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What drives the Halal Food and Beverage Trade? A Gravity Model Investigation

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Abstract: The study aimed to determine the antecedents or drivers of the Halal food and beverage trade. The Halal F&B statistics were manually derived by applying the Shariah principle of "presumption of permissibility" and the WTO assumption when assigning HS codes on the specific trade concerns database to determine the approximate value of Halal F&B trade between countries, which is an important contribution of this study. We utilized the gravity model of international trade and the Poisson-Pseudo-Maximum Likelihood (PPML) approach, which is the gravity model's commonly suggested estimator. The examined samples include bilateral trade data from 59 nations (20 OIC members) between 2007 and 2016. The tested determinants are the variables of the economy, distance, level of income, exchange rate, regional trade agreement, common border, common language, colonial relationship, and landlocked commerce. Results indicate that the economic size of trade partners, regional trade agreements, shared borders, and common language significantly positively impact the value of Halal F&B exports. In contrast, distance, exporting nation income, exchange rate, and landlocked trade significantly negatively impact. Meanwhile, it appeared that neither the income level of the importing country nor its colonial relationship had a substantial impact on commerce.

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1. Introduction

Despite the fast growth of the Halal sector over the past few decades, few empirical studies have been conducted on the factors that influence international Halal trade. This study is a preliminary investigation into the elements that affect the value of Halal commerce flow. It focuses on the Halal food and beverage industry, the largest section of the Halal economy.

Halal has evolved from an exclusive niche market for Muslim consumers to a vibrant worldwide market phenomenon during the past two decades (Centre, 2015). According to the state of the global Islamic economy report 2017/18, the value of the global Halal market was roughly USD 2.006 trillion in 2016 and is projected to reach USD 3.082 trillion by 2022. (Reuters, 2017). Recently, the scope of Halal has expanded to include fashion, tourism, cosmetics, pharmaceuticals, and the media, among others. This makes Halal one of the world's fastest-growing consumer segments. The size of the Halal economic sectors (excluding the Islamic financial industry) and their predicted size in 2022 are depicted in Figure 1.

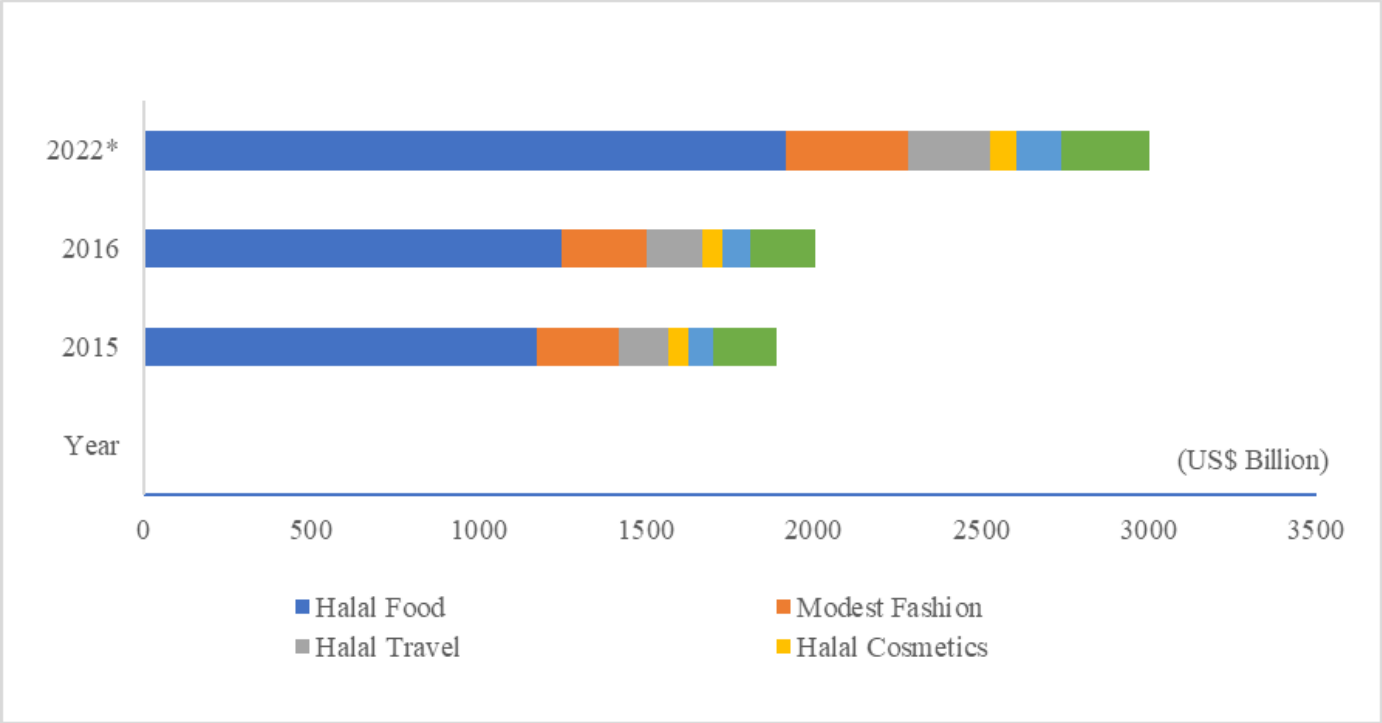

Figure 1: The expected market size of the global Halal economy (excluding Islamic finance)
Sources: Thomson Reuters' the state of the global Islamic economy report 2016/17 and 2017/2018

Some of the elements that contribute to the expansion of the Halal market and its worldwide trade are as follows:

First is the rapid increase in size and dispersion of the global Muslim population. In 2011, the Pew Research Center estimated that the global Muslim population was approximately 1,8 billion. By 2030, the world's Muslim population is projected to reach 2,2 billion, representing 26% of the world's total population. Due to increasing fertility, migration, and religious shifts, the Muslim population has grown faster than any other religious group, especially in Europe and the United States, according to a study (Mohamed, 2018). Additionally, the Muslim diaspora is ubiquitous in every corner of the world (Desilver, 2017). An estimated 134 nations have a Muslim population of at least 1 percent of their overall population (Muslim, 2018).

