Domestic Competition and Export Performance in the Beer Industry: Evidence from the EU

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Abstract

This paper investigates how domestic market competition influences beer export performance in the European Union between 2014 and 2023. Employing a gravity model framework and Poisson Pseudo-Maximum Likelihood estimation, it incorporates standard trade variables alongside two measures of domestic competition: the Herfindahl-Hirschman Index and the ratio of microbreweries to total breweries. The empirical results, based on 1 277 observations, indicate that lower market concentration and a higher share of microbreweries are significantly associated with greater export volumes. Conceptually, the paper extends heterogeneous-firm trade to a mature, differentiated consumer industry and identifies both an efficiency/selection channel and a non-price differentiation channel. Empirically, it offers new sector-level, multi-country evidence that links domestic market dynamism and firm diversity to external competitiveness, and informs policies on competition and SME support.

Keywords	***DOI***	***JEL code***
Competition, export performance, international trade, beer industry, microbrewery	*https://doi.org/10.54694/stat.2025.34*	*D43, F14, L11, L66, O24*

INTRODUCTION

The European beer industry has undergone significant changes over the last decade, especially with the increasing number of microbreweries, defined as breweries producing up to 10 000 hectoliters annually, across the continent. As of 2023, craft breweries accounted for approximately 20% of total beer production in the United Kingdom (Brewers of Europe, 2025; Society of Independent Brewers, 2024) and 7–8% in France (Businesscoot, 2025), illustrating their substantial presence in two of Europe's

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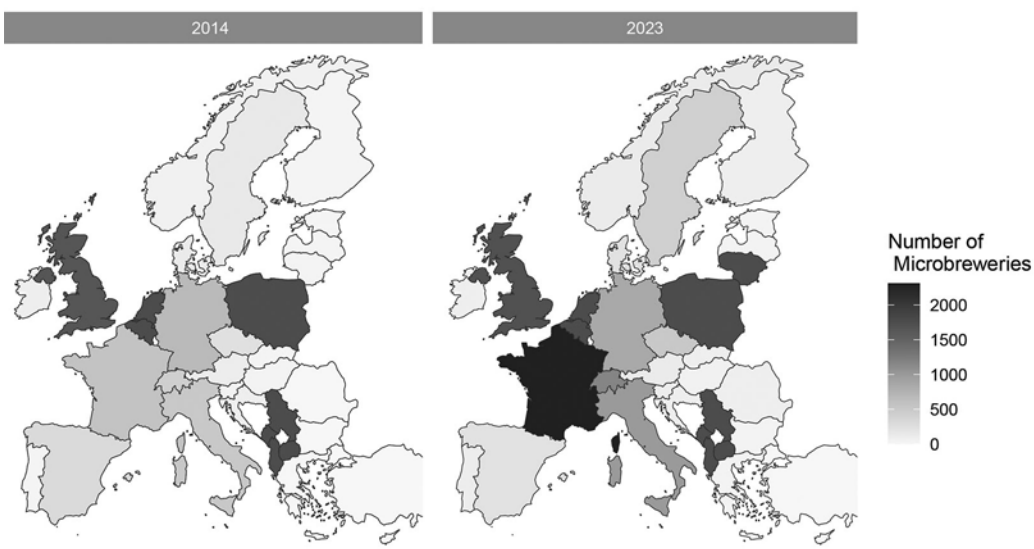
most active microbrewery markets. The Czech Republic, consistently the world's top beer consumer, mirrors this trend. Surveys reveal that 81% of Czech consumers are open to trying craft beers, and 45% are willing to pay a premium for locally produced options (Ipsos, 2017), indicating a rising demand for distinctive, high-quality beer products that challenge the dominance of traditional brewing firms.

This shift is shaped by broader cultural and generational transformations. Spáčil and Teichmannová (2016) document how beer consumption among Generation Y (Millennials) follows a moderate, normally distributed pattern, where moderate drinking is most common, while fewer individuals drink either very frequently or rarely. In contrast, the distribution in Generation X has a fatter tail, meaning that many drink beer several times per week, but only a small percentage do not drink at all. On the other hand, Generation Z (today's youngest alcohol consumers) exhibit markedly lower consumption levels, reflecting growing health consciousness and lifestyle reorientation (Ipsos, 2024).

These patterns underpin what researchers have called the "Drink Less, But Better" trend (Lerro et al., 2020; Mastanjević et al., 2019), emphasizing premiumization and responsible drinking. Culturally, this resonates with the rise of neolocalism, a revalorization of local identity and production (Maier, 2016). Neolocalist dynamics are particularly evident in the beer sector, where small breweries embed place-based narratives, regional dialects, and historical references into branding strategies (Materna, 2022), offering a form of cultural resistance to the global standardization of tastes.

This trend extends across Europe. In Italy, Garavaglia (2022) finds that post-war concentration gave way to a surge of microbrewery entry, driven by consumer demand for differentiated, locally rooted products. The number of breweries across Europe more than doubled between 2010 and 2020 (Brewers of Europe, 2025), signaling a continent-wide reconfiguration of industrial structure. Figure 1 shows how the number of microbreweries rose sharply between 2014 and 2023, contributing to a more fragmented domestic competitive environment. This evolution reflects both shifting consumer preferences and a structural transformation of industry dynamics, wherein large incumbents now coexist with a growing cohort of adaptive small-scale producers.

