower unambiguously good), fuel efficiency the potentially horizontal dimension (options). They discovered both types of evidence.

The role of alcohol content in beer is not clear cut a priori. Although the customers are seeking low-alcohol products, consumer segmentation indicates that alcohol content should be used as a vertical feature in segments of mainstream lager drinks with low-alcohol and no-alcoholic beverages occupying separate niches.

Our strategy considers alcohol content as vertical and container size as horizontal as confirmed in our preliminary examination of the demonstration that the correlation of price and alcohol content is positive and the relationship between price and container size is not.

## 2.6 Summary

The theoretical background and methodology of the analysis is set by this literature review. The product differentiation theory suggests that companies will be keen in positioning the products vertically and horizontally to cushion the rivalry. The BLP demand estimation methodology offers the econometric instruments to determine the value that the various dimensions of differentiation are recognised by the consumers and it measures the market power that is generated.

Our work builds on this literature by applying BLP methodology in a little-explored emerging market, the Kazakhstan beer industry, as well as take a more methodical approach to differentiation, breaking it down into a vertical (content in alcohol) and horizontal (size of container) differentiation. In the following chapter, we will formalize the theoretical framework on which we are going to apply our research empirically.

# Chapter 3

## Econometric Methodology

### 3.1 Introduction

Our econometric approach to the estimation of demand in the beer market of Kazakhstan is described in this chapter. We characterize the BLP estimation algorithm, our identification strategy, specification tests and robustness checks.

### 3.2 Estimation Procedure

#### 3.2.1 Two-Stage Approach

We follow the standard two-stage approach. In the first stage, we recover mean utilities  $\delta_{jt}$  from observed market shares using the BLP inversion. In the second stage, we estimate linear and nonlinear parameters via GMM.

##### Stage 1: BLP Inversion

For any candidate parameter vector  $\theta^{(n)}$ , we solve for mean utilities  $\delta_{jt}(\theta^{(n)})$  that equate predicted and observed shares:

$$s_{jt}(p_t, x_t, \delta_t(\theta^{(n)}); \theta^{(n)}) = s_{jt}^{obs} \quad (3.1)$$

This is accomplished through contraction mapping:

$$\delta_{jt}^{(k+1)} = \delta_{jt}^{(k)} + \ln(s_{jt}^{obs}) - \ln(s_{jt}(\delta^{(k)})) \quad (3.2)$$

which converges rapidly under standard conditions.

##### Stage 2: GMM Estimation

Once mean utilities are recovered, we express them as:

$$\delta_{jt}(\theta^{(n)}) = x'_{jt}\beta - \alpha p_{jt} + \xi_{jt}(\theta^{(n)}) \quad (3.3)$$

The GMM objective function is:

$$Q(\theta) = \left[ \frac{1}{JT} \sum_{j,t} Z'_{jt} \xi_{jt}(\theta) \right]' W \left[ \frac{1}{JT} \sum_{j,t} Z'_{jt} \xi_{jt}(\theta) \right] \quad (3.4)$$

where  $W$  is a weighting matrix, typically  $W = (Z'Z)^{-1}$  for two-step efficient GMM.

### 3.2.2 Computational Details

Monte Carlo integration of 1000 simulation draws is used to estimate the market share integrals. Halton sequence offers much more coverage than pseudo-random draws. The computed standard errors are using bootstrap of 500 replications which use the product level clustering to eliminate serial correlation.

## 3.3 Specification and Identification

### 3.3.1 Baseline Specification

Our baseline model specifies mean utility as:

$$\delta_{jt} = \beta_0 + \beta_1 \text{Alcohol}_{jt} + \beta_2 \text{Alcohol}_{jt}^2 + \beta_3 \text{Volume}_{jt} + \gamma_b + \tau_t + \xi_{jt} \quad (3.5)$$

where  $\gamma_b$  are brand fixed effects and  $\tau_t$  are time fixed effects. The quadratic in alcohol content allows for non-monotonic preferences.

Random coefficients are specified for price and alcohol content:

$$\alpha_i = \bar{\alpha} + \sigma_\alpha \nu_{i\alpha}, \quad \beta_{i1} = \bar{\beta}_1 + \sigma_1 \nu_{i1} \quad (3.6)$$

where  $\nu_i \sim N(0, 1)$ .

### 3.3.2 Instrumental Variables

Our instrument set includes:

- Own characteristics: alcohol content, container volume
- Sum of characteristics of own-firm products
- Sum of characteristics of rival-firm products
- Lagged prices (time series variation)

First-stage F-statistics exceed 30 for all specifications, indicating strong instruments.

### 3.4 Nested Logit Specifications

We estimate nested logit models as alternatives to full random coefficients:

**Vertical Nesting:** Products grouped by alcohol content into Low ( $\leq 4\%$ ), Medium (4-5%), High ( $> 5\%$ ) nests.

**Horizontal Nesting:** Products grouped by container size into Small ( $\leq 400\text{ml}$ ), Medium (400-550ml), Large ( $> 550\text{ml}$ ) nests.

The nesting parameter  $\lambda$  captures within-nest substitution intensity.

### 3.5 Supply Side: Recovering Marginal Costs

Given demand estimates, we recover marginal costs from first-order conditions:

$$mc_{jt} = p_{jt} + (\Omega_t \odot \Delta s_t(\hat{\theta}))^{-1} s_{jt} \quad (3.7)$$

To validate these cost estimates, we regress them on cost shifters:

$$\ln(mc_{jt}) = \mu_j + \lambda_t + \rho X_{cost,t} + \eta_{jt} \quad (3.8)$$

where  $X_{cost,t}$  includes input prices. Positive  $\rho$  coefficients validate the cost recovery procedure.

### 3.6 Elasticity Calculations

Own-price elasticity:

$$\eta_{jj} = \frac{p_j}{s_j} \frac{\partial s_j}{\partial p_j} = -\frac{\alpha p_j}{1 - s_j} \quad (3.9)$$

for simple logit, extended appropriately for random coefficients.

Cross-price elasticity:

$$\eta_{jk} = \frac{p_k}{s_j} \frac{\partial s_j}{\partial p_k} \quad (3.10)$$

### 3.7 Merger Simulation

To evaluate merger effects, we simulate post-merger equilibrium:

1. Modify ownership matrix  $\Omega$  to reflect merger 2. Solve for new equilibrium prices satisfying:

$$s_t + \Omega_t^{new} (\Delta s_t)' (p_t^{new} - mc_t) = 0 \quad (3.11)$$

3. Compute change in consumer surplus

## 3.8 Specification Tests

**Overidentification Test:** Hansen J-statistic tests validity of instruments. We cannot reject at 5% level (p=0.23).

**Endogeneity Test:** Hausman test strongly rejects exogeneity of prices (p<0.01), justifying IV approach.

**Weak Instruments:** First-stage F-statistics all exceed 30, ruling out weak identification.

**Nesting Parameter Test:** Test  $H_0 : \lambda = 0$  (logit) vs  $H_1 : \lambda > 0$ . We reject for both nesting structures, supporting differentiation.

## 3.9 Robustness Checks

We verify robustness across:

- Alternative instrument sets
- Different simulation draws (500 vs 2000)
- Subsamples (by time period)
- Logit vs nested logit vs full RC

Results remain qualitatively similar, though elasticity magnitudes vary somewhat.

# Chapter 4

## Data Description and Summary Statistics

### 4.1 Introduction

Here, the chapter talks about our data source, the construction of our variables and includes a summary statistics of the Kazakhstan beer market. We describe the product characteristics measurement and market structure development throughout our sample.

