DEPARTMENT OF ECONOMIC POLICY
Faculty of Economics and Management | Slovak University of Agriculture in Nitra
Trieda A. Hlinku 2 | 94976 Nitra | Slovakia

DETERMINANTS OF INTERNATIONAL BEER EXPORT

- Eva Bieleková
- Jan Pokrivčák

DEP WORKING PAPER

No. 4/2018

Nitra | 2018

Determinants of International Beer Export

Eva Bieleková[1]
Jan Pokrivčák[1]

ABSTRACT

In last two decades, the global beer industry is undergoing changes. The process of consolidation led at first to unification of products, but as a response, new consumer trends such as orientation on exclusive and origin-specific beer emerged. Consumption in typical beer countries shows a downward trend, while there is a significant increase in emerging economies. The aim of this paper is to identify factors, which influence international beer export using the gravity model approach. We found that international beer exports in the period of 2000-2017 were positively influenced by the gross domestic product of importing countries and the beer production of exporters. Countries that share common borders or the same language tend to trade more than otherwise. Colonial ties show to be a very strong and positive determinant of international beer exports, they enhance beer exports by more than 7 times than countries not colonially tied. In addition, we found an export enhancing impact of customs unions and signed free trade agreements between trading countries. Beer export is negatively affected by the distance from exporting to importing country, which confirms the relevance of transport cost in trade with beer.

Keywords: international trade, export analysis, gravity model, beer

Acknowledgements

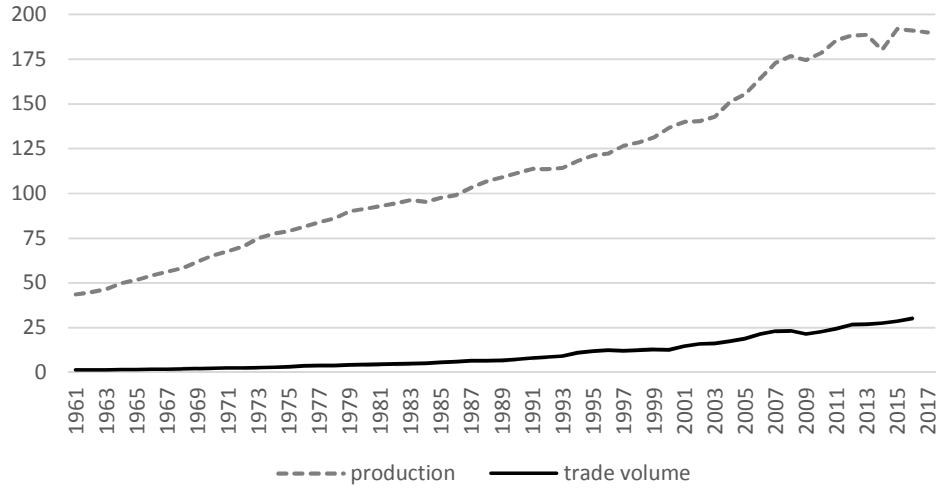
This work was supported by the Scientific Grant Agency of the Ministry of Education, Science, Research and Sport of the Slovak Republic under the project VEGA No. 1/0935/17.

[1] Slovak University of Agriculture in Nitra, Faculty of Economics and Management

INTRODUCTION

From the early decades of the 20th century, the beer production is growing globally. In the beginning of the period, Europe was the biggest producer of this commodity. After the 1950s, however, American and Asian countries gradually begun to catch up the European levels of production, what together with other factors contributed to the rise of world beer trade. Nowadays (2017), beer is the 222nd most traded product in the world (Product Complexity Index); around 15 % of the global beer production is being traded (Fig. 1).

Figure 1 World beer production and trade volume in billion litters



Source: FAO and Kirin Beer University database

Global beer export more than doubled since the year 2000, and currently it amounts 15.2 billion litters (value of 10.7 billion dollars). The top world beer exporter Mexico is followed by Netherlands, Belgium and Germany (UN Comtrade, 2018), while the largest amount of beer production comes from China, the United States, Brazil, Mexico, and Germany. In 2017, the European countries contributed to the global beer export with 57.1 % and North America with 32 %. Contrariwise, the leading beer importing area is North America (42 %) followed by Europe with the share of 35 % on world beer imports.