Figure 1 Comparison of number of microbreweries in EU between 2014 and 2023



Source: Own elaboration based on Brewers of Europe (2025)

These developments raise an important question about how domestic market conditions translate into international competitiveness. According to heterogeneous-firm trade theory, stronger domestic rivalry reallocates output toward more productive firms, thereby enhancing export capacity (Melitz, 2003; Melitz and Ottaviano, 2008). Empirical evidence supports this link between competition and exports in manufacturing and technology-intensive sectors, where efficiency and scale dominate (e.g., Clougherty and Zhang, 2009; Goodwin and Pierola, 2015). In contrast, the mechanisms connecting domestic competition to export success in mature consumer industries, such as beer, where differentiation, quality, and local identity play a central role, remain quantitatively underexplored.

This study extends heterogeneous-firm trade mechanisms to such differentiated consumer markets by combining the efficiency/selection channel with a non-price differentiation channel proxied by producer diversity. It addresses this gap by examining whether changes in domestic market structure influence export performance in the European beer industry.

Employing a reduced-form gravity model and panel data on EU beer trade between 2014 and 2023, it tests whether stronger rivalry (lower market concentration) and greater producer diversity (higher share of small breweries) are associated with higher export volumes. The central research question is: *How does domestic competition affect beer export performance across EU member states?*

The paper is structured as follows: Section 1 provides the literature review, Sections 2 and 3 outline the data sources and methodology, Section 4 presents the empirical findings and discusses the implications. Finally, the paper concludes with recommendations for industry stakeholders and policymakers.

1 LITERATURE REVIEW

This paper investigates how domestic market structure affects export performance, with a specific focus on the European Union's beer industry. While much of the traditional trade literature emphasizes cross--country determinants of export volumes (e.g., Anderson and van Wincoop, 2003; Tinbergen, 1962; Yotov, 2016), an expanding body of research highlights the critical role of within-country factors, including domestic competition, market structure and industry dynamics, in shaping export volumes (e.g., Clougherty and Zhang, 2009; Goodwin and Pierola, 2015; Melitz, 2003; Melitz and Ottaviano, 2008). This section reviews relevant theoretical and empirical literature across the field and provides the theoretical basis for the empirical model developed in this paper.

1.1 Domestic competition and export performance

The link between market concentration and firm performance is well established in industrial organization and trade literature. Concentrated markets tend to reduce competitive pressure, leading to lower efficiency and innovation (Boone, 2000; Vives, 2008), while lower concentration typically fosters rivalry, reallocation, and better industry outcomes (Melitz and Ottaviano, 2008). Syverson (2011) emphasizes that firm-level productivity differences significantly shape aggregate outcomes, with market structure evolving through competitive dynamics. Empirical studies confirm that less concentrated industries achieve higher allocative efficiency and productivity. Loualiche et al. (2021) show that increased entry erodes incumbents' power, improving efficiency.

The post-Melitz (2003) literature highlights how domestic competition enhances export performance. Greater rivalry raises industry productivity, enabling more firms to cover the fixed costs of exporting - a self-selection process favoring the most efficient firms (Bernard et al., 2012; Wagner, 2007). Several studies validate this. Goodwin and Pierola (2015) link pro-competition reforms to stronger SME exports. Clougherty and Zhang (2009) show that domestic airline competition raises export intensity. Chen et al. (2009) find similar effects from EU reforms. Argentesi et al. (2024) show exporters report gains in efficiency, innovation, and competitiveness from domestic rivalry. Freund and Pierola (2015) warn of the risks of export concentration, noting top exporters often dominate trade. Broader participation, enabled by competition and lower barriers, enhances resilience and performance.

Competition also drives non-price competitiveness. The Alchian-Allen effect (Hummels and Skiba, 2004) predicts that high trade costs lead exporters to specialize in quality. Competitive pressure motivates quality upgrading (Amiti and Khandelwal, 2013; Iacovone and Javorcik, 2012), and De Loecker (2011) finds that exporters raise prices due to quality gains rather than cost increases. Recent studies further emphasize non-price differentiation: Keil (2024) finds that branding, design, and certification intensity raise export shares in consumer industries, while Reimer and Langpap (2022) show that sustainability and regional identity strengthen export competitiveness in European food and beverage sectors. However, although the latter study extends the analysis to the beverage sector, it relies primarily on survey-based evidence rather than quantitative trade data, leaving room for a sector-level empirical assessment that this paper provides.

Chaney's (2008) gravity model shows that trade depends on both export volumes and the number of exporting firms: lower barriers expand the extensive margin by allowing smaller firms to enter export markets. In sectors like brewing, where entry barriers have fallen, this suggests that increased domestic competition enhances exports through broader firm participation.

1.2 Industry evolution and microbrewery dynamics in European beer markets

The European beer industry has transformed in recent decades, with declining concentration and a surge in microbreweries. Between 2010 and 2020, the number of breweries in the EU more than doubled, driven largely by small-scale entrants (Brewers of Europe, 2025).

Literature highlights the impact of this shift. In Italy, craft breweries increased variety and catered to local tastes (Fastigi et al., 2018). UK microbreweries proved more agile in adapting to demand (Ellis and Bosworth, 2015), while Germany and CEE saw declining concentration and greater price dispersion (Materna et al., 2022; Pokrivčák et al., 2019).