The second aspect is the rise in Muslim education and economic prosperity, particularly among younger people. In contrast to the global trend, 60 percent of the population in Muslim-majority countries is under 30 years old, according to data. At the same time, many nations are experiencing an aging society problem (Lugo et al., 2011). These newer generations tend to have greater spending power and distinct preferences than their predecessors. They expect and can purchase a wide variety of goods and services that satisfy their taste and lifestyle while remaining consistent with their religion. This modifies the new development of Halal products for international trade (Izberk-Bilgin et al., 2016).

Additionally, the preference for Halal products is no longer restricted to Muslim consumers alone. Recent evidence indicates a surge in the positive impression of non-Muslim customers toward Halal products, particularly among groups with health and ethical concerns, because Halal promotes substance purity and recommends eating products closest to their original state. In addition, Halal is associated with traditional principles such as fair trade, organic agriculture, animal welfare, food safety, and ecological economics (Afsari et al., 2017; Khan et al., 2016).

Numerous policymakers view the expansion of Halal as a tremendous opportunity to increase their nation's riches (Abd Aziz et al., 2015). They have made significant efforts to capture this prospective market (Samori et al., 2014). Muslim countries like Malaysia, the United Arab Emirates, and Turkey are among the most active. They have a clear ambition to become a hub for the Halal trade and hold yearly Halal exhibits to promote this sector. In addition, non-Muslim countries such as Thailand, Japan, and South Korea seek to establish themselves as leaders in the Halal market. Countries such as Australia and Brazil, which are among the leading providers of meat and poultry to Middle Eastern nations, are examples (The Halal Industry Development Corporation, 2015).

Despite the global interest in Halal trade, we discovered that few academic studies had been conducted on the factors that affect Halal trade flow. Although the topic of Halal has attracted the interest of researchers, particularly in the business and marketing areas, this is particularly true in the

field of business marketing. Numerous research on consumer awareness, attitude, and perception of Halal logos or products have been conducted (Zulfakar et al., 2014). However, study on the factors that influence the trade of Halal items is relatively uncommon. In reality, the outcome of this determinative research should be able to give policymakers and market participants useful business information.

2. Stylized Facts and Past Literature

Researchers' interest in Halal has expanded recently, particularly in biological science, commerce, and marketing. Numerous research has either focused on consumer views, such as awareness, attitude, and perception toward Halal trademarks or products, or on certification processes, supply chain and ingredient traceability to assure the accuracy of the certification process (Zulfakar et al., 2014). Abd Aziz et al. (2015) reviewed the emergence and expansion of Halal studies between 2007 and 2014. They discovered that most Halal research focuses on Halal food and beverage, the largest part of the Halal industry. Most of the study focused on consumer behavior, while a smaller portion was devoted to Halal certification, Halal logos, and Halal brands.

Halal logos play a crucial part in consumer decision-making, even though most studies on Halal have concentrated on customer perspectives. Numerous studies have demonstrated the importance of Halal to consumers and its influence on their purchasing decisions (Abdul et al., 2009; Abu Musa, 2011; Bonne et al., 2007; Karim et al., 2011; Shafie et al., 2006).

Halal is undoubtedly one of the most important criteria for consumers in Muslim-majority nations. Shafie et al. (2006) evaluated the effect of Halal certification on the purchasing decisions of Malaysian consumers. They performed a poll to determine the elements that influence consumer purchase decisions. 891 out of a total of 1000 respondents indicated that the halal label did influence their purchasing decisions. Abdul et al. (2009) studied how consumers decide to purchase Halal food. Muslim attendees of the 2008 Malaysian Agriculture, Horticulture, and Agrotourism Show were the most concerned about the Halal status of food items, according to a questionnaire distributed to 213 attendees of the event. Halal certification is a significant aspect of their decision-making. They underlined the importance of the certification's credibility to persuade the buyer that the labeled food is safe for ingestion.

In addition, Muslim consumers tend to avoid foods they cannot be certain are Halal. Aris et al. (2012) presented the topic of the Istihalah notion, which they believe should be debated to break down Halal's rigidity practice on the market. Istihalah, in brief, refers to the total transformation of a banned material into a new substance that no longer possesses its old attributes (smell, color, taste, etc.) and name, hence rendering the new substance Halal. For instance, fruit from a tree obtained all of its nutrients from Haram substances like pig carcasses, the transformation of wine into vinegar, or pig-derived gelatine. According to Imam Hanafi, Maliki, and Ibn Taimiyyah, Istihalah is a flexible term that can be applied to various situations; hence, all the above conditions are considered permissible. Shafii and Hanbali sects, on the other hand, limit the use of the Istihalah idea. This means that gelatine obtained from pigs and wine converted to vinegar through chemical or biotechnological processes is not halal.