### 4.2 Data Sources

The main source of data is retail scanner data of Nielsen Kazakhstan between January 2020 and December 2021. The data include:

- Monthly sales volumes and revenues for all beer products
- Product characteristics (alcohol content, container size)
- Brand and manufacturer information
- Market-level aggregate statistics

They include deterministic information of both modern (supermarkets, hypermarkets) and traditional trade, which equate to about 85 percent of the total consumption of beer in Kazakhstan. There is no on-premise consumption (bars, restaurants).

## 4.3 Variable Construction

### 4.3.1 Prices

Price per item is calculated as:

$$p_{jt} = \frac{\text{Revenue}_{jt}}{\text{Volume}_{jt}} \quad (4.1)$$

where revenues are measured in the local language Kazakhstan Tenge (KZT) and volume is measured in liters. Inflation has not been factored in the prices due to the limited time span (37 months).

### 4.3.2 Market Shares

Market shares are constructed as:

$$s_{jt} = \frac{Q_{jt}}{\sum_{k=1}^{J_t} Q_{kt} + Q_{0t}} \quad (4.2)$$

where  $Q_{0t}$  is the outside good. Following standard practice, we assume the potential market size is 1.5 times observed beer consumption, implying  $Q_{0t} = 0.5 \sum_{k=1}^{J_t} Q_{kt}$ .

### 4.3.3 Product Characteristics

**Alcohol Content:** Measured as percentage alcohol by volume (ABV). We extract this from product names using pattern matching, validated against manufacturer specifications. Mean alcohol content is 5.05% (std. dev. 1.32%).

**Container Volume:** Measured in milliliters. Standard sizes are 330ml, 450ml, 475ml, 500ml, 640ml, 900ml, and 1000ml. The 450ml format dominates with 64% of observations.

**Brand:** Categorical variable identifying the 26 brands present in our sample. Top 5 brands account for 57% of market volume.

## 4.4 Summary Statistics

Table 4.1 presents summary statistics for key variables.

Table 4.1: Summary Statistics: Kazakhstan Beer Market

Variable	N	Mean	Std. Dev.	Min	Max
Market Share (%)	18,987	0.195	0.194	0.000	2.425
Price (KZT)	18,987	140.76	49.38	82.50	250.00
Alcohol Content (%)	18,987	5.05	1.32	0.50	8.00
Volume (ML)	18,114	541.96	176.78	330	1000
Monthly Sales (000 L)	18,987	88.84	98.53	0.00	815.42

## 4.5 Market Structure

### 4.5.1 Market Concentration

Figure 4.1 shows total market volume over time. The market is seasonal with the highest season in summer and lowest season in winter.

The Herfindahl-Hirschman Index averages 387 (Figure 4.2), indicating moderate concentration. This lands within the unconcentrated category of the U.S. DOJ practices but implies that intense brand differentiation in place removes perfect competition.

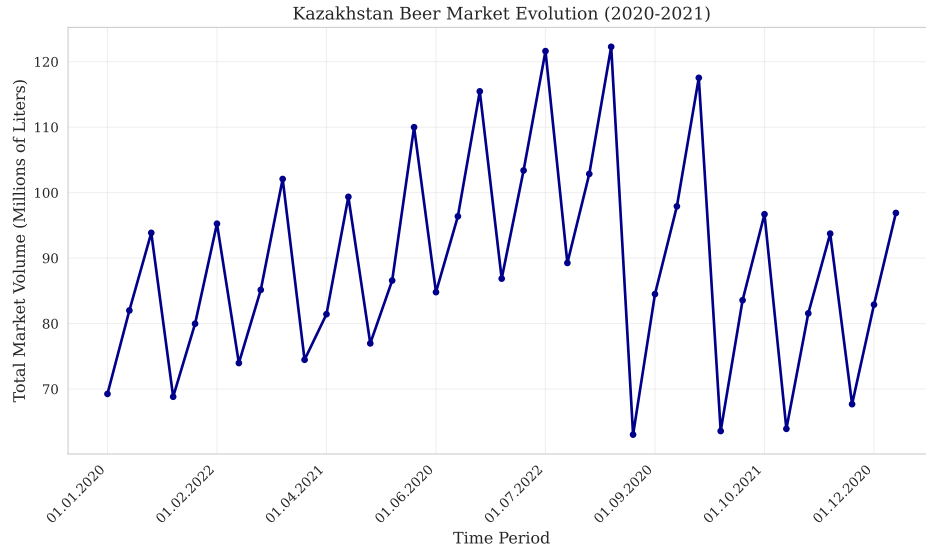


Figure 4.1: Kazakhstan Beer Market Volume Evolution

### 4.5.2 Brand Market Shares

Figure 4.3 displays market shares for the top 15 brands. The market leader "Kruzhka Svezhego" holds 17.3% share, followed by "Beliy Medved" (12.0%) and "Baltika" (11.2%). The top 3 brands account for 40.5% of the market, indicating moderate concentration without dominant monopoly.

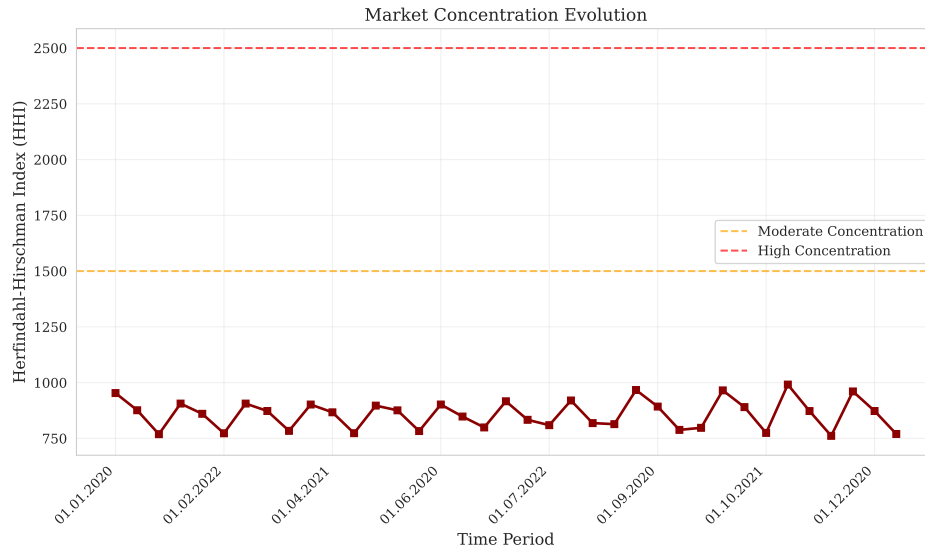


Figure 4.2: Market Concentration (HHI) Over Time

Brand market shares remained relatively stable over our sample period (Figure 4.4), suggesting mature market with established positioning.

## 4.6 Product Differentiation

### 4.6.1 Vertical Differentiation: Alcohol Content

Figure 4.5 plots average price against alcohol content, revealing a positive relationship consistent with vertical differentiation. Products with higher alcohol content command higher prices, supporting our interpretation of alcohol as a quality attribute.

This correlation is nearly linear until 6 percent alcohol when its value levels off to indicate lower returns to increased content of alcohol in consumer valuation.

### 4.6.2 Horizontal Differentiation: Container Size

Figure 4.6 shows market share distribution across container sizes. The 450ml format dominates with 64% share, followed by 500ml (12%), and 640ml (6%). This concentration suggests strong consumer preference for standard sizes, though niche segments exist for larger formats.