Innovation and branding are central to microbrewery strategies. They emphasize authenticity, quality, and locality (Aquilani et al., 2015; Lerro et al., 2020), often prompting strategic responses from larger firms, such as product diversification and quality upgrades. In Slovenia, small breweries have fostered both innovation and internationalization (Faganel and Rižnar, 2023), while Czech producers are quick to adopt niche trends like non-alcoholic or locally inspired beers (Maier, 2016). Storytelling tied to ingredients, techniques, and local identity enhances consumer loyalty and supports price premiums despite limited scale (Ellis and Bosworth, 2015; Lerro et al., 2020).

Garavaglia (2022) documents the rise of microbreweries in Italy and explores how entry patterns vary by institutional and demand-side factors, revealing regional disparities. More competitive regions support the persistence of efficient producers, a dynamic consistent with Chaney's (2008) model of competitive sorting and firm reallocation.

Evidence from Belgium shows that microbreweries can succeed internationally by leveraging uniqueness and quality, with exports reaching up to 80% of output (Poelmans and Ostyn, 2020). These cases illustrate how domestic competition strengthens differentiation and increases export potential.

1.3 Gravity in practice: empirical approaches to beer trade patterns

The gravity model, first introduced by Tinbergen (1962), explains bilateral trade flows based on the economic size of trading partners and the distance between them. Drawing from Newton's law of gravitation, it posits that trade increases with GDP and decreases with distance. In its log-linear form, it typically includes GDPs of both countries, distance, and trade resistance factors (Anderson and van Wincoop, 2003; Yotov, 2016). Its predictive accuracy and flexibility make it a core tool in empirical trade analysis.

Recent studies apply the gravity model to beer trade, confirming the continued relevance of GDP, distance, and shared borders while incorporating sector-specific dynamics. Dreyer et al. (2017) show that German beer exports are shaped by economic size, EU membership, and exchange-rate volatility,

where higher exporter GDP and institutional integration increase exports, while distance and currency fluctuations reduce them. Similarly, Bieleková and Pokrivčák (2020) extend the analysis to a broader panel of European beer exporters and find that GDP and cultural proximity (common borders, language, or colonial ties) stimulate trade, whereas distance, landlockedness, and importer population exert negative effects.

Olper et al. (2012) explore home bias in EU beer consumption, finding that proximity and production scale significantly affect trade. Their gravity estimates indicate stronger home market effects for beer than for wine, especially in countries with smaller export sectors.

Although not using a gravity model directly, Garavaglia and Swinnen (2018) emphasize the need to include firm heterogeneity, distribution, and product differentiation when modeling beer trade, reinforcing the value of sector-specific controls.

Building on this literature, the present study extends the gravity approach by incorporating indicators of domestic market structure - specifically the Herfindahl-Hirschman Index (HHI) and the microbrewery ratio - to test how rivalry and producer diversity affect export performance in the EU beer sector. Drawing on heterogeneous-firm trade theory (Melitz, 2003; Melitz and Ottaviano, 2008) and recent evidence on non-price competitiveness (Keil, 2024; Reimer and Langpap, 2022), the analysis tests two hypotheses:

Hypothesis 1: Lower market concentration increases beer export volumes.

Hypothesis 2: A higher share of small producers enhances beer export performance.

2 DATA

Data for the empirical analysis is obtained from several sources. Country and year selection depends on data availability and comparability. The panel data set covers 1 277 bilateral observations for 28 EU countries (including the United Kingdom) over 2014–2023. Trading partners were selected each year until their cumulative share reached at least 70% of the exporting country's total beer export volumes. In this way, the coverage of the largest volumes of exports from each country is ensured. The reason for choosing these countries is that EU national brewers associations provide sufficient data quality, however, extensive time series are not available. Therefore, a shorter time period that is associated with the notable surge in the popularity of specialty beers, craft beers, and microbrewing in the EU is chosen (e.g., Lerro et al., 2020).

A detailed summary of all variables, including descriptions and data sources is provided in Appendix Table A1. The dependent variable is total beer export volumes from exporter to importer (*tot_exp_eur*), in millions of EUR, capturing bilateral trade flows (e.g., Tinbergen, 1962). Explanatory variables follow the standard gravity framework and include economic size and demand indicators, GDP per capita and population of exporter and importer, capturing income and market potential (Anderson and van Wincoop, 2003; Bieleková and Pokrivčák, 2020). Geographic distance, measured as the shortest air route between capitals, proxies trade costs that have declined with lower barriers and improved logistics. Industry-specific variables include beer production (Bieleková and Pokrivčák, 2020; Olper et al., 2012), consumption (Faganel and Rižnar, 2023) (both per capita), and average nominal price in the exporting country (Garavaglia and Swinnen, 2018). These reflect supply, demand, and price competitiveness. The key competitiveness measure is the Herfindahl-Hirschman Index (*HHI*) of the exporting country's beer market. Additional controls include dummy variables for advertising restrictions (*after10*) (Anderson et al., 2009), shared borders (*contig*) and common currency (*curr*) (Bieleková and Pokrivčák, 2020; Dreyer et al., 2017; Olper et al., 2012), whether the importer is an island (*island*) (Armstrong and Read, 2006), and COVID-19 period (*covid*) (Baldwin and Tomiura, 2020), accounting for institutional and temporal effects.

