EFFECTS OF RELIGIOUS HETEROGENEITY ON GLOBAL BEEF TRADE

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Abstract
The aim of this study is to assess the effect of religious distance between two countries on the beef market. The motivation for the research stems from the incorporation of formal institutional aspects, such as the rules established by religions, into international trade theories. More specifically, the study discusses how institutions and organizations influence the decision-making of agents (government, businesses, and consumers) guide a country's export performance. The beef market was chosen due to the religious specifications associated with animal slaughter and processing. A structural gravity model is employed with 21 exporting countries and 167 importing countries for the commodity during the period from 2000 to 2021. The study concludes that bilateral beef trade is influenced by distance, importer and exporter income, common language, and trade agreements. However, the religious asymmetry between countries does not statistically impact overall beef trade flows, except when focusing on major Halal and Kosher-certified beef exporters. In these cases, religion significantly influences trade, particularly in the frozen beef sector. Furthermore, religious certifications, such as Halal and Kosher, offer a competitive advantage for exporters by meeting the specific demands of religiously observant markets.
Key words*: Religion; Beef; International Trade; Cultural Barriers; Gravity Model.*

1. Introduction

International trade is necessary for ensuring food security and maintaining public food reserves. A 14% global supply expansion in the meat market is anticipated by 2030, accompanied by a 5.9% rise in beef availability (OECD-FAO, 2024). This growth trend is also observed on the demand side. The consumption of animal protein is driven by dietary changes resulting from urbanization and rising global average income. Consequently, there is an anticipated increase in international meat flows, particularly towards Asia and the Middle East (OECD-FAO, 2024).

Although commodity trade is generally associated with products that have uniform characteristics, are produced on a large scale and with homogeneous physical attributes (Martins, Martinelli, 2010), products can be differentiated by historical, institutional and cultural factors, such as religious traditions and cultural ties (Ermgassen et al., 2021; Carneiro et al., 2022). This is especially applicable in the meat trade, which, despite being categorized as a commodity, may be ascribed other characterizations that are not solely reliant on its physical and observable characteristics (Fonseca et al., 2021).

International negotiations have included specific provisions for meat products, considering unobservable quality attributes, including adherence to processing and slaughter methods, which are essential for markets influenced by religious beliefs. Regulations that define these qualities can influence market access and generate trade possibilities (Dall'Azen, Weise, 2014).

The Halal industry, which follows processing rules following the Islamic religion, encompasses more than 1.8 billion consumers across 112 countries. By 2030, the industry is expected to continue growing, given the forecast that the Muslim population will reach 29% of the global population (Daud et al., 2022). Furthermore, the number of young Muslims with higher educational levels is rising, reflecting the growth of a new market segment with high purchasing power, estimated at approximately USD 2.57 trillion by 2024 (Hossain et al., 2021).

Similarly, the Kosher meat business offers appealing possibilities. The term Kosher denotes items prepared by Jewish law and is linked to health and hygiene due to rigorous food processing, demanding cooperation and transparency from supplying companies (Hossain et

al., 2021; Rudy et al., 2019). In 2021, the global Jewish population was predicted to be roughly 15.2 million, constituting about 0,195% of the total global population (DellaPergola, 2022). The primary slaughter requirements for this religious group require the animal's vitality and awareness during the slaughter and the complete removal of blood, which is considered impure and unsuitable for consumption (Rudy et al., 2019).

Halal and Kosher products not only represent religious symbols with potential for the Islamic and Jewish consumer markets, are also associated with excellence in quality assurance, attracting non-Muslim and non-Jewish consumers who value quality, safety, health, and authenticity (Hossain et al., 2021; Abdul-Talib, Abd-Razak, 2013). To ensure these characteristics, religious agencies must certify products which attest to compliance with technical standards and the brand's symbol.

In the realm of certifications, trust among the parties involved is important, influencing the selection of the governance framework and commercial partner to guarantee reliability. Implementing procedures that cultivate trust among agents is essential for alleviating uncertainty, deterring opportunistic behavior, and reducing transaction costs (Colares-Santos, Shanoyan, Schiavi, 2020).

However, religious and cultural issues, when incorporated into contracts, can be considered trade barriers (Audu et al., 2023). Companies wishing to export products in compliance with religious requirements must adapt their production processes to the standards established by their trading partners to ensure market access (Aguiar, 2020). This leads to additional costs that may reduce exporters' competitiveness, with the consequences of leaving the market.