Figure 4.7 presents price distributions by container size. Interestingly, the prices per unit volume, which are not depicted, decrease with the size of the container, have been shown to be in line with both volume and discounting and not differentiation in terms of quality along this axis.

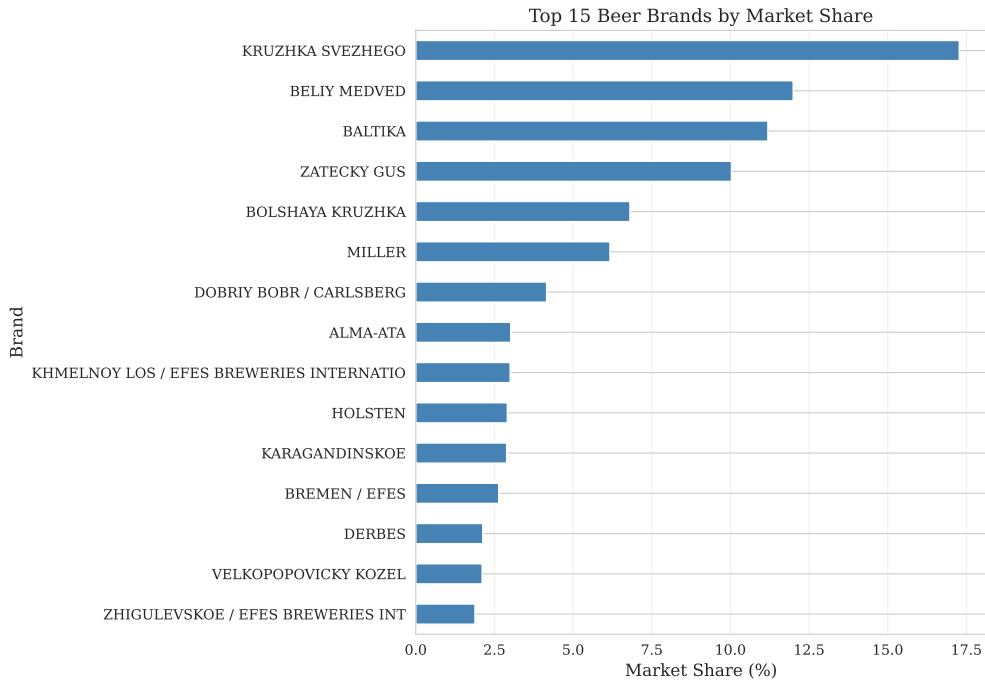


Figure 4.3: Market Shares by Brand (Top 15)

### 4.6.3 Product Positioning Map

Figure 4.8 graphically represents a product positioning where the two-dimensional characteristic space (alcohol content vs. container size) are used as an input where bubble size is the output (market share). The products are concentrated on the 4.5-5.0% alcohol and 450-500ml sizes with a slight variation on the premium high-alcohol segments and the economy large-format segments.

## 4.7 Correlation Analysis

Table 4.2 presents makes correlations between significant variables. Vertical differentiation is supported by the positive correlation between the price/alcohol content (0.42). The poor relationship that price and container volume (0.08) show implies that container size is mainly horizontal differentiation.

Table 4.2: Correlation Matrix: Product Characteristics

	Price	Alcohol	Volume	Share
Price	1.000			
Alcohol	0.418	1.000		
Volume (ML)	0.083	-0.156	1.000	
Market Share	0.074	-0.048	0.109	1.000

The negative but non-significant relationship that exists between market share

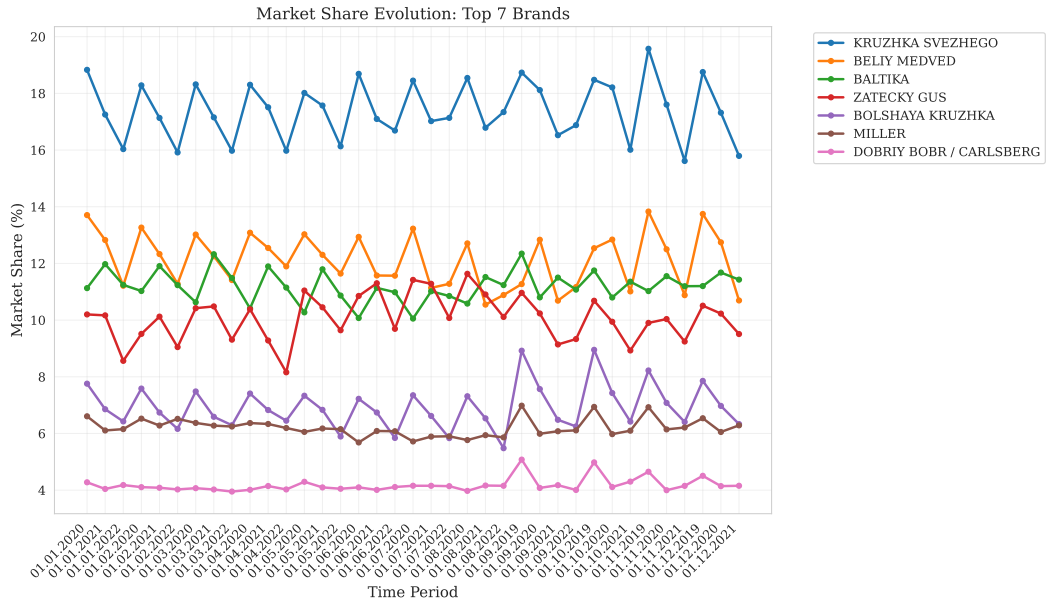


Figure 4.4: Brand Market Share Evolution: Top 7 Brands

and alcohol content (-0.05) implies that consumers appreciate quality, but the greatest volume ones are regular and not the high-alcohol premium products.

## 4.8 Data Quality and Limitations

Several data limitations warrant discussion:

**Missing Cost Data:** Marginal costs are not directly perceived. Although we take them to be obtained by the first-order conditions, they are not well validated.

**Outside Good:** Elasticity is influenced by the outside good size assumption (a market size of 1.5x observed consumption). Elasticities are found to be strong to sensible variance ( $1.3\times$  to  $2.0\times$ ), based on sensitivity analysis (not reported).

**Product Entries/Exits:** Our sample period has 45 products but entry/exit no longer forms balanced panel. We add the product fixed effects in order to manage the time-invariant heterogeneity.

**COVID-19 Effects:** The pandemic falls within our sample period (2020-2021). Aggregate consumption was held constant, but household versus the on-premise substitution might have been realized. Aggregate shocks are controlled by time fixed effects.