This analysis employs the HHI as an indicator of competitiveness within the beer industry. The HHI considers the full distribution of market shares, squaring each firm's share before summing the values.

This gives greater weight to larger firms while still reflecting the influence of smaller players. Unlike the Concentration Ratio or the Gini coefficient, the HHI is sensitive to structural changes across the entire market, making it especially valuable in industries like brewing, where market consolidation and the entry of new firms can occur simultaneously (Peleckis, 2022). Because the HHI is highly sensitive to shifts in market share, it is widely used to assess market structure and its impact on competition, pricing, and efficiency.

Mathematically, the HHI is calculated by summing the squares of each firm's market share:

$$HHI = \sum_{i=1}^{N} \left(MS_i \right)^2, \tag{1}$$

where MS_i is the market share of firm i in the market and N is the number of firms on the market. When expressed on a normalized 0–1 scale, an HHI of 1 represents a pure monopoly (one firm controlling the entire market), while an HHI close to zero signals a highly competitive market with many firms holding similar shares. In the context of the EU beer industry, the HHI provides a powerful tool for assessing how market structure has evolved over time. Traditionally, a handful of multinational brewers have held dominant positions in most European markets. At the same time, the past decade has seen a surge in the number of microbreweries, introducing greater diversity in beer styles, branding, and consumer preferences (Ellis and Bosworth, 2015; Fastigi et al., 2018). This dual dynamic, consolidation among the largest players and fragmentation due to an influx of small-scale producers, makes the beer industry a particularly interesting case for studying market concentration.

Table 1 presents an overview of the descriptive statistics for the variables utilized in the model. The number of observations of the baseline model is 1 277, although it varies slightly across models, which results from missing data for certain countries or years in some indicators, leading to the exclusion of these observations when constructing the extended model specifications. For instance, data necessary

Table 1 Descriptive statistics

Variable	N	Mean	SD	Median	Min	Max	VIF
tot_exp_eur	1 373	37.695	82.513	11.892	0.034	789.999	-
GDP_exp	1 373	27 318.080	15 413.545	24 440.000	6 120.000	97 300.000	3.899
GDP_imp	1 349	28 792.321	17 373.178	28 250.000	6 72.000	82 780.000	1.335
dist	1 373	2 147.092	2 961.849	845.000	54.880	16 366.000	2.878
pop_imp	1 362	148.646	350.654	38.400	0.076	1 425.893	2.221
prod_exp	1 360	0.884	0.530	0.805	0.070	3.717	2.438
prod_imp	1 246	0.740	0.819	0.608	0.000	21.977	2.952
cons_exp	1 354	72.536	26.750	71.000	28.000	150.308	2.694
cons_imp	1 157	62.061	24.105	66.625	2.500	150.308	2.851
microbrew_brew	1 131	0.771	0.190	0.833	0.318	1.000	-
contig	1 373	0.404	0.491	0.000	0.000	1.000	1.482
curr	1 373	0.320	0.467	0.000	0.000	1.000	1.439
island	1 373	0.110	0.313	0.000	0.000	1.000	1.185
after10	1 373	0.283	0.450	0.000	0.000	1.000	1.530
price	864	2.152	0.979	2.005	0.770	5.725	3.451
HHI	1 299	0.232	0.081	0.226	0.082	0.494	1.404
covid	1 373	0.210	0.408	0.000	0.000	1.000	1.033

Note: The last column reports the Variance Inflation Factor values for Model (6) in Table 3, i.e., the specification that includes all explanatory variables.
Source: Own calculations

Table 2 Correlation matrix of the model

	tot_exp_eur	GDP_exp	GDP_imp	dist	pop_imp	prod_exp	prod_imp	cons_exp	cons_imp	microb_rew_brew	contig	curr	island	after10	price	HHI	covid
tot_exp_eur	1.000***	0.377***	0.171***	0.051	0.095*	0.194***	–0.057	0.034	–0.125**	–0.030	0.037	0.040	0.165***	–0.253***	0.011	–0.300***	–0.039
GDP_exp		1.000***	0.390***	0.098*	–0.004	0.141***	0.020	–0.113**	–0.067	0.072	–0.033	0.068	0.108**	–0.203***	0.695***	–0.298***	–0.024
GDP_imp			1.000***	0.040	–0.228***	–0.008	0.125**	–0.096*	0.013	0.088*	–0.123**	–0.023	0.239***	–0.091*	0.265***	–0.139***	–0.060
dist				1.000***	0.687***	–0.090*	–0.264***	–0.150***	–0.335***	0.089*	–0.423***	–0.283***	0.024	–0.142***	0.050	–0.168***	0.037
pop_imp					1.000***	–0.103*	–0.288***	–0.123**	–0.394***	0.063	–0.268***	–0.219***	–0.088*	–0.025	–0.047	–0.118**	0.023
prod_exp						1.000***	–0.072	0.680***	0.037	–0.168***	0.071	–0.072	–0.054	–0.325***	–0.155***	0.087*	–0.028
prod_imp							1.000***	–0.001	0.691***	0.031	0.143***	0.167***	–0.048	0.096*	0.042	–0.064	–0.034
cons_exp								1.000***	0.114**	–0.337***	0.107*	–0.139***	–0.119**	–0.220***	–0.354***	0.031	–0.015
cons_imp									1.000***	–0.040	0.176***	0.024	0.018	0.109**	0.028	0.078	–0.088*
microbrew_brew										1.000***	–0.154***	–0.199***	0.090*	0.151***	0.347***	–0.038	0.052
contig											1.000***	0.168***	–0.100*	0.074	–0.084*	0.091*	–0.026
curr												1.000***	–0.167***	0.195***	0.075	0.005	–0.051
island													1.000***	–0.123**	0.121**	–0.114**	–0.008
after10														1.000***	0.130**	0.256***	0.030
price															1.000***	–0.097*	–0.042
HHI																1.000***	–0.034
covid																	1.000***