Eventually, this is questioned. Audu et al. (2023) states that religious asymmetries appear to have little impact on trade flows, even when comparing the most and least religious nations globally. Regardless of the level of religiosity, countries do not typically form trade partnerships based on shared religious beliefs. Instead, trade reciprocity and economic considerations are more significant in shaping trade. For instance, countries with high levels of religiosity, such as Israel, Saudi Arabia, and India, continue to maintain stable trade relations with nations that do not share their religious traditions, indicating that religion does not directly influence trade decisions (Audu et al., 2023). However, Costa et al. (2023) and Hamid et al. (2022) argue that religion can affect positively or negatively the trade of certain products, such as cultural products (films) and food.

New investigations further underscore how religious, cultural and economic factors shape trade patterns. Applying a gravity model to Indonesia's seafood exports, Herianingrum et al. (2024) highlight how GDP and shared language can strengthen export performance and bolster the Halal market. Meanwhile, Muchtar et al. (2025) employ a computable general equilibrium approach to show that free trade agreements with countries members of the Organization of Islamic Cooperation (OIC) can boost welfare and real GDP for Indonesia's halal food sector, though some product segments may face export declines. From a different angle, Zhang et al. (2023) use a stochastic frontier gravity model to analyze U.S. bourbon whisky exports, demonstrating that economic size, common language, and policy measures can promote trade, again indicating how specialized product attributes, religious or otherwise, interact with classical trade drivers. Within the European Union, Zaninović (2025) further confirms that factor productivity, resource endowments and the ability to meet evolving standards are key determinants of agricultural trade flows. These more recent studies show that production attributes (e.g., Halal compliance, resource use and geographical indication) intertwine with broader economic variables to shape the contours of trade, reinforcing the importance of analyzing religious and cultural distance alongside conventional drivers.

Based on the opportunities to expand trade in this market segment and from the different possibilities of commercial effects, that is, positive, negative or non-significant effects, the

question arises: what is the effect of religious distance on the global trade of beef? The objective of this study is to evaluate, through a statistical model, the effect of religious asymmetry on the beef trade flow between 2000 and 2021.

According to the literature, religious similarity can have ambiguous effects on trades, sometimes facilitating it by fostering trust and reputation among members of the same religion, and at other times being exclusionary, considered a trade barrier that hinders commerce between trading partners with different religious backgrounds. This can create obstacles to market access and limit opportunities for countries that do not share the same religious practices, affecting the flow of products and services across borders (Lewer & Van den Berg, 2007).

2. Transaction costs as barriers considering New Institutional Economics

Classical theories of international trade, which are based on productivity, allocation, and the endowment of production factors, did not explicitly emphasize trade costs. Anderson and van Wincoop (2004) discuss that transportation costs and tariffs have been surpassed by transaction costs, which become more prominent as trade flows expand. Transaction costs refer to the burdens faced by exporters when conducting business in the international market; these include everything from initial negotiations to the completion of contracts and the delivery of products (Maragno, Kalatziz, & Paulillo, 2006).

The Transaction Cost Theory (TCT) emphasizes that transaction costs are relevant due to several assumptions: bounded rationality, which refers to the human behavior limited by the vast amount of information that must be considered in a commercial transaction; uncertainty, which addresses problems of information asymmetry; opportunism, which involves exploiting these asymmetries for individual gain; and asset specificity, which refers to the specific characteristics required for an exclusive transaction (Dall'Azen & Weise, 2014). Economic agents, aware of the costs involved in transactions and the limitations they impose, opt for governance structures that may minimize them (Mendes, Figueiredo, & Michels, 2008).

Dasilva-Glasgow (2020), Cabarello and Soto-Oñate (2016), and Acemoglu, Antràs, and Helpman (2007) highlight the role of institutions as a solution for governance structures within the context of an efficient economic system, arguing that they emerge as a response to transaction costs. Dall'Azen and Weise (2014) reinforce that the institutional environment affects the transaction costs related to the production and importation of goods and services, as it establishes rules, norms, and mechanisms that facilitate transactions and ensure security and trust among participants.

North (1993) defines institutions as the "rules of the game" that determine the behavior of economic agents and establish the mechanisms for enforcing these rules. There are two main types of institutions: formal institutions, represented by laws, regulations, and contractual agreements enforced by a governing authority, and informal institutions, which include traditions, customs, and social norms. Informal institutions can influence formal institutions when traditions, customs, or social practices, such as religion, are transformed into laws and become established within a country’s normative structures (Dall'Azen & Weise, 2014). Once formal rules are established, they are responsible for setting regular behavioral patterns in markets, thereby reducing uncertainty among economic agents operating under these rules (Mendes, Figueiredo, & Michels, 2008).