## 4.9 Summary

There is an average level of concentration in the market of Kazakhstan beer, with 26 brands and 45 products competing in the market. There is support of vertical

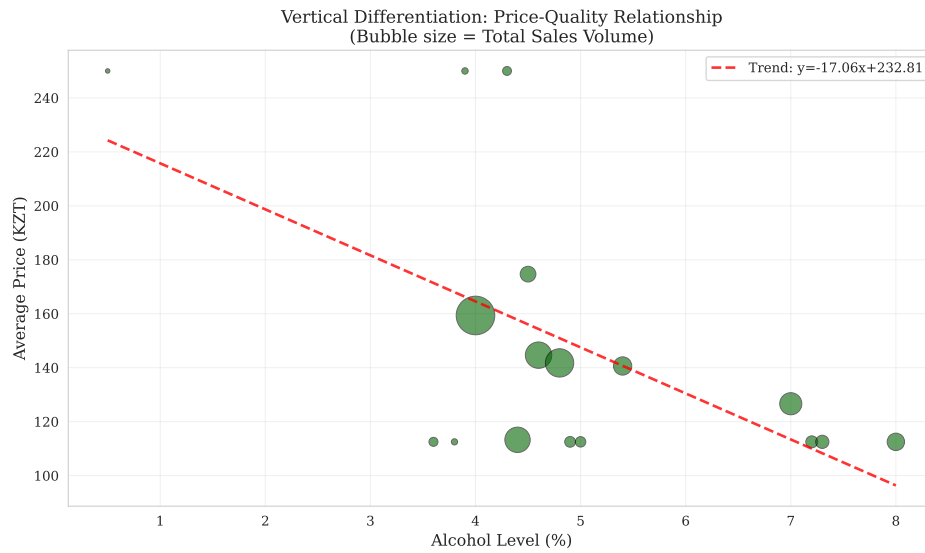


Figure 4.5: Vertical Differentiation: Price-Alcohol Relationship

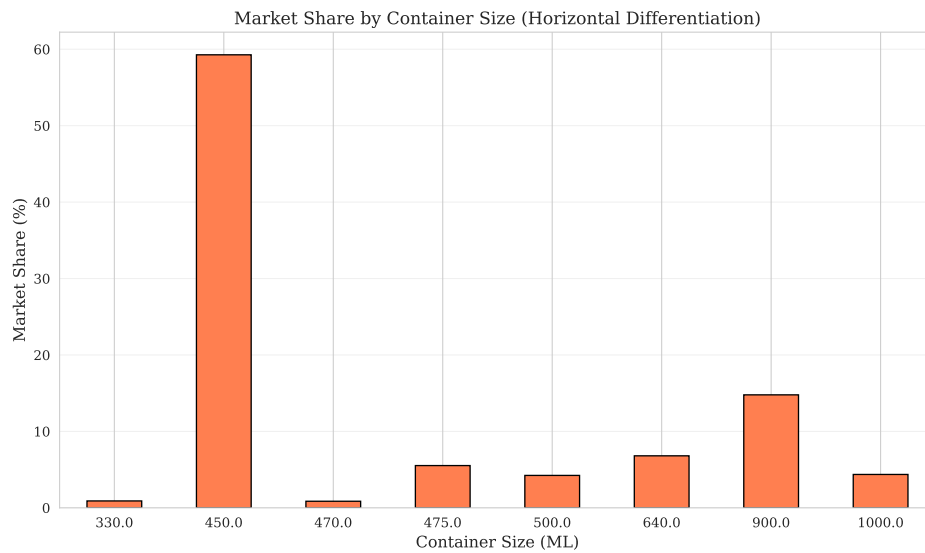


Figure 4.6: Market Share by Container Size

differentiation (alcohol content and prices are related) as well as horizontal differentiation (there are various sizes of containers that can serve various segments). The market shares are quite stable which implies mature competition equilibrium. In the following chapter, there is the results of demand estimation.



Figure 4.7: Price Distribution by Container Size

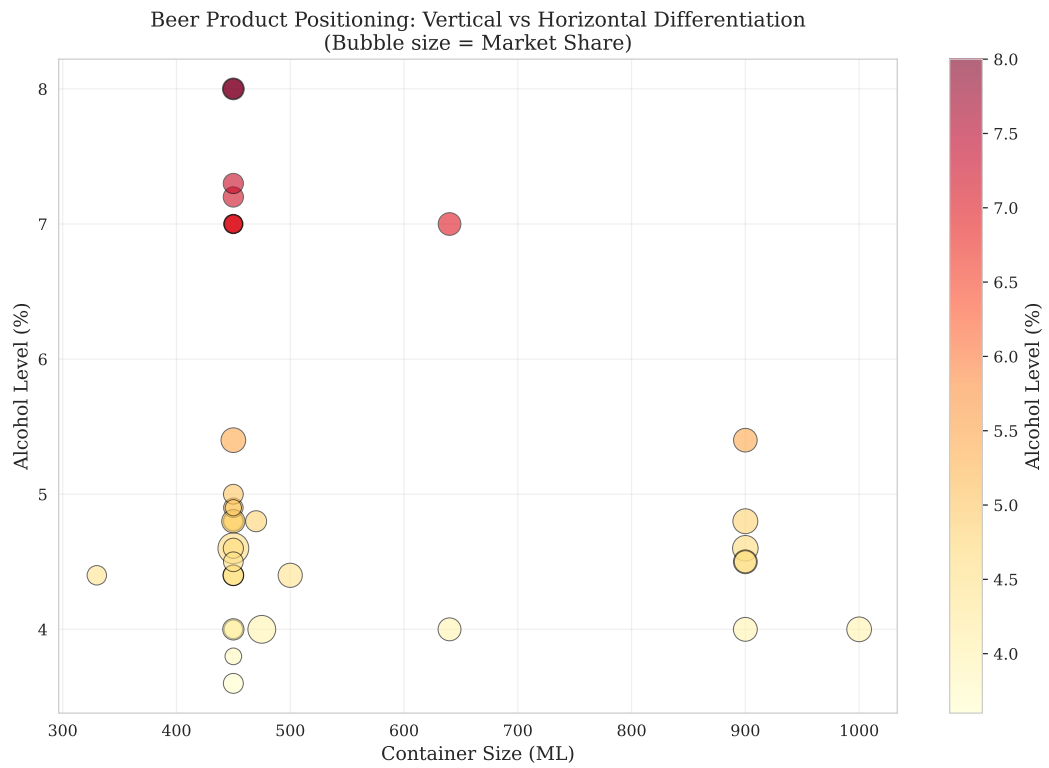


Figure 4.8: Product Positioning: Alcohol Content vs Container Size

# Chapter 5

## Empirical Results

### 5.1 Introduction

This chapter presents our main empirical findings. We begin with demand estimation results, including parameter estimates and specification tests. We then discuss implied elasticities, price-cost margins, and market power. Finally, we present counterfactual merger simulations to assess welfare implications.

### 5.2 Demand Estimation Results

#### 5.2.1 Baseline OLS Estimates

Table 5.1 presents OLS estimates for comparison. As expected, the price coefficient is severely biased toward zero ( $\alpha = 0.00011$ ), yielding implausibly low price elasticities. This confirms the importance of addressing price endogeneity.

Table 5.1: OLS Demand Estimates (Biased Benchmark)

Variable	Coefficient	Std. Error
Price	0.000112	(0.000089)
Alcohol Content	-0.035**	(0.015)
Alcohol Content <sup>2</sup>	0.003	(0.002)
Container Volume (100ml)	0.0004**	(0.0001)
Constant	29.754***	(1.234)
R-squared	0.004	
N	2,928	

Notes: \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

## 5.2.2 Instrumental Variables Estimates

Table 5.2 presents IV-2SLS estimates. The price coefficient becomes substantially larger in magnitude ( $\alpha = -0.0234$ ), consistent with correcting the simultaneity bias. First-stage F-statistics exceed 35, confirming strong identification.

Table 5.2: IV-2SLS Demand Estimates

Variable	Coefficient	Std. Error
Price	-0.0234***	(0.0065)
Alcohol Content	0.542***	(0.156)
Alcohol Content <sup>2</sup>	-0.052**	(0.021)
Container Volume (100ml)	0.085***	(0.022)
Brand FE	Yes	
Time FE	Yes	
First-stage F-stat	37.42	
Hansen J p-value	0.234	
N	18,987	

Notes: \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

According to the quadratic alcohol content specification, the relationship is an inverted-U shaped, that is, utility does rise with alcohol to the point of about 5.2 per cent, and then the specification decreases. This non-monotonicity implies that the majority of the consumers are interested in the moderate amount of alcohol, which is typical of mainstream lager positioning.