Note: *p<0.1; **p<0.05; ***p<0.01.
Source: Own calculations

for the calculation of the Herfindahl–Hirschman Index are not available for Malta, Cyprus, and Luxembourg, while information on the number of microbreweries is missing for Belgium, the Netherlands, and Poland. High variability in exporter GDP and distance reflects the dominance of large exporters such as Germany, Belgium, and the Netherlands and the inclusion of both intra-EU and extra-EU destinations. Winsorization mitigates these outliers while preserving cross-country heterogeneity essential for gravity estimations. Given the model's nature, all variables (excluding the dummy variables) are transformed into logarithmic form. Following the application of logarithms to the variables, there is a notable decrease in the standard deviations of these variables.

The exporter country population variable was initially included but omitted owing to high correlation with GDP to ensure the unbiasedness of the estimators. Consequently, Table 2 shows the correlation matrix of the model, expressing the weak correlation between the variables under study.

3 RESEARCH DESIGN

To investigate the impact of domestic competition on beer export volumes within the European Union, this study employs the gravity model of international trade. The gravity model posits that trade volume between two countries is proportional to their economic size and inversely related to distance:

$$X_{ij} = G\left(\frac{Y_i^{\alpha} Y_j^{\beta}}{D_{ij}^{\gamma}}\right), \tag{2}$$

where X_{ij} represents the trade flow from country i to country j; Y_i and Y_j are the economic sizes (GDP) of countries i and j, respectively; D_{ij} denotes the distance between the two countries; G is a constant of proportionality; α, β and γ are parameters to be estimated. By taking the natural logarithm of both sides, the equation becomes linear and suitable for econometric analysis:

$$lnX_{ij} = lnG + \alpha lnY_i + \beta lnY_j - \gamma lnD_{ij} + \varepsilon_{ij}, \tag{3}$$

where ε_{ij} is the error term capturing unobserved factors affecting trade flows.

The model includes standard gravity variables, economic size and distance, augmented by sector-specific and policy-related factors. By integrating a measure of domestic competition based on theoretical concepts, this study extends the existing literature.

Considering the gravity model structure, the proposed model for the empirical analysis is as follows:[2]

$$\begin{aligned} tot\_exp\_eur_{ijt} = {} & \beta_0 + \beta_1 \ln\left(GDP_{it}\right) + \beta_2 \ln\left(GDP_{jt}\right) + \beta_3 \ln\left(dist_{ij}\right) + \boldsymbol{\gamma}' \ln\left(\boldsymbol{X}_{it}\right) + \boldsymbol{\delta}' \ln\left(\boldsymbol{M}_{jt}\right) \\ & + \boldsymbol{\theta}' \ln\left(\boldsymbol{I}_{it}\right) + \boldsymbol{\lambda}' \boldsymbol{C}_{ij} + \epsilon_{ijt}, \end{aligned} \tag{4}$$

where $\boldsymbol{X}_{it}$ represents a vector of macroeconomic variables for the exporting country:

$$\boldsymbol{X}_{it} = \gamma_1 pop_{it} + \gamma_2 prod_{it} + \gamma_3 cons_{it}, \tag{5}$$

$\boldsymbol{M}_{jt}$ includes macroeconomic variables for the importing country:

$$\boldsymbol{M}_{jt} = \delta_1 pop_{jt} + \delta_2 prod_{jt} + \delta_3 cons_{jt}, \tag{6}$$

$\boldsymbol{I}_{it}$ denotes industry-specific variables as:

$$\boldsymbol{I}_{it} = \theta_1 price_{it} + \theta_2 HHI_{it}, \tag{7}$$

[2] For variables description please see Table A1 in Appendix.

$\boldsymbol{C}_{ij}$ consists of control dummy variables such as:

$$\boldsymbol{C}_{ij} = \lambda_1 after10_{it} + \lambda_2 contig_{ij} + \lambda_3 curr_{ij} + \lambda_4 island_j + \lambda_5 covid\,. \tag{8}$$

Two key variables representing competitiveness are included in the model: the Herfindahl–Hirschman index (HHI_{it}) in the exporting country and the average nominal price of beer in the exporting country ($price_{it}$).

The Herfindahl–Hirschman index in the exporting country is used in this study as a proxy for domestic competition intensity within the beer industry. Based on the theoretical framework, a more concentrated market is expected to have a negative impact on export volumes. The average nominal price of beer in the exporting country is included to assess the price competitiveness of exporters. Higher domestic beer prices may render export volumes less competitive in international markets due to increased production costs and reduced-price attractiveness to foreign consumers (Dreyer et al., 2017).