The former highly fragmented global beer industry has gone in last ten years through a process of consolidation via mergers and acquisitions (M&As). Increasing concentration lead primarily by large companies producing homogenous products reduced the number of competitors on the market and started a trend of premiumisation of the production (Tremblay and Tremblay, 2004; Madsen

and Wu, 2016). The motivation behind expansion of premium beer trade is the interest of consumers in new, exclusive and origin-specific products (Goméz-Corona and Escalona-Buendía, 2016) and preference of the less but better-quality option.

Beer trade is driven by changes in beer consumption. Consumption in typical beer countries as Czech Republic, Germany or Poland has recently shown a downward trend (Colen and Swinnen, 2010), on the other hand, a significant increase was captured in emerging economies, e.g. in China. International beer is considered superior in emerging markets and furthermore, there is a growing demand for origin-specific products (Barker, 2018), which is covered by imports and beer form new-created multinational takeovers. Other factor influencing global beer consumption and trade is religion. Some religions, e.g. Islam, Buddhist or Mormon, do not allow the consummation of alcohol (Ashley and Rankin, 1988). That accordingly limits trade with countries where the share of non-drinkers is substantial.

Beer comprises mostly from water, thus, its trade costs relating to transport, tariff and non-tariff restrictions are high. Because of high trade costs, firms in the beer industry tend to localize near consumers (Olper et al, 2012). Furthermore, many countries use protectionist policies (e.g. tariffs, government standards and laws, certifications, testing of consignments, excise duties), which create additional restrictions to trade with alcoholic beverages (Bjelić, 2016). The effect of tariff barriers can be lowered when regional and preferential trade agreements (RTA and PTA) exist between the trading partners. FTAs affect both tariff and non-tariff barriers; they contain services, investment or intellectual property rights (Wine institute, 2018).

Decision to sell a product to foreign markets should be made with respect to the characteristics of these markets. In this paper, we want to identify the factors stimulating current international beer export activities. One of the methods, which can be used for this purpose, is the gravity model of trade.

Most studies using gravity model deal with the simulation of countries' total foreign trade. A smaller number of studies is focused on foreign trade of specific commodities such as beer. For example, in case of cognac, Bouët (2015) states that the distance elasticity of cognac exports is negative but relatively small, while the elasticity to GDP is positive and relatively large. Balogh (2017) examined global wine trade flows with the conclusion that common cultural relations and trade agreements between trading partners lower the cost of wine export. The findings of De

Matteis et al (2017) suggest that technical barriers to trade adversely impact the exports of distillers dried grains with solubles to an extent larger than the influence of tariff. In case of beer, gravity with combination of pricing to market model was used by Dreyer et al (2016) to identify factors enhancing German beer export. The authors found that German beer export is strongly affected by the membership of trading partners in the EU and introduction of the Euro.

DATA AND METHODOLOGY

The objective of this paper is to identify the determinants of international beer export using the gravity model approach. To our knowledge, only a very few studies address this topic in the literature especially by applying the gravity model approach.

Theoretical background of the gravity model

Gravity model is used for modelling the allocation of traded goods transmitted from the export country (*i*) to the destination (importing) country (*j*). In terms of international trade assessment, the model origins with Tinbergen (1962). Since then it became a widely used and complex econometrical tool applied to this area of research. As a base for our estimation, we use the natural logarithm equation of Tinbergen (1962)

$$\ln X_{ij} = \ln G + a_1 \ln M_i + a_2 \ln M_j + a_3 \phi_{ij} + a_4 N_{ij} + a_5 V_{ij} + \varepsilon_{ij} \quad (1)$$

where X_{ij} is export from country *i* to country *j*; G is a constant; $a_1 - a_5$ are elasticities of variables; M_i and M_j represent economic attractors of export; variables ϕ_{ij} (geographical distance) and N_{ij} (trade costs) represent trade frictions; V_{ij} represent political or semi-economic factors and ε_{ij} is the error term.