3. Halal Trade

Masron et al. (2014) conducted the initial research on the determinants of Halal food export in Malaysia. They estimated the value of Halal exports based on the total value of food exports but restricted Middle Eastern trade partners to only 12 OIC nations. The objective was to study the association between the amount of Malaysian Halal development, defined by the number of issued halal certificates and enterprises operating in halal parks, and food export performance. The 2004-2009 panel data with OLS, fixed, and random effect estimation revealed that the level of Halal development has a favorable impact on the export of Halal food from Malaysia. Another significant positive determinant is the economic size (proxied by GDP). However, distance and exporter's income were significant negative factors (GDP per capita). Mazlan et al. (2015) analyzed the determinants of Halal exports from Malaysia to its 44 developing partner nations between 2010 and 2013. Using a fixed-effects model on 176 observations, they discovered that the importer's gross domestic product (GDP) is the only significant positive predictor for Malaysian Halal exports. Other variables, such as population size, have no substantial effect on export value. Their analysis supplied the investigation's initial attempt by utilizing actual, documented data from a Malaysian agency. However, there are certain restrictions. The observed period was too brief, resulting in an insufficient number of observations. This may be limited by the quantity of data they possess. Abdullah et al. (2017) evaluated the effect of distance and the Muslim population on the performance of Malaysian Halal trading in partner nations. Using panel data regression based on the gravity model between Malaysia and its top 10 trade partners plus 4 selected OIC countries (Iran, Saudi Arabia, Egypt, and Turkey) from the first quarter of 2010 to the fourth quarter of 2016, it was discovered that distance has a significant negative relationship with trade value, consistent with the gravity theory. However, the number of Muslims in the partner countries has no substantial effect on Halal commerce. Hong (2016) estimated the determinants of Halal personal care items exported from Malaysia to China's Muslim regions using the augmented gravity model. She determined that trade openness, the state's diplomatic ties, and the cost of the goods are key factors in explaining exports. The possibility of Malaysia being the only nation to record Halal trade statistics is notable. Ali et al. (2017) said that the Halal Development Corporation was the source of their export data (HDC). The statistics are measured by the value of exports from companies with Halal certification (Mazlan et al., 2015). Malaysia is the most active nation in the Halal industry. They identified Halal in their Third Industrial Masterplan between 2006 and 2016 and made the development of Halal sectors a state priority.

Observed empirical Halal trade research in other nations is sparse. There are trade-related works available. In the case of South Korea (Park et al., 2019), Pakistan (Qureshi, 2012), and Maghreb countries (Algeria, Libya, Mauritania, Morocco, and Tunisia), for instance: (Noor et al., 2015). However, these arguments are primarily conceptual.

Abidin et al. (2013) examined the economic factors of Malaysian exports to selected OIC nations. Using the export data and gravity model from 1997 to 2009, they discovered that economic size, distance, trade openness, institutions, inflation, and exchange rates substantially impact Malaysia's export value. Nuroglu (2010) analyzed the influence of population on the value of bilateral commerce between the top six OIC nations (Indonesia, Malaysia, Turkey, Saudi Arabia, Iran, and the United Arab Emirates) from 1985 to 2009. Population and exchange rate volatility were among the most influential factors determining commerce between groups. The fluctuation of currency rates diminishes the value of commerce.

Additionally, a larger population in the exporting nation increases exports, while a larger population in the importing country decreases trade. He explained that an increase in population leads to a rise in production. Therefore, it increases export capacity and reduces import requirements.

4. The Gravity Model of International Trade

The gravity model of international trade is a frequently used model that attempts to identify the factors that determine international trade. Tinbergen initially applied it to global trade flows in 1962. He utilized Isaac Newton's 1687 law of universal gravitation in physics to analyze worldwide commerce flows. Newton's law indicates that the gravitational force between two objects is proportional to their masses and the distance between them.

$$F_{ij} = G\frac{M_i M_j}{d_{ij}^2} \quad \text{..... (1)}$$

Where the gravitational force (F_{ij}) is proportional to the product of the object's masses M_i and M_j and inversely proportional to the square of the distance d_{ij}^2 between each other. The gravitational constant (G) is an empirically determined value. Tinbergen suggested that the proportion of trade flows between two countries conforms to the gravity equation that the trade volume between two trading partners is proportional to their economic sizes and inversely proportional to the barriers between them (Chaney et al., 2011). He assumed the following relationship:

$$X_{ij} = K\frac{Y_i^{\propto} Y_j^{\beta}}{D_{ij}^{\gamma}} \quad \text{..... (2)}$$

where X_{ij} is trade indexed between trading partners i and j, Y_i and Y_j are the economic sizes of the two, and D_{ij} represents the distance or trade barriers between them.

By taking the natural logarithm of the above equation and adding an error term, the gravity model can be obtained as a linear relationship which allows the interpretation of its coefficients as follows:

$$log(X_{ij}) = logK + \propto logY_i + \beta logY_j - \gamma logD_{ij} + \varepsilon_{ij} \quad \text{..... (3)}$$

The gravity model has been widely utilized in international trade studies to evaluate the effects of trade policy. It has been regarded as one of the most empirically robust and influential explanations in international trade research (Porojan, 2001). However, the model was first critiqued for relying primarily on intuition and lacking academic support. Later, researchers like Anderson (1979), Bergstrand (1985), Anderson et al. (2003), and others, who developed supporting theoretical foundations for the gravity model, dispelled this objection.

5. Estimation Model Specification

The theoretical gravity model and earlier studies on trade determinants provide a collection of variables that regularly influence the value of bilateral trade flows between trading partners. Since as far as we are aware, Halal food is the only sector that has not been analyzed expressly for the elements influencing its trade value. Before digging deeper into the specifics of additional factors of interest, it is crucial to examine the impact of this set of common determinants in the first phase of this study.

The proposed paradigm for the empirical inquiry is as follows:

$$HFE_{ijt} = k + \beta_1 ln\, GDP_{it} + \beta_2 ln\, GDP_{jt} + \beta_3 ln\, DIST_{ij} + \Theta Control_{ijt} + \varepsilon_t \quad \text{..... (4)}$$

Where

$$Control_{ijt} = \theta_1 RTA_{ij} + \theta_2 LAN_{ij} + \theta_3 FX_{ijt} + \theta_4 GDPC_{it} + \theta_5 GDPC_{jt} + \theta_6 Border_{ij} + \theta_7 Col_{ij} + \theta_8 Landlock_{ij} \quad \text{.....(5)}$$

The HFE_{ijt} is the dependent variable representing the value of the Halal food trade from country i to country j at time t. The variables in Eq.4 are taken from the theoretical gravity model where GDP_{it} and GDP_{jt} represent the size of the economy of the trade partners at the time t, and DIS_{ij} is the distance between the two countries. The list of control variables tested in Eq.5 is collected from the common variables found in the gravity literature, which are already discussed in the previous Chapter, including the relative exchange rate of trade partners (FX_{ijt}), income level of their population, which is proxied by the GDP per capita ($GDPC_{it}$ and $GDPC_{jt}$). In addition, some dummy variables, including regional trade agreement (RTA_{ij}), common official language (LAN_{ij}), common border ($Border_{ij}$), colonial relationship (Col_{ij}), and trade involvement with the landlocked country ($Landlock_{ij}$), are added for the examination.