The gravity model is estimated using the Poisson Pseudo-Maximum Likelihood (PPML) estimator, which is well-suited for trade data as it handles heteroskedasticity and zero trade flows effectively (Silva and Tenreyro, 2006). Unlike OLS on log-linear models, which can yield biased estimates due to $E[\ln y] \neq \ln E[y]$ (Silva and Tenreyro, 2006) and the exclusion of zero flows, PPML estimates the model in levels, preserving zero values and delivering consistent results (Silva and Tenreyro, 2011). It also downweights large trade flows, supporting robustness. Given these advantages, PPML is now standard in gravity model applications (e.g., Yotov et al., 2016).

To assess the impact of domestic competition on beer export volumes, a stepwise estimation strategy is followed. The baseline model includes key gravity variables, GDPs, distance, and the HHI, to identify the direct effect of competition. Covariates are then incrementally added to test the robustness of HHI's influence and examine how other factors affect model fit and coefficient stability. Year fixed effects are included in selected model specifications to control for global shocks. Their inclusion serves as a robustness check to ensure that the estimated relationships are not merely driven by time--specific influences, allowing identification of country-specific effects like domestic competition, which would be absorbed by more restrictive fixed effect structures (Baldwin and Taglioni, 2006; Yotov et al., 2016).

4 RESULTS AND DISCUSSION

This section presents the empirical findings from the gravity model estimations assessing the impact of domestic competition on beer export volumes within the European Union. The results are summarized in Table 3 (core specifications including country-, industry-specific, and institutional controls) and Table 4 (robustness analysis employing an alternative competition indicator). The key variable of interest is the Herfindahl–Hirschman index in the exporting country (HHI_{it}), which serves as a proxy for domestic competition intensity. Consistent with theoretical expectations (Bosma et al., 2011; Melitz and Ottaviano, 2008), stronger domestic competition enhances market efficiency and firm-level productivity. All models were subjected to standard diagnostic procedures for multicollinearity and heteroskedasticity. Variance Inflation Factor values were well below conventional thresholds (<5) – for VIF values of Model (6), Table 3, the one that includes all the explanatory variables, see Table 1. The Breusch–Pagan test indicated the presence of heteroskedasticity at α = 5% significance level; therefore, heteroskedasticity-robust standard errors are reported throughout.

In the baseline model (Model 1, Table 3), which includes the fundamental gravity variables and the domestic competition measure, the coefficient for HHI_{it} is negative and highly significant ($B = -0.414$, $p < 0.05$). The negative coefficient on HHI confirms that higher market concentration, indicating weaker domestic competition, reduces export volumes. The negative effect remains consistent and significant across all subsequent models, even as additional variables are introduced. This robustness

underscores the central role of domestic competition in enhancing export performance in the beer industry, thereby supporting Hypothesis 1.

The estimated coefficients for standard gravity variables are consistent with theoretical priors (Anderson and van Wincoop, 2003; Tinbergen, 1962; Yotov, 2016). When macroeconomic variables are added (Model 3), the exporting country's GDP exhibits positive and significant effect on beer export volumes, suggesting that larger economies with greater production capacity tend to export more. The positive coefficients for both exporting and importing countries' populations in Model 3–7 suggest that larger markets facilitate greater trade flows, a principle that is consistent with the market size effect described in economic literature (e.g., Anderson and van Wincoop, 2003; Tinbergen, 1962; Yotov, 2016). This effect suggests that countries with larger populations tend to trade more because they offer larger markets for goods and services, as well as greater diversity in production capabilities. Distance, as expected (e.g., Anderson and van Wincoop, 2003; Tinbergen, 1962; Yotov, 2016), has a negative and significant impact on export volumes from Model (3) onwards, reinforcing the importance of trade costs.

Industry-specific variables provide further insights. Exporter-side beer production per capita is positively associated with export volumes, while importer-side production is insignificant, consistent with home-market absorption effects and the "home bias" in beer consumption (Olper et al., 2012). Notably, the exporting country per capita consumption effect is large and significantly negative across Models (4) to (7), indicating that strong domestic demand may crowd out export potential. This mirrors findings from Dreyer et al. (2017) and Wieczorek and Czupryna (2021), who highlight the importance of internal consumption dynamics. The coefficient on the average domestic beer price is negative and highly significant, confirming the relevance of cost competitiveness even in a differentiated consumer industry (Garavaglia and Swinnen, 2018).

Control variables added in Models 5–7 do not show (based on the dataset) statistically significant effects on beer export volumes. The statistically insignificant impact of the Covid-19 pandemic on beer export volumes (Model 6) challenges initial presumptions (Baldwin and Tomiura, 2020) about global trade disruptions. This resilience might be attributed to the essential nature of food and beverage products, combined with the adaptability of supply chains and trade networks.

The inclusion of time fixed effects supports the robustness of the findings by accounting for global shocks and trends. The fact that the key coefficients remain significant and consistent when time fixed effects are included indicates that the observed relationships are not driven by temporal factors but are inherent to the dynamics of the beer industry and trade patterns within the EU. Overall, the adjusted R^2 values increase progressively with the inclusion of additional variables, indicating improved model fit and explanatory power.