We extend this equation by including variables with relevance to the international beer export to estimate their impact; the model has the following form:

$$\ln EX_{ijt} = \ln G + a_1 \ln pop_{jt} + a_2 \ln prod_{it} + a_3 \ln gdp_{it} + a_4 \ln gdp_{jt} + a_5\, contig_{ij} + a_6\, comlang_{ij} + a_7\, col_{ij} + a_8\, curcol_{ij} + a_9\, smctry_{ij} + a_{10}\, curr_{ijt} + a_{11}\, FTA_{ijt} + a_{12}\, CU_{ijt} + a_{13} \ln dist_{ij} + a_{14} \ln ndrel_j + a_{15} \ln land_i + a_{16} \ln land_j + a_{17}\, island_j + \mu_i + \mu_j + \mu_t + \varepsilon_{ijt} \quad (2)$$

Where:
EX_{ijt} – volume of beer export from export country *i* to import country *j* in year *t* in millions of litters
a_1-a_{17} – elasticities of variables
G – constant
μ_i, μ_j, μ_t – country-specific and time-specific dummy variables capturing multilateral resistance terms
ε_{ijt} – error term
Trade attractors:
pop_{jt} – population of *j* in millions of people
$prod_{it}$ – beer production of *i* in millions of litters
gdp_{it}, gdp_{jt} – gross domestic product of *i* and *j* in billion USD
$contig_{ij}$ – dummy variable (dummy) equal unity when *i* and *j* have common borders
$comlang_{ij}$ – dummy equal unity when *i* and *j* share the same official language
col_{ij} – dummy equal unity when *i* and *j* had/have a colonial link
$curcol_{ij}$ – dummy equal unity when currently *i* and *j* have a colonial link
$smctry_{ij}$ – dummy equal unity when *i* and *j* are/were part of the same country
$curr_{ijt}$ – dummy equal unity when *i* and *j* use common official currency
FTA_{ijt} – dummy equal unity when *i* and *j* have a signed free trade agreement
CU_{ijt} – dummy equal unity when *i* and *j* are members of a customs union
Trade frictions:
$dist_{ij}$ – average distance of *i* and *j* in km
$ndrel_j$ – share of adherence of religions that do not allow alcohol consumption
$land_i$, $land_j$ – dummy equal unity when *i* or *j* are landlocked countries
$island_j$ – dummy equal unity when *j* is an island

Estimation will be carried out using ordinary least squares (OLS) technique. We estimate 3 models. The first model A is a multiple linear regression model (pooled OLS). In the second model B, a set of time-specific dummy variables will be included to capture export variation over time, and a set of dummy variables for all exporters and importers will be included into the third model C to account also for unobservable multilateral resistance. The best fitted model will be selected by comparing the following characteristics (König and Schulze, 2008):

- measure of adjusted R-squared coefficient (the higher is the adjusted R-squared, the more variability in dependent variable is explained through the model),
- Mean square error (MSE), where the better model is the one with lower MSE,
- Akaike information criterion (AIC), where the better is the model with the lower AIC.

Description of variables and data availability

To estimate effects of factors influencing the international beer export, an unbalanced panel data set is created; the zero observation of the dependent variable are not included. International beer export is represented by export volumes of the biggest global beer exporting countries (Mexico,

Netherlands, Belgium, Germany, USA, United Kingdom, France, Ireland, Denmark, Czech Republic, China, Spain, Italy, Portugal, Singapore, Thailand and Poland); they account for more than 85 % of global beer exports (in value and in volume). The dependent variable is the annual volume of export in mil. litters from 17 selected reporters to 210 importing countries in the period of 2000-2017. Export data was extracted from UN Comtrade Database (corresponding to the harmonised system code HS4 2203).

First explanatory variables are conventional gravity model variables gross domestic product (GDP) of exporting countries *i* and GDP of importing countries *j*. Data on GDP is expressed in millions USD (current prices) and retrieved from the World bank database. In case of exporter, GDP represents its productive capacity. We expect that increase in GDP will increase the exporters' production possibilities and by that the availability of goods for export.

The population of importing country represents potential consumers of beer. However, no a priori relationship between population and trade has been identified in other studies. A positive sign would mean that bigger countries can absorb more of goods traded; a negative sign according to Giorgio (2004) could mean that growing population has a need for more differentiated supply of goods. Data on population size of the 210 importing countries is taken from the World bank database.

Production variable is used as a proxy for output capacity (supply) of exporters. We expect the coefficient of the variable be positive. Production data are drawn from Food and Agriculture Organization Corporate Statistical database (FAOSTAT) and Kirin Beer University database.

Data on average distance between the trading countries comes from CEPII database. Distance variable is used as a proxy for transport costs of trade. According to Buch, Kleinert and Toubal (2004), the magnitude and sign of the distance coefficient are related to the importance of bilateral activities with partners that are far away relative to those that are located nearby. We expect the distance to have a negative effect on beer export.