According to the gravity theory and the literature, the value of trade flow is positively related to the economic size of trade partners and inversely influenced by the distance between them. Thus, we expect that impact of GDP_{it}, GDP_{jt}, and $DIST_{ij}$ According to the literature explored, the trade will align with Halal food. For the list of control variables in Eq.5, we expect that the variables that should benefit the Halal food trade are: regional trade agreement (RTA_{ij}), income level of the importer ($GDPC_{jt}$), common language (LAN_{ij}), common border ($Border_{ij}$), and colonial relationship (Col_{ij}).

Regional trade agreement (RTA_{ij}) can benefit the trade flow since it reduces the trade barriers, such as customs and tariffs between its members (Smillie et al., 2019). The income level of the importer ($GDPC_{jt}$) increases the consumption capability of people within the country and creates demand for more imported products (Ramezzana, 2000). In terms of countries that share a common border ($Border_{ij}$), it should comparatively be more convenient for goods transportation between them, resulting in a higher value of trade (Cheong et al., 2018; Didier, 2018; Fratianni, 2007; Gani, 2017; Gundogdu, 2009; Hatab et al., 2010; Liu et al., 2018; Miran et al., 2013; Rautala, 2015). Lastly, the countries which have a common official language (LAN_{ij}) and colonial relationship (Col_{ij}) should trade more, according to the literature (Cheong et al., 2018; Elliott et al., 2019; Fratianni, 2007; Gani, 2017; Hatab et al., 2010).

The factors that are expected to have negative impacts on trade include the relative exchange rate of the exporter over the importer (FX_{ijt}), the income of the exporter ($GDPC_{it}$), and trade with the landlocked country ($Landlock_{ij}$). The exchange rate (FX_{ijt}) is the portion of one unit of the exporter's currency to the importers. It determines the price of the exporter's product in the eye of the importer. Thus, a higher level of this relative exchange rate means more expensiveness of the product from the importer's perspective (Bhattacharyya et al., 2018; Masron et al., 2014). Therefore, the exchange rate variable (FXijt) is expected to impact the Halal food trade's total value negatively. The higher income of exporting countries ($GDPC_{it}$) can reduce the amount of exports due to higher demands of local consumption (Abidin et al., 2013; Hatab et al., 2010; Masron et al., 2014). The landlocked country ($Landlock_{ij}$) has a natural barrier to trade due to its limitation in transportation (Kharel et al., 2010).

6. Estimation Method

Poisson Pseudo-Maximum Likelihood (PPML) is proposed as the primary method for our panel data analysis. Due to its capacity to resolve econometric challenges of gravity trade estimation, the approach is one of the most often used estimators in recent scholarship (Kuik et al., 2019; Shepherd et al., 2019). Silva et al. (2006) identified several crucial aspects that must be considered while evaluating gravity models. Due to heteroscedasticity, heterogeneity, and autocorrelation, the employment of a log-linearized model can result in very misleading and skewed estimates. They underlined that several

econometric applications ignore the fundamental fact that the expected value of the logarithm of a random variable is distinct from its expected value (E(ln y) ln E(y)). In heteroskedasticity, such as huge volumes of cross-sectional data, interpreting parameters using log-linearized model estimation generates skewed estimations of the genuine elasticities. The gravity model is one of the instances in which heteroscedasticity, heterogeneity, and autocorrelation are found due to the composition of cross-sectional data distributed through time, the variance in country characteristics, and the volume of trade flow between small and major nations.

The second economic concern is the regular occurrence of zero trade values in the bilateral trade observation. The presence of a dependent variable with a zero value complicates the usage of the log-linear form of the gravity equation. The logarithm of 0 is undefined in mathematics. Two typical approaches have been used to address the zero-trade flow issue: removing the zero-trade pairs from the data set and (ii) altering the data by adding minor values, such as one to the value of the dependent variable, and then estimating the model in log-linear form. However, both methods present estimating difficulties. The zero-trade value has statistical significance; omitting or altering it might result in sample selection bias and inconsistent estimators of the parameters of interest (Kabir et al., 2017). To address these econometric concerns, Silva et al. (2006) proposed estimating the gravity equation using the PPML. The method is consistent in the presence of heteroscedasticity and gives a simple solution to deal with dependent variable values of zero. Since the PPML estimator is not required to linearize the model through logarithms, the issue of zero-trade value is eliminated (Shepherd et al., 2019). It retains total trade flows between the actual and estimated bilateral trade matrices, resolving the "adding up" problem posed by other gravity model estimators (in which total forecast trade surpasses total actual trade).

The Poisson regression model is defined by Silva et al. (2010) as follows:

$$\Pr(y_i = j|x_i) = \frac{\exp(-\lambda)\lambda^j}{j!},\ j = 0,1,2,\dots \quad (6)$$

where λ is generally specified as $\lambda = \exp(x_i'\beta) = \exp(\beta_0 + \beta_1 x_{1i} + \cdots)$. The β is the vector of parameters of interest which can be estimated by maximizing the log-likelihood function given by

$$\ln L(\beta) = \sum_{i=1}^{n}[-\exp(x_i'\beta) + (x_i'\beta)y_i - \ln(y_i!)] \quad (7)$$

The PPML is broadly accepted and has been used as the main estimation method for much recent gravity literature, including Head et al. (2010), Dai et al. (2014), Dutt et al. (2020), Bojnec et al. (2015), Cestepe et al. (2015), Saucier et al. (2017), Larch et al. (2018), Webb et al. (2018), and Didier (2018).