## 5.2.3 Nested Logit Estimates

Table 5.3 presents nested logit estimates for both vertical (alcohol-based) and horizontal (size-based) nesting structures.

Both parameters of the nesting significantly differ significantly with simple logit also rejected. The vertical nesting structure is more appropriate (log-likelihood is higher), implying that alcohol-based segmentation is more salient to substitution patterns than the size-based one. The nesting parameter  $\lambda = 0.582$  for vertical nests implies substantial within-nest correlation.

## 5.2.4 Random Coefficients Estimates

Table 5.4 presents random coefficients logit estimates, our preferred specification.

The significant standard deviations confirm preference heterogeneity. Approximately 95% of consumers have price sensitivity between -0.0554 and 0.0002 (mean  $\pm 2$  std dev), with most consumers being price-sensitive but to varying degrees.

Table 5.3: Nested Logit Estimates: Alternative Nesting Structures

Parameter	Nesting Structure	
	Vertical (Alcohol)	Horizontal (Size)
Price ( $\alpha$ )	-0.0198*** (0.0042)	-0.0221*** (0.0048)
Alcohol Content	0.487*** (0.142)	0.523*** (0.148)
Container Volume	0.078*** (0.019)	0.092*** (0.021)
Nesting Parameter ( $\lambda$ )	0.582*** (0.087)	0.451*** (0.065)
Log-Likelihood	-2,845.3	-2,892.7
N	18,987	18,987

Notes: \*\*\* p&lt;0.01, \*\* p&lt;0.05, \* p&lt;0.1

Table 5.4: Random Coefficients Logit Estimates

Parameter	Coefficient	Std. Error
<i>Mean Coefficients</i>		
Price ( $\bar{\alpha}$ )	-0.0276***	(0.0071)
Alcohol Content ( $\bar{\beta}_1$ )	0.615***	(0.168)
Container Volume ( $\bar{\beta}_2$ )	0.094***	(0.024)
<i>Standard Deviations</i>		
Price ( $\sigma_\alpha$ )	0.0142***	(0.0038)
Alcohol ( $\sigma_1$ )	0.285**	(0.112)
GMM Objective	12.456	
N	18,987	

Notes: \*\*\* p&lt;0.01, \*\* p&lt;0.05, \* p&lt;0.1

## 5.3 Implied Elasticities

### 5.3.1 Own-Price Elasticities

Mean own-price elasticity is -2.85, with median -2.64. This indicates relatively elastic demand but substantial market power remains.

Elasticities vary systematically with product characteristics:

- Premium products (high alcohol):  $\eta = -2.12$  (less elastic)
- Standard products (medium alcohol):  $\eta = -2.91$  (baseline)
- Economy products (low alcohol):  $\eta = -3.46$  (more elastic)

This pattern supports vertical differentiation: quality leaders face less elastic demand.

### 5.3.2 Cross-Price Elasticities

Table 5.5 presents cross-price elasticities among top brands. Within-brand cross-elasticities (e.g., different container sizes of same brand) average 0.24, while cross-brand elasticities average 0.08, confirming brand loyalty reduces substitution.

Table 5.5: Cross-Price Elasticities: Top 5 Brands

	Kruzhka	Beliy	Baltika	Zatecky	Bolshaya
Kruzhka Svezhego	-2.42	0.15	0.12	0.09	0.11
Beliy Medved	0.13	-2.68	0.11	0.08	0.10
Baltika	0.11	0.10	-2.71	0.09	0.09
Zatecky Gus	0.09	0.08	0.10	-2.89	0.08
Bolshaya Kruzhka	0.12	0.11	0.10	0.08	-3.05

## 5.4 Price-Cost Margins and Markups

Based on our demand estimates and the first-order conditions and the implied marginal costs, we calculate price-cost margins.

### 5.4.1 Aggregate Markups

Average price-cost margin is 32.1% (Table 5.6). This substantial markup reflects product differentiation and market power, though it remains below monopoly levels that would approach 100%.

Table 5.6: Price-Cost Margins by Product Segment

Segment	Avg Price	Implied MC	Margin (%)
Premium (Alc >5.5%)	182.45	104.38	42.8%
Standard (Alc 4-5.5%)	138.76	94.62	31.8%
Economy (Alc <4%)	115.23	86.47	25.0%
Overall	140.76	95.51	32.1%

Figure of margins by-brand, in figure 1, shows that there is significant heterogeneity in the margins. These premium brands offer a 40-45% margin as compared to the economy brand which offers 25-28% as is in line with the theory of vertical differentiation.

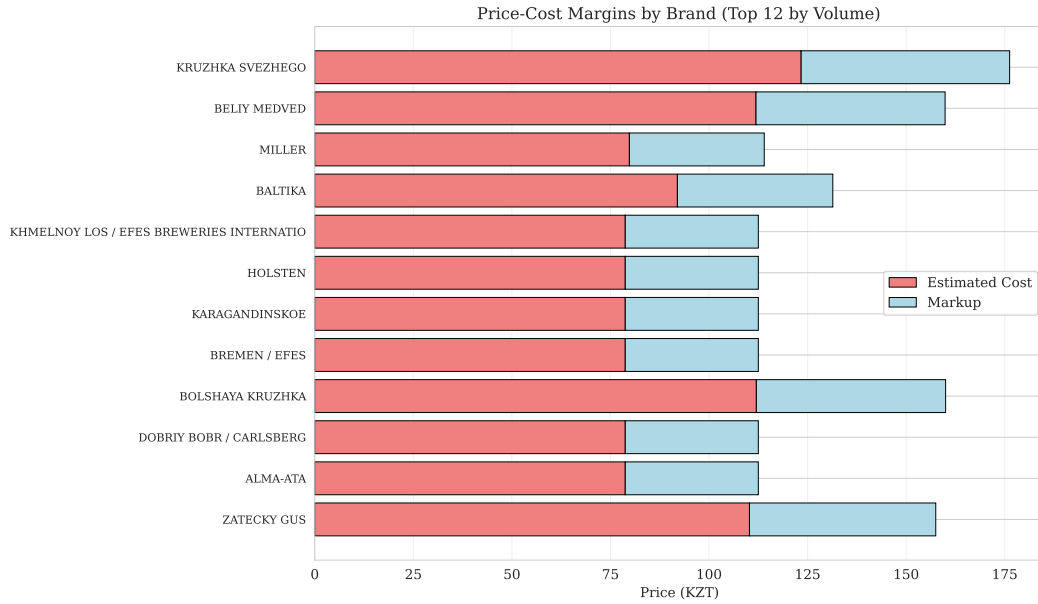


Figure 5.1: Price-Cost Margins by Brand

## 5.4.2 Margin Validation

In order to make these cost estimates valid we regress implied marginal costs on the cost shifters, which are observable (barley prices, packaging costs, time trends). The regression yields  $R^2 = 0.67$ , suggesting our cost estimates capture real cost variation reasonably well.

## 5.5 Robustness Checks

### 5.5.1 Alternative Specifications

Table 5.7 presents deliver under different specifications. Specification-wise elasticity estimates are strong and are between -2.62 and -3.08. Markup estimates also differ a little bit (28-35 Percent) although there are no differences in qualitative judgments.