CEPII database was also used to acquire data on common official language, common borders, colonial history of trading countries and data on countries that once were or currently are a part of the same state. Trade with neighbouring countries can be beneficial, as it reduces transport costs. We included a dummy variable to control for this effect and expecting its coefficient to be positive. Other variables related to transport costs are $land_i$ and $land_j$, which take the value of 1 when

country i or j are landlocked, and dummy variable $island_i$ equal unity when the importing countries are islands. In both cases, we expect that these factors reduce the beer export.

Trade costs not only include costs of transportation, they also can be related to exchange rates. To capture this effect, we include the variable common currency (World atlas.com). We expect a common currency used by trading countries to lower the trade costs and enhance trade.

The language variable is added to capture possible effect of common official language of trade partners on export. We expect the language factor to have a positive effect on beer trade. Similarly, a positive coefficient sign is expected also in case of common colonial link of trading countries and the fact that they are or were a common country as well.

Data on adherence fractions of population of different religion groups and atheists in 2000 was retrieved from the World Christian Database. We estimated the share of people belonging to religions not allowing alcohol consumption (Moslims and Budhists) on countries' total population number. The expectation is that the higher the share of non-drinkers in importing country, the lower the beer exports.

Finally, we estimated the effect of customs unions and free trade agreements (FTA), which are considered to decrease or eliminate tariffs and trade barriers. Data on CU and FTA was retrieved from the Regional trade agreements information system (RTA-IS) of WTO.

RESULTS

The estimation results for all estimated models are reported in Table 1. If we consider the criteria mentioned in methodology of the paper (Table 2), the best fitted model for the identification of determinants of international beer export is the model with both country- and time-specific fixed effects (model C). Model and the explanatory variables explain 56 % of the variability in export. Most of the explanatory variables are strongly statistically significant, and most coefficients have the expected sign. Next, we will report the results of the best fitted model C.

Table 1: Estimation results

	Pooled regression (A)		FEt (B)		FEijt (C)	
EXPijt	Coef.	Sig	Coef.	Sig	Coef.	Sig
Ln gdpjt	0.696	***	0.702	***	0.590	***
	(0.000)		(0.000)		(0.000)	
Ln gdpit	-0.201	***	-0.182	***		
	(0.000)		(0.002)			
Ln popjt	-0.363	***	-0.369	***		
	(0.000)		(0.000)			
Ln prodit	0.483	***	0.470	***	0.384	***
	(0.000)		(0.000)		(0.002)	
contigij	1.126	***	1.126	***	1.012	***
	(0.000)		(0.000)		(0.000)	
comlangij	0.682	***	0.686	***	0.391	***
	(0.000)		(0.000)		(0.006)	
colij	0.043		0.031		0.858	***
	(0.840)		(0.884)		(0.000)	
curcolij	1.980	***	1.980	***	1.942	***
	(0.000)		(0.000)		(0.000)	
smctryij	0.795	**	0.798	**	0.557	
	(0.024)		(0.023)		(0.290)	
currijt	0.599	***	0.584	***	0.343	*
	(0.003)		(0.004)		(0.059)	
FTAijt	-0.054		-0.050		0.333	***
	(0.620)		(0.657)		(0.001)	
CUijt	0.222		0.248		0.334	**
	(0.198)		(0.156)		(0.036)	
Ln distcapij	-0.947	***	-0.942	***	-1.296	***
	(0.000)		(0.000)		(0.000)	
ndrrelj	-0.959	***	-0.949	***	n.e.	
	(0.000)		(0.000)			
landj	-0.613	***	-0.60	***	n.e.	
	(0.000)		(0.000)			
islandj	-0.346	***	-0.345	***	n.e.	
	(0.009)		(0.009)			
landi	-1.186	***	-1.159	***	n.e.	
	(0.000)		(0.000)			
Constant	13.337	***	13.385	***	12.031	***
	(0.000)		(0.000)		(0.000)	
Number of obs.	25 812					
Adj. R-squared	0.337		0.338		0.563	
Prob > F	0.000		0.000		0.000	

*Significant at: *** p<0.01, ** p<0.05, * p<0.1*

Note: Robust p-values are displayed in parentheses; the country- and time-specific fixed effects are omitted; gdp_{it} and pop_{jt} were excluded from model C due to multicollinearity problem; n.e. denotes variables, which were dropped to avoid perfect collinearity with fixed effects