7. Robustness Checks

The robustness of the PPML estimation result will be evaluated by comparing it to the Heckman Sample Selection (HSS) estimation result. Shepherd et al. (2019) also advocated HSS as an alternative gravity model estimator with PPML. HSS is innately able to incorporate zero trade observations into the dataset. It permits independent data-generation procedures for zero and non-zero values. Compared to PPML, the HSS is less advantageous when dealing with heteroskedasticity. As a result, it is less frequently utilized as a gravity model workhorse estimator. Nonetheless, newer works such as Natale et al. (2015) and Ehrich et al. (2018)) used the HSS as their primary estimation technique.

To determine the consistency of estimated coefficients, we also decided to compare the estimation result with the classic log-linearized model, including ordinary least squares (OLS), two-stage least squares (2SLS), and random effects model (RE). The dependent variable was modified to incorporate zero observations in the dataset. Even though Silva et al. (2006) do not suggest this method, it is still one of the most common methods used in the literature for comparison and robustness testing (Natale et al., 2015). Notably, we decided to compare the estimated findings of the random effect model over the fixed effect model since certain of our dependent variables, including OICT and HCO, are time-invariant. The fixed effect model cannot quantify the effects of various Halal trade drivers.

8. Data and Sources

The limited Halal commerce database is one of this study's greatest obstacles. As far as we know, no specific trade statistic captures the value of certified Halal items, except Malaysia's self-reporting (International Trade Centre, 2015 pp X). To determine the value of the Halal trade, we apply the WTO assumption on the particular trade concerns database (STC) when allocating HS codes, which states:

"To assign an HS code to this product, some assumptions had to be made. In particular, when an STC refers to

1. *Food-related products. A broad definition is, in general, used. This includes all HS codes at the 4-digit level from 01 to 04, 07 to 12, 15 to 22, and 33. Note that for:*

c. *Halal products: a broad definition of food excluding swine meat, live animals, and alcoholic beverages.*

d. *Halal food: defined as Halal products excluded cosmetics."*

(Technical Barriers to Trade: Specific Trade Concerns Database, 2018)[1]

Thus, we conducted the Halal food trade value according to the above assumption using the UN Comtrade database for the Halal trade data. We took the total number of food-related products (HS codes at the 6-digit level from 01 to 04, 07 to 12, 15 to 22, and 33) deducted by the value of trade in live animals (HS 01), cosmetics (HS 33), swine meat and its by-products (HS0203, HS020630, HS020641, HS020649, HS0209, HS021011, HS021012, HS021019, HS1501, HS1503, HS160241, HS160242, HS160249), and alcoholic beverages (HS2203, HS2204, HS2205, HS2206, HS2207, HS2208). Appendix B shows the details of the HS code in our study.

Figure 2 below visualizes the screening method of the HS Code to acquire the approximate Halal F&B trade value. The technique examines in detail the HS code up to 6 digits of specification, then excludes the value of the non-Halal item from the total value of F&B trade. For example, in the Figure case, the values of HS0203, HS020630, HS020641, and HS020649, which are swine meat-related products, are screened out from the sample.

Even though the assumption does not exactly align with the Halal notion in the Muslim worldview — for instance, the meat recognized in the HS code is not mentioned in the slaughter process — this is for preliminary research. Also, it parallels the Shariah assumption of permissibility, which holds that all things are permitted unless there is clear evidence that they are forbidden.

The value of exports (in US dollars) was employed as a proxy for bilateral trade flows. According to Shepherd et al. (2019),

[1]https://www.wto.org/english/res_e/publications_e/readme_tbt_stc_e.doc

the factors used in the gravity model should be included in bilateral trade. He also stated that the worth must be expressed in nominal rather than actual terms. Multilateral resistance terms, which consist of price indices, significantly decrease the export value. Consequently, deflating exports using various price indices, such as the CPI or the GDP deflator, would not sufficiently represent the unobserved multilateral resistance terms and could give misleading results.