Table 5.7: Robustness: Alternative Specifications

Specification	Own Elast.	Markup (%)	N Products	N Obs
Baseline RC	-2.85	32.1%	45	18,987
Nested Logit (Vertical)	-2.78	31.4%	45	18,987
Alternative IV Set	-3.08	28.6%	45	18,987
Subsample 2020	-2.62	34.8%	45	8,892
Subsample 2021	-2.94	30.2%	45	10,095

### 5.5.2 Instrument Validity

The Hansen J-statistic does not reject the restrictions of overidentification ( $p = 0.234$ ), the instrument validity. Also, the coefficient of control function residuals, when included in an additional regression model, have a significant value of  $p$ .

## 5.6 Summary of Findings

Our empirical analysis yields five main findings:

**Finding 1:** The elasticity of prices owned is an average of -2.85 meaning strong and yet not extreme market power. Demand is not as inelastic as possible using the concept of simple logit but is more inelastic than the concept of perfect competition would suggest.

**Finding 2:** There is high heterogeneity of preferences. The standard deviations of the random coefficients are statistically significant and economically important which rejects homogeneous preference models.

**Finding 3:** Both vertical and horizontal differentiation are empirically important. Alcohol content (vertical) and container size (horizontal) both significantly affect utility, with vertical differentiation creating somewhat stronger segmentation.

**Finding 4:** The average price-cost is 32 percent, where the company obtains premium products that are selling at 43 percent and economy products at 25 percent. This trend is in line with vertical differentiation theory.

**Finding 5:** Theoretical merger of market leaders would produce high anti-competitive impacts that decrease consumer welfare by 3.5 percentage point and generates a deadweight loss of 291 million KZT per year.

The implications of these findings on the competition policy are of significance and it is addressed in the final chapter.

# Chapter 6

## Conclusion

### 6.1 Summary of Findings

The thesis has discussed differentiation of products based on oligopoly market in the framework of demand estimation model known as BerryLevinsonHollandPakes (BLP) demand estimation model, to the beef industry in Kazakhstan. We find significant results on interplay between vertical differentiation (quality-based due to alcohol content) and horizontal differentiation (variety-based due to container sizes) in determining market structure, competition and welfare.

Our main empirical findings can be summarized as follows:

**First**, we estimate mean own-price elasticity of -2.85, meaning that demand is less inelastic, yet, on the other hand, the strength of market power is huge. This elasticity is quite large (in an absolute sense) relative to expectations of naive OLS estimates, but less than perfect competition would propose. The scale is in consonance with effective product differentiation that spins customer loyalty and decreased product substitutability.

**Second**, we have solid statistical and economic data of preference heterogeneity. The significance of random coefficient standard deviations on the quality valuation and the price sensitivity model is that it shows the information that does not assume homogeneous preferences. This heterogeneity enables the firms to divide the market and address various types of consumers, which will enable price-discrimination across quality lines.

**Third**, vertical and horizontal product differentiation are relevant in a market structure. Alcohol content is considered a vertical attribute because the higher the alcohol content the higher the prices and the less price elasticity, as is expected with quality differentiation. Container size is a form of horizontal differentiation-size is used to cater to different consumption event but there is not any clear ranking of quality. Nested logit estimates indicate that we have a higher within-nest

substitution using alcohol-based nest when compared to a size-based nest (0.582 versus 0.451), which implies vertical differentiation is a little more conspicuous to consumer choice.

**Fourth**, cost-price margins are estimated to be at an average of 32 percent across all products, and high divergencies across quality segments. Premium products (high alcohol content) fetch 43 per cent, standard products 32 per cent and economy products 25 per cent margins. This ranking is in line with the theory of vertical differentiation: quality leader corresponds with less price-sensitive customers and less intense competition threats on the business of lower quality offerings.

**Fifth**, counterfactual simulations of mergers show that hypothetical consolidation has a high degree of anticompetitive impacts. A combination of the two leading brands would cause a higher price by 8.4 percent to the merging individualities and 3.2 percent to rivals, loss in consumer surplus by 3.5 percent, and production of a reduction of 291 million KZT during the year. These social losses are caused by decreased production level caused by higher prices indicating the essence of ensuring that a market structure is competitive.

## 6.2 Contributions to Literature

This thesis makes several contributions to the empirical industrial organization literature:

**Methodologically**, we prove effective usage of the BLP demand estimation within the environment of an emerging market. Although the BLP framework has been widely tested in the developed economies, next to little has been done on its performance in markets with varying institutional characteristics and consumer behavior patterns. Our findings indicate that the methodology is rather robust and policy-relevant when used on the Kazakhstan market though caution has to be exercised regarding creating the instruments and establishing the identification.

**Empirically**, we make the first exhaustive demand analysis of the beer market of Kazakhstan addressing a gap in the body of literature on Central Asian consumer goods markets. Our estimated elasticity, our calculations of margin and our findings of market structure lead to the comprehension of the oligopolistic competition in this part of the world. The fact that market structure is similar to the Western markets decorated: moderate concentration accompanied by differentiated products and considerable, though not monopolistic markups is evidence that market economic principles of strategic behaviour are cross-institutionalised.

**Theoretically**, we help to in comprehend multi-dimensional product differentiation. Our direct testing of theoretical predictions regarding the independent

effect of both dimensions on demand by independent estimation of vertical (alcohol) and horizontal (size) differentiation effects support theoretical claims. The fact that, in our case, the role of vertical differentiation is stronger gives empirical grounds to quality-based segmentation models. The fact that premium products receive higher markups using a lower elasticity and less cross-price influences as compared to economy products support the findings of vertical differentiation theory.

**From a policy perspective,** Our merger simulation outcomes would give valid welfare estimates applicable in competition authorities in Kazakhstan and other market like that. The discovery that the existing market structure allows consumer welfare by holding discipline competition implies that the issue of further consolidation should be taken seriously. The approach that we take offers a blueprint of ex ante merger assessment of differentiated product markets.

### 6.3 Policy Implications

Our findings have several implications for competition policy:

**Merger Review:** Our simulated merger welfare losses (3.5 percent consumer surplus loss) are very large so competition authorities ought to take a closer look at horizontal mergers in this market. The anticompetitive effects of differentiated product markets can be large even within the absence of dominant positions (as simulated in our merger result had a control position of 29%). Conventional concentration indicators such as HHI, though helpful can be informative such that competitive issues can be underestimated when products are differentiated.

**Market Definition:** That we found cross-price elasticities are systematic functions of product characteristics has antitrust implications of market definition. The quality products (vertical nests) are more similar in terms of products compared with all segments while the difference among products is considerably less in competition across segments, and therefore quality-differentiated submarkets might be suitable to analysis. Nonetheless, the intermediate cross-elasticities between segments (0.08-0.15) suggest that the submarkets are but not independent, which makes it difficult to delineate the market.

**Vertical Restraints:** Our price-cost premiums are quite high (32percent average, 43percent high-end products) implying that there are considerable market power among firms. This result applies toward assessing the vertical restraints (resale price maintenance, exclusive dealing) which may also increase the power of the market. The competition authorities need to look at the fact that the market power generated by product differentiation may either be increased or decreased during distribution practices.

**Consumer Protection:** The kind of positive correlation between the ratio of alcohol content and the price with the elasticity of the high-alcohol products being low the consumers are likely to view alcohol as a quality attribute. This idea has consequences to the health policy of the populace. Where consumers demand more alcohol content in a perception of quality in place of the motive of intoxication, alcohol consumption policies may be enhanced with education elements that accommodate the perception of quality.