Table 2: Characteristics of estimated models

	Pooled regression (A)	FEt (B)	FEijt (C)
Adj. R-squared	0.337	0.338	0.563
Root MSE	2.402	2.402	1.950
Akaike crit. (AIC)	118513	118519	107974

GDP of importing countries is statistically significant at the 1 % level across all three models and ranges from 0.6 to 0.7. It shows that 1 % increase in GDP in the importing country would be followed by 0.6-0.7 % increase in exports to the country. We can conclude that beer is considered a superior and normal good by its consumers. Our results are consistent with other studies (e.g. Fogarty, 2010; Dreyer et al, 2016), which report the income elasticity of beer be positive.

Exporter's supply capacity was proxied by the production variable. The estimated coefficient ranging from 0.38-0.48 is statistically significant, it has the expected sign. Thus, a 1 % increase in production can enhance beer exports by 0.38-0.48 %.

Another conventional gravity model variable is distance; its coefficient proved statistically significant and has the estimated value of –0.94-to –1.3. We can conclude that compared to European (–0.9 in Olper et al, 2012) or German beer exports (0.4-0.56 in Dreyer et al, 2016), the magnitude of transport costs of our group of selected exporters is greater; specifically, a 10 % increase in distance between the trading countries lowers the international beer exports by 9.4-13.0 %.

Some trading countries in our sample use the same official language. In all 3 estimated models, the variable is strongly statistically significant and takes the value of 0.39-0.69. The result shows that trading countries sharing a common language ten to trade 48-99 % (exp(0.39) –1=0.48) more than otherwise.

Another factor, which was expected to have a positive effect on international beer export, is trade with neighbouring countries. The variable is strongly statistically significant in all 3 models, and it varies between 1.01 and 1.13. Countries sharing common borders tend to trade 175 to 210 % more other countries. The fact that beer trade between contiguous countries is enhanced is also reported in the study of Olper et al (2012).

The influence of the landlockedness or the fact that countries are islands could not have been estimated in the country-specific fixed effect model, but according to the two other models, variables are all strongly significant and their coefficients are negative as expected. The highest trade-reducing effect (–1.17 in average) when landlocked is estimated for the exporter. We found that the land-lockedness of an exporter decreases the trade by 69 %.

Colonial links between trading partners positively influence international beer exports. In case the countries had colonial relations in the past bet not anymore, the exports are 136 % higher than to countries without colonial relationships. In case of importers that currently have a colonial link to

exporter, the exports tend to be approximately 620 % higher than to countries without a current colonial link.

Because of multicollinearity problem, the effect of religion was not estimated in the country-specific fixed effect model. In the two other models, the variable is significant, and the coefficients have expected signs. We can conclude that higher share of non-drinkers in importing country negatively affects beer exports.

Next, we found a positive effect of signed FTAs and membership in customs unions (statistically significant at 1 % level) on the volume of beer exports. According to the best fitted model, countries that do engage in FTAs and customs unions tend to trade 39 % more than countries that do not.

CONCLUSION

The objective of this paper was to identify determinants of international beer export using the gravity model approach. To our knowledge, only a very few studies address this topic in the literature especially by applying the gravity model. Based on estimation results we conclude that gravity model with fixed effects is an appropriate tool for explaining the variability of international beer export. The best fitted model explained 56 % of beer export variability. The additional variability could be related to factors such as the trade openness of countries, tariffs or exchange rates, which were not covered by our model.

According to estimation results, international beer exports in the period of 2000-2017 were positively influenced by the gross domestic product of importing countries and the beer production of exporters. We estimated the income elasticity of beer to be positive and less than 1, which indicates that by its consumers, beer is considered a superior and normal good. Countries sharing common borders, same language or that have a common colonial link tend to trade more than countries without such relationships. Colonial ties shown to be a very strong and positive determinant of international beer exports as export to colonially linked countries was estimated to be 620 % higher than otherwise. In addition, we found that countries engaging in FTAs or/and customs unions tend to trade more than countries that do not.

The beer export activities are negatively influenced by the distance between trading countries, which is a proxy variable for transport cost of beer in international space. We also estimated the effect of other elements of trade cost (e.g. landlockedness of exporters or importers, countries being

islands, the share of non-drinkers). While their trade-reducing effect was confirmed by less fitted models, it could not have been estimated by the country-specific fixed effect model.