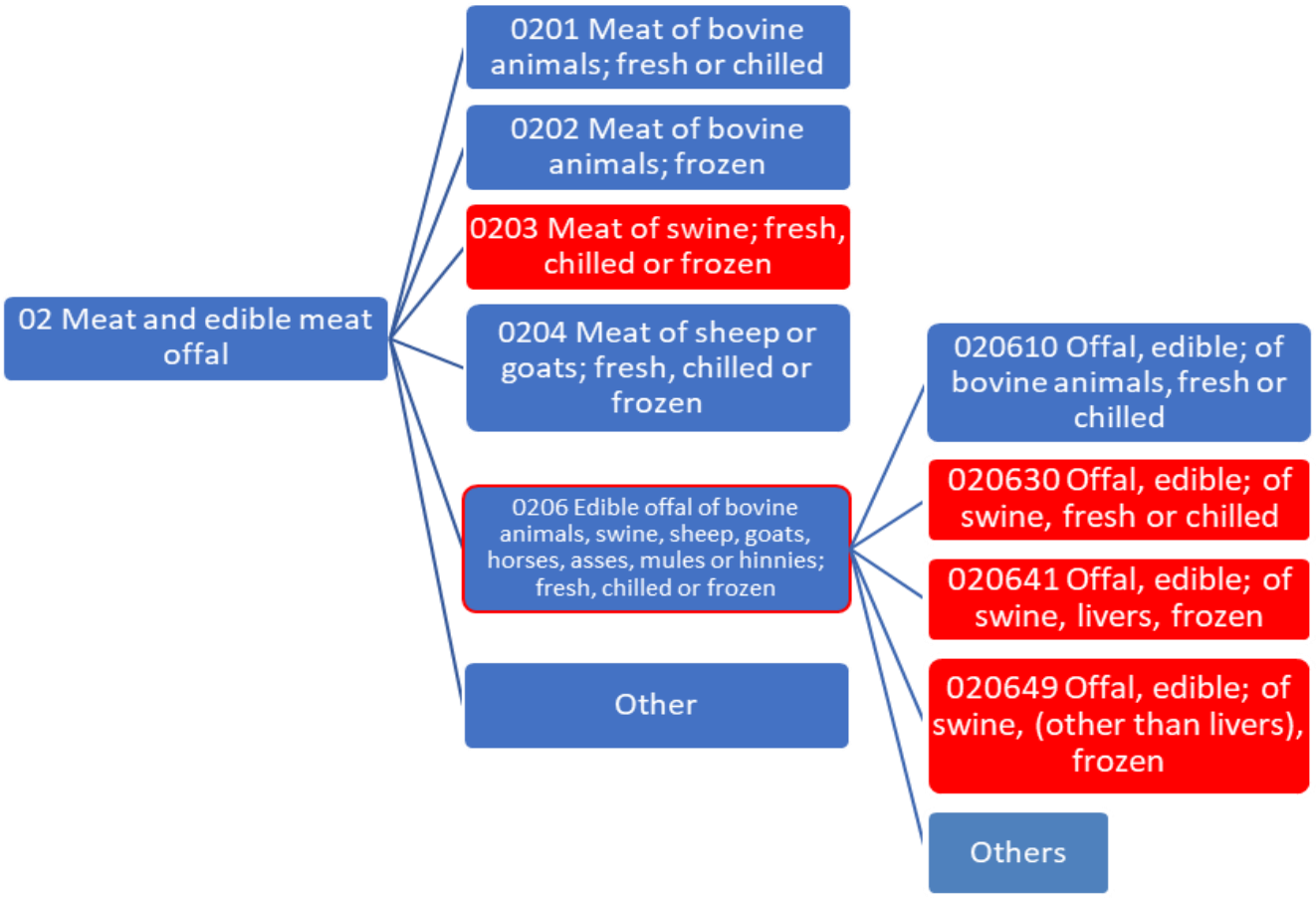

Figure 2: The Sample of Screening Method of HS Code for Halal F&B Trade Value

Similarly, nominal GDP (USD) was utilized as a proxy for the economic size of trade partners. According to the gravity model, the GDP is a suitable proxy. However, nominal aggregate GDP numbers, not real terms or GDP per capita, are misleading (Shepherd et al., 2019). In gravity literature, the GDP per capita has occasionally been employed as a separate independent variable to represent the income level but not the economic scale specified in the theoretical gravity model.

In this analysis, the distance (in kilometers) between the capital cities of the partners was utilized. The greater distance results in increased transport costs and delivery times, which inhibits trade flows. Since economic distance data is unavailable for all sample countries, the use of geographic distance is acceptable. It has been utilized in the majority of published works, such as Antonucci et al. (2006), Francois et al. (2013), Natale et al. (2015), Wong et al. (2016), and others.

The examined samples include bilateral trade data from 59 countries (20 OIC members) chosen based on their economic size and the value of their F&B exports. The estimation interval spans the years 2007 through 2016

9. Results and Discussion

In this part, we evaluated the influence of gravity model factors on Halal food commerce (HFEIJ). The regression procedure was based on Shepherd et al. (2019)'s user guide for the gravity model of international trade, which the United Nations published. According to the PPML approach, the dependent variable was transformed into level form, and the distance was clustered because it was identical between the same trading partners.

To examine the consistency of the regression outcome, we categorized the test determinants into five regressions. The first regression strictly adheres to the original gravity equation model, which accounted for solely the impact of trading partner economic size and distance. In the other regression, we added variables to the model incrementally. The results of the regression are shown in Table 1 below. According to the regression results, the significant positive factors for the value of Halal trade in the F&B sector include the economic size of trading partners (LGDPI and LGDPJ), regional trade agreements (RTA), a shared language (LAN), and a shared border (BORDER).

The elements that harm the trade are the distance (LDIST), the exchange rate of the exporter-to-importer unit (LFXIJ), the per capita income of the exporting nation (LGDPCI), and the landlocked trade partner (LGDPCI) (LANDLOCK). The insignificant factors are the importer's per capita income (LGDPCJ) and the colonial relationship (COL).

According to the theory of gravity model of international trade, the value of trade flow has a positive relationship with the economic size of trading partners (LGDPI and LGDPJ) and an inverse relationship with the distance between them. The negative impact of the LGDPCI is also consistent with the hypothesis that greater average incomes in exporting nations will diminish the value of international commerce. According to Abidin et al. (2013), Hatab et al. (2010), and Masron et al. (2014), a higher level of income leads to a greater demand for domestic consumption. This finding is consistent with these

findings. Thus, the exporting products will be more absorbed by the local market, resulting in a reduced export quantity.

The negligible effect of LGDPCJ is contrary to expectations. Previous major research revealed that the importing country benefits from the value of international trade due to increased demand for consumption and product variety (Cheong et al., 2018; Elliott et al., 2019; Fratianni, 2007; Ramezzana, 2000; Rautala, 2015). However, it might be argued that the higher level of income results in increased output in the importing countries, which can counteract the increase in demand for food and beverage products.