As a robustness check, the key variable of interest, market concentration measured by the Herfindahl-Hirschman Index, was substituted with an alternative indicator of domestic competition: the ratio of microbreweries to total breweries in the exporting country. The results in Table 4 support the main findings. The coefficient on the microbrewery ratio is positive and highly significant across all specifications, indicating that a higher share of microbreweries, interpreted as a more competitive and dynamic domestic industry, is associated with increased export volumes. This confirms Hypothesis 2, suggesting that non-price competitiveness factors enhance export volumes. While Keil (2024) and Reimer and Langpap (2022) develop these mechanisms in general models of trade and firm behavior, this research extends their insights to a mature consumer industry. It demonstrates empirically that rivalry and diversity within domestic markets can translate differentiation advantages into stronger export performance. Other variables behave similarly to those in Table 3: exporter GDP remains a key determinant; exporter consumption retains its negative effect; and, in the robustness models, contiguity and island status are positive and significant, reflecting reduced trade frictions for neighbors and higher import dependence for islands, consistent with Bieleková and Pokrivčák (2020), and Dreyer et al. (2017).

Table 3 Estimation output

	Dependent variable: tot_exp_eur						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
log(HHI)	−0.414*** (0.100)	−0.411*** (0.101)	−0.745*** (0.096)	−0.799*** (0.118)	−0.775*** (0.122)	−0.783*** (0.122)	−0.799*** (0.122)
log(GDP_exp)	1.630*** (0.067)	1.627*** (0.067)	1.296*** (0.064)	1.493*** (0.129)	1.446*** (0.132)	1.448*** (0.132)	1.501*** (0.135)
log(GDP_imp)	0.127*** (0.046)	0.128*** (0.046)	0.166*** (0.045)	0.158*** (0.059)	0.155** (0.061)	0.153** (0.061)	0.132** (0.062)
log(dist)	−0.003 (0.029)	−0.003 (0.029)	−0.237*** (0.039)	−0.344*** (0.046)	−0.302*** (0.053)	−0.301*** (0.053)	−0.288*** (0.053)
log(pop_imp)			0.267*** (0.026)	0.262*** (0.032)	0.261*** (0.032)	0.260*** (0.032)	0.256*** (0.032)
log(prod_exp)			0.826*** (0.055)	1.273*** (0.099)	1.252*** (0.105)	1.260*** (0.106)	1.284*** (0.107)
log(prod_imp)			-0.029 (0.032)	0.031 (0.059)	0.028 (0.060)	0.030 (0.060)	0.033 (0.060)
log(cons_exp)				−1.499*** (0.147)	−1.458*** (0.153)	−1.469*** (0.153)	−1.500*** (0.153)
log(cons_imp)				−0.218* (0.132)	-0.220 (0.135)	-0.228* (0.136)	−0.215 (0.135)
log(price)				−1.049*** (0.150)	−0.996*** (0.154)	−1.004*** (0.155)	−1.093*** (0.160)
after10					−0.061 (0.098)	−0.054 (0.098)	−0.009 (0.099)
contig					0.154* (0.090)	0.153* (0.090)	0.147* (0.089)
curr					0.060 (0.093)	0.054 (0.093)	−0.039 (0.093)
island					0.101 (0.128)	0.101 (0.128)	0.101 (0.128)
covid						−0.066 (0.077)	
Constant	−15.700*** (0.664)	−15.580*** (0.674)	−12.364*** (0.657)	−5.608*** (1.523)	−5.632*** (1.544)	−5.519*** (1.550)	−5.893*** (1.573)
Observations	1,277	1,277	1,277	703	703	703	703
Adjusted R^2	0.403	0.401	0.546	0.591	0.591	0.591	0.596
Time F.E.	N	Y	N	N	N	N	Y

Note: *p<0.1; **p<0.05; ***p<0.01; heteroskedasticity consistent standard errors are reported in parentheses.
Source: Own calculations

Overall, the empirical evidence from both competition indicators, market concentration and producer diversity, demonstrates that domestic market structure plays a decisive role in determining export performance in the European beer industry. The results complement qualitative studies of microbrewery dynamics (Bieleková and Pokrivčák, 2020; Garavaglia, 2022; Pokrivčák et al., 2019) and align with gravity-based research emphasizing the importance of economic scale, proximity, and institutional integration in beverage trade (Bieleková and Pokrivčák, 2020; Dreyer, 2017; Olper et al., 2012). From a policy perspective, these findings suggest that competition-enhancing regulations, reduced entry barriers, and targeted support for small and innovative producers can generate indirect trade benefits by strengthening both efficiency-based and differentiation-based competitiveness within the internal market.