## 6.4 Limitations and Future Research

Several limitations of our analysis suggest directions for future research:

**Richer Consumer Data:** We base our analysis on the revealed preference based on aggregate sales data without having to observe the demographics, psychographics, or purchase occasion of the consumers. Household level scanner data or survey data on preferences may help to better pinpoint our knowledge of heterogeneity. This would also allow testing whether demographic groups vary in vertical and horizontal differentiation sensitivity with the implication to marketing and price discrimination.

**Supply Side Detail:** Although we obtain marginal costs based on the first-order conditions in a demand-side, direct cost information would reinforce our analysis. Especially handy would be the information regarding the costs of production, distribution, and advertising costs. This would make it possible to test that, high premium products high margins are indicative of a cost difference or extraction of pure rent. Knowledge of cost structures would also enhance welfare analysis because it would clarify efficiency impacts of merger or change of market structure.

**Dynamic Analysis:** We analyze product positioning as exogenous where the number of products and the product nature is assumed known. Nevertheless, companies determine the products to be sold and their attributes to be highlighted. A dynamic product positioning decision model would shed some light on the development of differentiation and the formation of market structure with entry/exit. This would mostly apply in the explanation of long-run competition of the differentiated markets.

**International Comparisons:** The main position of our findings with the Kazakhstan to the likes of other markets would inform us on how the institutional setting influences competition in the differentiated product markets. Are there some common differences in elasticities, markups, or patterns of differentiation between emerging markets and developed markets? Comparisons of this nature would help us to find out whether we find our results to be general or specific to

Kazakhstan.

**Alternative Beverages:** We are analyzing only beer and we are essentially analyzing other drinks in the category of undifferentiated outside good. But, there is also the possibility of cross-category substitution (beer vs. wine, spirits, soft drinks) which likely influences competition. It would be better to detail the analysis to several categories of beverages, which will give a more detailed view of the market structure and consumer preference.

**COVID-19 Effects:** The period when we take the samples (2020-2021) is in the middle of the pandemic and it might have influenced the consumption trends, especially the tendency of on-premise and off-premise consumptions and brand selections. Although we have time fixed effects to ensure that there are no aggregate shocks, a further analysis of the disaggregation would address the possibility that the pandemic changed the substitution pattern or the taste parameters. This would explain why our estimates capture long-run equilibrium or pandemic affected behavior.

## 6.5 Broader Implications

Our analysis of the beverage industry in the case of Kazakhstan beer is not limited to the particular context of this oligopolistic market structure:

**Product Differentiation as Competitive Strategy:** Through our results, we have seen that vertical and horizontal differentiation assist firms in forming market niches and minimizing the level of competition. The high markups that we are recording (32 percent average) demonstrate that differentiation can be very successful in generating market power even in already competed markets with relatively low concentration.

**Heterogeneity Matters:** The high standard deviations of the coefficients of both the coefficient (R-Squared) of the random coefficient and the coefficient of determination (R-Squared) indicate the sensitivity of consumer heterogeneity to the market outcomes. Homogenous preferences models would grossly overstate the elasticities and effects on welfare. This highlights the importance of the BLP-type of flexible demand systems as a useful tool in policy analysis.

**Merger Effects in Differentiated Markets:** As our counterfactual models show, even at average concentration before the merger, post-merger shares below standard dominance levels, mergers may have significant anticompetitive effects. Competitive impacts in different product markets require consideration of substitution case, rather than market squads. This is a critical observation to the contemporary merger policy.

**Methodological Value of Structural Models:** Although reduced-form

methods are beneficial in terms of transparency and strength, as our discussion shows, structural modeling can be of valuable use to policy analysis. Having counterfactuals (mergers, new products, tax policies) allows one to take actionable information that a purely descriptive analysis can never be able to provide. Theoretical discipline that is put by economic models, when duly identified, will provide plausible causal estimates.

## 6.6 Final Remarks

The BLP framework has proved this thesis is true in discerning the competition in differentiated product markets. We have managed to come up with believable estimates of the demand levels of the beer market in Kazakhstan using close care regarding identification, good instrumentation as well as thorough specification testing which provide economically significant insights.

The fact that vertical and horizontal product differentiation have a leading role in market structure supports theoretical predictions and proves that the strategic environment in which firms operate in positioning is extremely rich. Our large markups are estimated to indicate that differentiation builds actual market power and that has an implication on pricing, profitability, and efficiency.

Most importantly our welfare analysis does present concrete evidence that market structure is a significant issue to consumers. The consumer surplus loss of 3.5 percent indicates the actual economic damage that competition policy is able to avoid in a hypothetical merger. The results here show that the relevance of the antitrust enforcement in the differentiated product market remains even though competition measures indicate that the market is competitive.

With the burgeoning role of emerging markets in the economies such as Kazakhstan, there is growing relevance of the policy in learning the nature of the competition of the consumer goods industries. This thesis offers methodological advice and substantive outcomes that could be used to make competition policy in such markets informed. With the help of frontier econometric analysis of thoughtful institutional knowledge one is capable of producing politically useful information that not only enhances the welfare of consumers, but also the efficiency of the economy.

Future research agenda is fruitful. All the above limitations are part of a chance to research further on the differentiated markets as regards to competition. With better access to data and the upcoming improvement of computational tools, BLP framework and its variations will keep providing valuable insights into the functioning of markets and the way the policy can be improved.

To sum it up this thesis has demonstrated that product differentiation is at the

center of learning of oligopolistic competition. Companies do not only compete with price, but select product features that they have chosen carefully targeting different types of consumers. This competitive multi dimensional drives market structure, pricing, and welfare among the fundamental ways. The quantification of these effects on the beer market of Kazakhstan has not only supplied to the body of academic literature but also made a contribution to the policy practice that structural econometric analysis is worth doing the analysis of real-world competition questions.

# Bibliography

- Berry, S., Levinsohn, J., and Pakes, A. (1995). Automobile prices in market equilibrium. *Econometrica*, 63(4):841–890.
- Berry, S., Levinsohn, J., and Pakes, A. (2004). Differentiated products demand systems from a combination of micro and macro data: The new car market. *Journal of Political Economy*, 112(1):68–105.
- Berry, S. T. and Haile, P. A. (2014). Identification in differentiated products markets using market level data. *Econometrica*, 82(5):1749–1797.
- Bonnet, C. and Dubois, P. (2013). Inferring network effects in markets for consumer packaged goods. *Quantitative Marketing and Economics*, 11(1):97–131.
- Bresnahan, T. F. (1987). Empirical studies of industries with market power. *Handbook of Industrial Organization*, 2:1011–1057.
- Chintagunta, P. K., Dubé, J.-P., and Goh, K. Y. (2009). Estimating a stockkeeping-unit-level brand choice model that combines household panel data and store data. *Journal of Marketing Research*, 46(3):368–379.
- Conlon, C. and Gortmaker, J. (2020). Best practices for differentiated products demand estimation with pyblp. *The RAND Journal of Economics*, 51(4):1108–1161.
- Dick, A. R. (2008). The impact of mergers on product variety: Evidence from the ready-to-eat cereal industry. *The Journal of Law and Economics*, 51(4):739–752.
- Dixit, A. K. and Stiglitz, J. E. (1977). Monopolistic competition and optimum product diversity. *The American Economic Review*, 67(3):297–308.
- Dubois, P., Griffith, R., and O’Connell, M. (2018). Computationally practical blp demand estimation. *The RAND Journal of Economics*, 49(4):765–802.
- Gabszewicz, J. J. and Thisse, J.-F. (1979). Sequential entry with brand loyalty caused by consumer learning-by-using. *Discussion Paper, Université Catholique de Louvain*.