Table 1: The PPML result for common factors that influence trade in the Halal F&B sector

	(1)	(2)	(3)	(4)	(5)
	HFEIJ	HFEIJ	HFEIJ	HFEIJ	HFEIJ
LGDPI	0.690***	0.720***	0.709***	0.700***	0.643***
	(18.23)	(18.76)	(18.21)	(21.00)	(18.73)
LGDPJ	0.724***	0.744***	0.755***	0.741***	0.681***
	(19.68)	(17.46)	(17.86)	(18.73)	(16.57)
LDIST	-0.805***	-0.862***	-0.863***	-0.522***	-0.432***
	(-13.01)	(-13.49)	(-13.53)	(-6.96)	(-6.85)
LGDPCI		-0.130***	-0.166***	-0.210***	-0.155***
		(-3.77)	(-4.90)	(-5.58)	(-3.80)
LGDPCJ		-0.0730	-0.0351	-0.0548	0.00377
		(-1.48)	(-0.65)	(-0.96)	(0.06)
LFXIJ			-0.0406***	-0.0462***	-0.0453***
			(-2.68)	(-2.62)	(-2.60)
RTA				1.071***	0.848***
				(7.13)	(7.29)
LAN				0.546***	0.312**
				(3.59)	(2.32)
COL				-0.111	-0.0826
				(-0.63)	(-0.55)
BORDER					0.765***
					(4.97)
LANDLOCK					-0.751***
					(-4.85)
_cons	-12.84***	-11.73***	-11.75***	-13.61***	-12.22***
	(-6.75)	(-6.45)	(-6.43)	(-7.36)	(-6.84)
N	34220	34220	34220	34220	34220
R-sq	0.470	0.459	0.467	0.576	0.617

Note: t statistics are in parentheses (). Statistical significance at the 10%, 5%, and 1% levels are indicated by *, **, and ***, respectively.

The significant negative outcome of LFXIJ determinants is consistent with theoretical expectations since it is the exporter's products' direct pricing component from the viewpoint of importers. The increasing value of LFXIJ results in higher goods prices and lower purchasing power. In addition, the positive effects of a regional trade agreement (RTA), a common language (LAN), and a common border (BORDER), as well as the negative effects of trading with landlocked countries (LANDLOCK), are consistent with the theoretical predictions. The substantial benefit of RTA demonstrates the efficiency of the free trade agreement as a vehicle for reducing trade barriers and promoting commerce among members. The common language is an indispensable trade facilitator that facilitates communication, reduces trade costs, and establishes relationships between commercial parties (Fidrmuc et al., 2016). The outcome is consistent with several previous studies, including those by Cheong et al. (2018), Elliott et al. (2019), and Fratianni (2007).

Moreover, the contiguous factor, or the sharing of a shared border between trading parties (BORDER), improves the value of trade flow, whereas the LANDLOCK factor decreases trade value. These variables can be categorized as subsets of distance determinants and are primarily related to transportation costs. The common boundary signifies lower costs, whereas LANDLOCK denotes higher costs. According to earlier investigations, including those conducted by Cheong et al. (2018), Didier (2018), Kharel et al. (2010), and Miran et al. (2013).

The lack of significance of the colonial connection factor (COL) is contrary to our expectations. While the relationship implies the similarity of institutional factors such as administrative and legal systems that can reduce asymmetric information and facilitate transactions between partners Jones (2013); (Linders et al., 2005), it appears insignificant in the case of the Halal food and beverage trade. Our regression results validate Head et al. (2010) assertion that, after many decades of colonial rule, the influence of colonial relationships on international trade has diminished. In general, the majority of the regression results of the common trade determinants are consistent with the theoretical expectation. However, to assess the result's reliability, we conducted robustness checks utilizing various estimating techniques. The results of these tests of resilience are discussed in the following section.

10. Robustness Test

To test the robustness of our PPML conclusion, we utilized four additional estimation techniques: Heckman Sample Selection (HSS), Pooled Ordinary Least Squares (POLS), Two-Stage Least-Squares (2SLS), and Random Effects (RE) models. The HSS is another approach typically used to estimate gravity models. It has a natural capacity to include zero trade observations in the dataset but has a weaker advantage than PPML Shepherd et al. (2019) in dealing with heteroskedasticity. The POLS, 2SLS, and RE, are typical methods for estimating panel data. To apply them to the situation, it is necessary to modify the dependent variable to include zero observations in the dataset. Table 2 displays the outcome of each estimating model.

Table 2: The robustness test for common factors that influence trade in the Halal F&B sector

	(1)	(2)	(3)	(4)	(5)
	PPML	HSS	POLS	2SLS	RE
LGDPI	0.643***	0.944***	1.882***	1.882***	1.494***
	(18.73)	(31.32)	(33.62)	(33.63)	(24.77)
LGDPJ	0.681***	0.550***	0.860***	0.860***	0.899***
	(16.57)	(19.07)	(16.37)	(16.38)	(15.85)
LDIST	-0.432***	-0.684***	-0.744***	-0.744***	-0.695***
	(-6.85)	(-13.76)	(-6.11)	(-6.11)	(-5.55)
LFXIJ	-0.0453***	-0.000356	-0.0658***	-0.0658***	-0.0786***
	(-2.60)	(-0.03)	(-2.97)	(-2.97)	(-3.41)
LGDPCI	-0.155***	-0.236***	-0.285***	-0.285***	-0.623***
	(-3.80)	(-6.71)	(-4.45)	(-4.45)	(-9.12)
LGDPCJ	0.00377	0.0564	0.201***	0.201***	0.142**
	(0.06)	(1.58)	(3.05)	(3.05)	(2.15)
RTA	0.848***	1.232***	2.323***	2.323***	2.722***
	(7.29)	(9.93)	(9.74)	(9.74)	(11.21)
LAN	0.312**	0.553***	1.706***	1.706***	1.514***
	(2.32)	(4.15)	(5.35)	(5.36)	(4.72)
BORDER	0.765***	0.867***	0.307	0.307	0.481
	(4.97)	(4.70)	(0.71)	(0.71)	(1.09)
COL	-0.0826	0.270**	-0.538	-0.538	-0.534
	(-0.55)	(1.98)	(-1.60)	(-1.60)	(-1.56)
LANDLOCK	-0.751***	-0.667***	-1.542***	-1.542***	-1.408***
	(-4.85)	(-5.58)	(-4.94)	(-4.94)	(-4.32)
_cons	-12.22***	-15.83***	-50.53***	-50.53***	-37.83***
	(-6.84)	(-14.21)	(-20.87)	(-20.88)	(-16.23)
N	34220	34220	34220	34220	34220
R-sq	0.617		0.289	0.289	

Note: t statistics are in parentheses (). Statistical significance at the 10%, 5%, and 1% levels are indicated by *, **, and ***, respectively.