Table 4 Estimation output – robustness check

	Dependent variable: tot_exp_eur						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
log(microbrew_brew)	0.816*** (0.135)	0.858*** (0.137)	1.096*** (0.130)	1.380*** (0.171)	1.478*** (0.179)	1.477*** (0.180)	1.540*** (0.178)
log(GDP_exp)	1.479*** (0.074)	1.486*** (0.074)	1.236*** (0.073)	2.084*** (0.135)	2.063*** (0.138)	2.066*** (0.138)	2.189*** (0.140)
log(GDP_imp)	0.037 (0.051)	0.040 (0.051)	0.092* (0.053)	0.047 (0.070)	0.022 (0.072)	0.019 (0.073)	−0.039 (0.073)
log(dist)	−0.044 (0.032)	−0.042 (0.032)	−0.170*** (0.047)	−0.262*** (0.056)	−0.149** (0.064)	−0.149** (0.064)	−0.120* (0.064)
log(pop_imp)			0.194*** (0.031)	0.189*** (0.038)	0.184*** (0.038)	0.183*** (0.038)	0.180*** (0.038)
log(prod_exp)			0.867*** (0.068)	1.123*** (0.128)	1.131*** (0.128)	1.129*** (0.128)	1.067*** (0.129)
log(prod_imp)			−0.015 (0.037)	−0.082 (0.067)	−0.080 (0.068)	−0.078 (0.068)	−0.089 (0.068)
log(cons_exp)				−1.292*** (0.180)	−1.183*** (0.184)	−1.184*** (0.184)	−1.096*** (0.184)
log(cons_imp)				0.203 (0.154)	0.198 (0.159)	0.191 (0.159)	0.235 (0.158)
log(price)				−1.887*** (0.166)	−1.879*** (0.168)	−1.884*** (0.169)	−2.062*** (0.173)
after10					0.153 (0.103)	0.155 (0.103)	0.192* (0.102)
contig					0.337*** (0.106)	0.336*** (0.106)	0.321*** (0.104)
curr					0.139 (0.108)	0.135 (0.109)	0.151 (0.108)
island					0.373** (0.153)	0.375** (0.153)	0.397*** (0.152)
covid						−0.046 (0.089)	
Constant	−12.571*** (0.738)	−12.411*** (0.748)	−9.995*** (0.760)	−11.483*** (1.750)	−12.455*** (1.781)	−12.416*** (1.783)	−13.866*** (1.807)
Observations	1,185	1,185	1,021	616	616	616	616
Adjusted Pseudo R^2	0.315	0.316	0.433	0.516	0.527	0.526	0.538
Time F.E.	N	Y	N	N	N	N	Y

Note: *p<0.1; **p<0.05; ***p<0.01; heteroskedasticity consistent standard errors are reported in parentheses.
Source: Own calculations

CONCLUSION

This paper examined how domestic market structure shapes export performance in a mature, differentiated consumer industry. Using a gravity framework estimated by PPML on EU beer trade between 2014 and 2023, it incorporated two complementary measures of domestic competition, market concentration (HHI) and producer diversity (microbrewery share). The estimates indicate that lower concentration and greater producer diversity are robustly associated with higher export volumes; the magnitudes are economically meaningful, with a 10% decline in HHI corresponding roughly to a 4% increase in exports, and results remain stable across specifications.

Theoretically, the present study extends heterogeneous-firm trade mechanisms to a context where non-price differentiation plays a central role, showing that domestic rivalry operates through both an efficiency/selection channel and a differentiation channel that is proxied by producer diversity. Empirically, it provides new sector-level evidence for the European beer industry using a multi-country panel linking domestic market transformation to external competitiveness within a gravity framework.

The findings have clear implications for policy and practice. Competition-enhancing regulation, timely entry and scale-up support for smaller producers, and instruments that lower the fixed costs of quality upgrading (such as certification facilitation, origin and sustainability labeling, and coordinated export promotion) are likely to yield indirect trade gains even in established consumer sectors. For incumbent firms, coexistence with dynamic small producers appears complementary: variety expansion, quality upgrading, and collaborative production can help translate identity-driven advantages into export performance.

Limitations remain. Reverse causality cannot be ruled out, and industry-level data obscure firm-level heterogeneity. Future research could exploit external shocks (mergers, advertising rules, tax reforms) or link brewery registries with customs data to analyze extensive and intensive export margins, quality premia, and reallocation dynamics, and to measure differentiation more directly.

Overall, the evidence indicates that export performance in mature consumer industries depends not only on macroeconomic scale and trade costs, but also on the internal organization of domestic markets. Policies that preserve rivalry and foster diverse producer ecosystems strengthen both productivity-based and differentiation-based competitiveness, with measurable gains in external performance.

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APPENDIX

Table 1 Overview of variables used

Variable	Description	Source
tot_exp_eur	Volume of total beer exports from exporting to importing country (in millions of EUR)	The Observatory of Economic Complexity
GDP_exp, GDP_imp	Real Gross Domestic Product per Capita of exporting and importing country (in EUR)	Eurostat
dist	Shortest air distance between the capital of exporting and importing country (in kilometers)	CEPII gravity database
pop_exp, pop_imp	Number of habitants of exporting and importing country (in millions)	CEPII gravity database
prod_exp, prod_imp	Beer production per capita of exporting and importing country (in hectoliters)	Brewers of Europe
cons_exp, cons_imp	Beer consumption per capita of exporting and importing country (in liters)	Brewers of Europe
HHI	Herfindahl–Hirschman index of the beer industry in the exporting country	Own calculation based on Euromonitor International
microbrew_brew	Ratio of the number of microbreweries to the number of breweries of the exporting country	Own calculation based on Brewers of Europe
price	Average nominal price of beer per unit in the exporting country (in EUR)	Statista Market Insights
tax_revenue	Government revenues generated from excise duties on the sale of beer of the exporting country per capita (in EUR)	Brewers of Europe
after10	Dummy variable, if the country allows TV advertisement of alcohol only after 10pm = 1 (in the exporting country)	European Centre for Monitoring Alcohol Marketing, European Commission
contig	Dummy variable, if countries share borders = 1	CEPII gravity database
curr	Dummy variable, if countries have the same currency = 1	CEPII gravity database
island	Dummy variable, if the importing country is an island = 1	Own compilation
covid	Dummy variable, if t = 2020 and 2021, = 1	Own compilation

Source: XXX