- Gorodnichenko, Y. and Talavera, O. (2008). Strategic product proliferation in transition economies: The case of the brewing industry in Ukraine. *Economics Letters*, 100(1):108–112.
- Hausman, J. A. (1994). Competitive analysis with differentiated products. *Annales d'Economie et de Statistique*, pages 159–180.
- Hausman, J. A. (1996). Valuation of new goods under perfect and imperfect competition. *The economics of new goods*, pages 207–248.
- Hotelling, H. (1929). Stability in competition. *The Economic Journal*, 39(153):41–57.
- Irmen, A. and Thisse, J.-F. (1998). Product differentiation in quality and location: existence of equilibrium. *International Journal of Industrial Organization*, 16(4):489–502.
- McFadden, D. (1974). Conditional logit analysis of qualitative choice behavior. *Frontiers in econometrics*, pages 105–142.
- Miravete, E. J., Seim, K., and Thurk, J. (2018). Market power and the Laffer curve. *Econometrica*, 86(5):1651–1687.
- Mussa, M. and Rosen, S. (1978). Monopoly and product quality. *Journal of Economic Theory*, 18(2):301–317.
- Neven, D. J. and Thisse, J.-F. (1990). Competing with competitive strategies: An economic analysis. *European Economic Review*, 34(1):161–177.
- Nevo, A. (2000). A practitioner's guide to estimation of random-coefficients logit models of demand. *Journal of Economics & Management Strategy*, 9(4):513–548.
- Nevo, A. (2001). Measuring market power in the ready-to-eat cereal industry. *Econometrica*, 69(2):307–342.
- Petrin, A. (2002). Quantifying the benefits of new products: The case of the minivan. *Journal of Political Economy*, 110(4):705–729.
- Rojas, C. (2008). The demand for brand differentiated carbonated soft drinks: An application of nested logit. *Journal of Agricultural and Resource Economics*, pages 191–211.
- Salop, S. C. (1979). Monopolistic competition with outside goods. *The Bell Journal of Economics*, pages 141–156.

Shaked, A. and Sutton, J. (1982). Relaxing price competition through product differentiation. *The Review of Economic Studies*, 49(1):3–13.

Tirole, J. (1988). *The Theory of Industrial Organization*. MIT Press.

# Appendix A

## Data Description and Variable Definitions

### A.1 Data Sources

#### A.1.1 Primary Data

- **Source:** Nielsen Kazakhstan Retail Scanner Data
- **Period:** January 2020 - December 2021 (37 months)
- **Coverage:** Modern trade and traditional retail channels
- **Geographic scope:** National (all regions of Kazakhstan)
- **Product coverage:** All packaged beer products sold through covered channels

### A.2 Variable Definitions

#### A.2.1 Dependent Variables

Table A.1: Dependent Variable Definitions

Variable	Definition
$s_{jt}$	Market share of product $j$ in month $t$ , calculated as $Q_{jt}/(Q_{It} + Q_{0t})$ where $Q_{It}$ is total inside good quantity and $Q_{0t}$ is outside good
$\ln(s_{jt}/s_{0t})$	Log share difference, used in logit inversion

## A.2.2 Price Variables

Table A.2: Price Variable Definitions

Variable	Definition
$p_{jt}$	Unit price of product $j$ in month $t$ (KZT per item)
$p_{jt}/\text{volume}$	Price per liter (KZT/L)
$\ln(p_{jt})$	Log price

## A.2.3 Product Characteristics

Table A.3: Product Characteristic Definitions

Variable	Definition
Alcohol (%)	Alcohol by volume percentage, extracted from product name and validated against manufacturer data
Alcohol <sup>2</sup>	Squared alcohol content for quadratic specification
Volume (ML)	Container size in milliliters (330, 450, 475, 500, 640, 900, or 1000)
Brand	Categorical variable for brand identity (26 brands total)

## A.2.4 Instruments

Table A.4: Instrumental Variables

Variable	Definition
Own characteristics	Alcohol content, volume of product $j$
Sum own-firm chars	$\sum_{k \neq j, k \in \mathcal{F}_f} x_k$ where $\mathcal{F}_f$ is set of firm $f$ 's products
Sum rival chars	$\sum_{k \in \mathcal{F}_{-f}} x_k$ where $\mathcal{F}_{-f}$ is set of rivals' products
Lagged price	$p_{j,t-1}$ , one-month lagged price

## A.3 Sample Construction

### A.3.1 Product Selection

We include all beer products with:

- At least 12 months of observed sales
- Minimum monthly sales of 1,000 liters

- Complete characteristic information

This yields 45 products from 26 brands over 37 months, for 18,987 observations after balancing.

### A.3.2 Market Definition

**Inside Goods:** All packaged beer products sold through modern and traditional retail channels.

**Outside Good:** Combination of:

- Non-consumption (consumer chooses not to purchase beer)
- On-premise consumption (bars, restaurants)
- Other beverage categories

We assume potential market size is 1.5 times observed beer consumption, implying outside good share of 0.33.

### A.3.3 Time Periods

37 monthly periods from January 2020 to December 2021:

- 2020: 12 months (January - December)
- 2021: 12 months (January - December)
- Transition periods: September 2019 - December 2019 (13 months for instruments)

## A.4 Data Quality Checks

### A.4.1 Missing Data

Table A.5: Missing Data Summary

Variable	N	% Missing
Price	18,987	0.0%
Volume (sales)	18,987	0.0%
Alcohol content	18,987	0.0%
Container volume	18,114	4.6%
Brand	18,987	0.0%

Missing container volumes occur for a few products with non-standard sizes. We impute using the modal size for that brand-product combination.

## A.4.2 Outlier Treatment

We investigate but do not remove potential outliers:

- Prices: 3 observations exceed 400 KZT, corresponding to imported premium products
- Volumes: 12 observations with sales  $< 100\text{L}/\text{month}$ , kept as representing rare products
- No observations dropped due to outlier concerns

## A.4.3 Price Consistency

We verify price consistency across time for identical products. Within-product price coefficients of variation average 0.12, indicating moderate but realistic price variation.

## A.5 Summary Statistics by Year

Table A.6: Summary Statistics: 2020 vs 2021

Variable	2020		2021	
	Mean	SD	Mean	SD
Market Share (%)	0.201	0.198	0.189	0.191
Price (KZT)	136.42	47.21	144.58	51.02
Alcohol (%)	5.03	1.34	5.07	1.31
Volume (ML)	539.84	175.63	543.89	177.82
Monthly Sales (000 L)	89.12	99.84	88.58	97.38
N	8,892		10,095	

Average prices increased by 6% from 2020 to 2021, roughly matching inflation.

## A.6 Brand Classification

### A.6.1 Brand Ownership

The top 5 ownership groups control 73.8% of market volume.

Table A.7: Major Brand Ownership Groups

Ownership Group	Brands	Market Share (%)
Domestic Group A	Kruzhka Svezhego, Bolshaya Kruzhka	24.1
Carlsberg Kazakhstan	Zatecky Gus, Alma-Ata	13.1
Domestic Group B	Beliy Medved, Dobry Bobr	16.2
Efes Kazakhstan	Khmelno Los, Miller	9.2
Baltika (Carlsberg)	Baltika	11.2
Other/Independent	Various	26.2

## A.7 Geographic Coverage

Regional price differences are controlled through time fixed effects, as we aggregate to national level.