The majority of the examined variables had consistent significance and estimated coefficients across the test models, as seen in the table above. Economic size (LGDPI and LGDPJ), regional trade agreement (RTA), and common language (LAN) have robust positive significant impacts on Halal F&B trade in all tested models, whereas distance (LDIST), level of income in the export country (LGDPCI), and the landlocked factor have robust negative significant impacts on Halal F&B trade across all estimations (LANDLOCK).

Exchange rate (LFXIJ), the income of the import nation (LGDPCJ), shared border (BORDER), and colonial relationship are the determinants for which there are estimation differences between models (COL). The LFXIJ appears to have a negligible effect on the HSS estimation, although other approaches reveal a large negative impact. The LGDPCJ result is statistically significant in POLS, 2SLS, and RE regression but not in PPML and HSS. In contrast, for BORDER, where PPML and HSS suggest positive insignificance, POLS, 2SLS, and RE regression imply insignificance. Lastly, the COL has a positive significance solely in the case of HSS, whereas other estimates indicate a negligible effect.

However, due to the superiority of PPML over other estimating methods, we will only analyze its outcome. In addition, since the estimated coefficients do not contradict one another, we may still conclude that the conclusion is resilient across multiple estimation methodologies.

The study analyzed the effect of common gravity model parameters on the Halal food and beverage sector. Following the hypothesis and theoretical predictions, the results indicated that most variables influence the Halal trade, except for the importing country's income level (GDPCI) and the colonial relationship (COL), which appeared to have no effect on the trade.

The insignificance of these variables can be explained by earlier research suggesting that a higher level of income can indicate a higher level of productivity, which can offset a greater need for consumption, and that the colonial era's influence has diminished greatly in the present-day (Head et al., 2010).

11. Conclusion

Despite the rapid growth of the Halal sector, few empirical studies have been conducted on the factors that influence international Halal trade. Only a few have been completed, and even those were limited to the size of one country, Malaysia (Abdullah et al., 2017; Hong, 2016; Masron et al., 2014; Mazlan et al., 2015). No international trade statistics have documented the value of Halal-certified items (International Trade Centre, 2015, p. X), except Malaysia, which self-reports this information. This poses a significant difficulty in researching Halal trade determinants (Abdullah et al., 2017). This study is a preliminary investigation into the elements that influence the value of Halal commerce flow. We choose to examine the Halal food and beverage industry because it is the largest sector within the Halal industry. To determine the approximate value of Halal F&B trade between nations, we employed the Shariah principle of "presumption of permissibility" and the WTO assumption for assigning HS codes to the specific trade concerns database (in the instance of Halal food). The study adhered to the standard and most widely known technique for international trade research. It used the gravity model of international trade as the foundational model. It estimated the result using the PPML method, which is the workhorse and most recommended estimator for the gravity model (Shepherd et al., 2019). The tested variables included the

size of the economy (LGDPI and LGDPJ), the distance (LDIST), the level of income (LGDPCI and LGDPPCJ), the exchange rate (LFXIJ), the regional trade agreement (RTA), the common border (BORDER), the common language (LAN), the colonial relationship (COL), and landlocked trade (LANDLOCK).

The impact of economic size (LGDPI and LGDPJ) and distance (LDIST), according to the gravity model, suggests that the trade flows between two countries are proportional to their economic size and inversely proportional to the distance between them (Bialynicka-Birula, 2015). This statement is true in the case of Halal F&B trade across all the levels of tested estimations. For other factors, which are considered as part of *"the sum of all trade resistance terms except distance"* or the R_{ijt} term in the *gravity with gravitas model* of (Anderson et al., 2003), we found that:

The income level of trading partners has varying effects on the value of Halal food and beverage trade between them. While the exporting country's income level (LGDPCI) harms the value of its Halal F&B exports, the importing country's income level (LGDPCJ) does not affect the trade. The increased income level implies a higher production level and a rise in consumer demand. The conclusion may indicate that, in general, individuals prefer home food and beverages that are tailored to their tastes over international items. Thus, when individuals have more disposable income, their increased demand for domestic F&B diminishes the value of exportable goods (in the case of LGDPCI). Alternatively, when food production is higher, it reduces the need for imported foodstuffs (in the case of LGDPCJ). In a global context, the exchange rate (LFXIJ) that determines the pricing element of the items continues to play a significant role in the trade flow. From the perspective of importers, the exporter's products become more expensive due to the appreciation of their currency. Thus, the country's ability to import is diminished, and it may seek alternative trading partners that can provide identical products at a lower price.

In terms of geographical determinants, the outcome of landlocked trade (LANDLOCK) conforms to the theoretical prediction. Trade with landlocked nations is more difficult and demands higher transportation costs. According to a World Bank Policy Research Working Paper, the cost of transportation in landlocked countries is, on average, 30% higher than in coastal nations, making landlocked nations the source of the majority of low-income economies (20 out of 54) (Arvis et al., 2007). The negative significance of the variable LANDLOCK at all analysis levels confirms this trade barrier's impact. Nonetheless, the influence of common border (BORDER) varies throughout the three levels of research. Theoretically, having a shared border is advantageous for trade between the two countries due to the ease of transporting commodities. In general, the LAN continues to serve an important role in facilitating bilateral trade.

On a global scale, it appears that the impact of COL on the Halal food and beverage economy is diminishing. The insignificant outcome validates Head et al. (2010).'s hypothesis that the superior influence of colonial relationships on international trade has diminished after decades of colonial rule.

Regarding trade cooperation determinants, we utilize the RTA variable to stand in for major trade agreements such as EU, AFTA, LAIA, ASEAN, NAFTA, and SAARC. Then we separate the OICT variable to assess the influence of OIC trade cooperation. Overall, the data demonstrate that RTA remains a potent tool for boosting member trade. It has positive implications for both global trade and commerce.

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