Acknowledgements

This work was supported by the Scientific Grant Agency of the Ministry of Education, Science, Research and Sport of the Slovak Republic under the project VEGA No. 1/0935/17.

References

- Ashley M.J. and Rankin, J.G. (1988). A public health approach to the prevention of alcohol-related health problems. Annual Review of Public Health, vol. 9, pp. 233-271. Retrieved from https://www.annualreviews.org/doi/pdf/10.1146/annurev.pu.09.050188.001313
- Bjelić, P. (2016). Trade Facilitation and Non-Tariff Measures in Beverages and Auto-Parts Supply Chains in CEFTA. Technical report. DOI: 10.13140/RG.2.2.31972.78720
- Buch, C. M., Kleinert, J. and Toubal, F. (2004). The distance puzzle: on the interpretation of the distance coefficient in gravity equations, Economics Letters 83, pp. 293-298.
- CEPII, Centre d'Etudes Prospectives et d'Informations Internationales. GeoDist Dataset. Accessed December 7, 2018, Retrieved from http://www.cepii.fr/CEPII/en/bdd_modele/bdd_modele.asp
- Colen, L. and Swinnen, F.M. (2010). Beer Drinking Nations. The Determinants of Global Beer Consumption., LICOS Discussion Paper, No. 270, Katholieke Universiteit Leuven, LICOS Centre for Institutions and Economic Performance, Leuven. Retrieved from http://hdl.handle.net/10419/75022
- De Matteis, M.C. (2017). Analyzing the Utilization and Trade of Distillers' Dried Grains with Solubles. Master's Thesis, University of Tennessee, 2017. Retrieved from https://trace.tennessee.edu/utk_gradthes/4866
- Dreyer, H., Fedoseeva, S. and Herrmann, R. (2016). Gravity meets pricing to market: What a combined-method approach tells us on German beer exports. AAWE working paper No. 194. 38 p. Retrieved from http://www.wine-economics.org/aawe/wp-content/uploads/2016/03/AAWE_WP194.pdf
- Fogarty, J. (2010). The Demand for Beer, Wine and Spirits: A survey of the literature. Journal of Economic Surveys 24/3, pp. 428-478.
- Giorgio, R. (2004). Empirical Evidence on the North-South Trade Flows: an Augmented Gravity Model. MPRA Paper No. 1326. Retrieved from https://mpra.ub.uni-muenchen.de/1326/1/MPRA_paper_1326.pdf

- Goméz-Corona, C., Escalona-Buendía, H. B., Garcia, M., Chollet, S. and Valentin, D. (2016). Craft vs. industrial: Habits, attitudes and motivations towards beer consumption in Mexico. Appetite, 96, 2016, pp. 358-367. DOI: 10.1016/j.appet.2015.10.002. 13
- Madsen E.S., Wu Y. (2016). Marketing and Globalization of the Brewing Industry. In Cabras I., Higgins D., Preece D. (eds) Brewing, Beer and Pubs. Palgrave Macmillan, London. DOI: 10.1057/9781137466181_3
- Martínez-Ramos, L., Martínez-Zarzoso, I. and Suárez-Burguet, C. (2007). The Role of Distance in Gravity Regressions: Is There Really a Missing Globalisation Puzzle? The B. E. Journal of Economic Analysis and Policy 7(1), Topics, Article 6. DOI: 10.2202/1935-1682.1557.
- König, J., and Schulze, P. M. (2008). Zur Analyse rheinland-pfälzischer Exportemittels Gravitations model (Working Paper No. 34). Retrieved from http://www.statoek.vwl.uni-mainz.de/Dateien/Arbeitspapier_Nr_34_Gravitationsmodell.pdf
- Olper, A., Curzi, D., Frisio, D.G., and Raimondi, V. (2012). Home Bias in Consumption: A Comparison between Wine and Beer. German Journal of Agricultural Economics (Agrarwirtschaft), 61, pp. 223-234.
- Tremblay, V.J. and Tremblay, C.H. (2004). The US brewing industry: data and economic analysis. Cambridge : MIT Press, 2004. ISBN: 9780262201513
- Wine institute. (2018). International trade policy. Accessed December 7, 2018. Retrieved from https://www.wineinstitute.org/international_trade_policy