New Institutional Economics posits that institutions create mechanisms—hence formal and informal rules—that reduce uncertainty among agents and, consequently, the transaction costs in a market economy. This occurs in a context in which rational actions are influenced by the social environment, resulting in limited choices due to the incompleteness of available information (Bueno, 2004). These premises open the possibility for fraudulent practices and opportunistic behavior among economic agents. However, the operation of institutions in

markets plays an essential role in reducing these possibilities (Mendes, Figueiredo, & Michels, 2008).

By establishing rules and regulations, institutions promote trust and cooperation between parties, thereby restricting fraudulent and opportunistic behavior and ensuring a more ethical and transparent conduct in economic interactions (Mendes, Figueiredo, & Michels, 2008). Religion plays an important role as an informal institution that influences social norms and values. In the case of the meat trade, religious beliefs may establish restrictions on which types of meat are acceptable for consumption, which slaughter practices are permitted, and how products should be labeled. Such religious norms may have a considerable impact on the demand and supply of meat, influencing consumption patterns and consumer preferences. For this reason, importers set product quality requirements that are essential for establishing trust between the consumer and the supplier (Thomé, Reis, & Paiva, 2003).

Nevertheless, while informal rules may promote trust and cooperation among commercial agents who share common religious beliefs, they can also create trade barriers for those who do not adhere to these norms. For example, meat producers who do not comply with specific religious requirements may encounter difficulties accessing certain markets or meeting the demand of particular religious consumer segments (Dall'Azen & Weise, 2014).

Indeed, studies have demonstrated that the sharing of certain religious cultures may have a positive effect on bilateral trade (Lewer & Van Den Berg, 2007; Bonne, Vermeir, & Verbeke, 2008; Lee & Park, 2016; Irshad et al., 2018). This occurs because, by sharing similar formal rules, transaction costs tend to be lower. The existence of common norms and practices between countries facilitates the establishment of trust between importers and exporters, in addition to reducing the need for exporters to make adjustments and adaptations to meet the partner country's rules (Czelusniak et al., 2018).

According to Lee and Park (2016), heterogeneous cultural values may transform into transaction costs and represent trade barriers equivalent to the imposition of tariffs, as they affect companies' export capacity and compromise their integration into the international market. This occurs because religious consumers value compliance with religious norms, yet meeting these specific requirements can incur additional costs for the supplier, such as the need to invest in specific slaughtering and preparation processes, certifications, and the acquisition of knowledge regarding religious practices. These additional costs can affect producers' competitiveness in the market and limit their ability to access certain consumer segments (Dall'Azen & Weise, 2014).

Lopez and Gama (2010) assert that the influence of cultural aspects on market initiatives may arise from differences in language, labor relations, colonial history, religion, and other aspects that distinguish companies from different countries. The authors emphasize that culture seeks to preserve customs, and therefore, it tends to resist change and reinforce consumption patterns. In this context, meeting certain requirements poses challenges for exporting countries to consolidate their shipments to specific markets.

From this perspective, different historical, religious, and institutional traits contribute to the construction of the cultural foundations of countries and regions, which become relevant in trade patterns. Under this approach, economic literature often views the religious heterogeneity between two countries as a trade barrier. In other words, if two countries have distinct religions and cultural behaviors, the reliability between the economic agents of both nations is lower and the transaction costs higher. When trust is lacking, the economic burden resulting from the cessation of trade flows with important markets can materialize.

Considering the above, it is pertinent to incorporate the analysis of cultural factors, specifically religion, as a potential determinant of exports in the international market. This variable assumes considerable importance in the meat market, which is a product subject to extensive regulation and with prospects of growth both in animal protein consumption and in

the number of consumers adhering to Jewish and Muslim faiths. The following section will present the methodology employed in this study.

3. Methodology

Theoretical gravity model

Tinbergen (1962) proposed a model to determine the standard behavior of international trade, which would prevail in the absence of trade impediments. The development of this idea occurred in the early 1960s, when the publications of Poyhonen (1963) and Linnemann (1966) established key variables in bilateral trade relations: the importer's demand, the exporter's supply, and transaction costs. At the time, the primary concern was to identify the differences between actual and expected trade volumes. Therefore, the development of trade models aimed to formalize the measurement of these deviations.

The proposed trade model, known as the gravity model, was based on principles like those in Newtonian physics. The association between bilateral distance and economic mass (Gross Domestic Product) with the possibility of trade attraction or repulsion established the theoretical foundation for the model. However, a consolidated economic framework was still required for the model to be applied in empirical analyses. From that point onward, some studies, including Aitken (1973) and Bergstrand (1985), employed trade principles to formulate equations for examining specific trade behaviors.

Even with these contributions, the gravity model has historically faced skepticism due to the lack of a clear economic theoretical framework for its estimations. Anderson and van Wincoop (2003) developed a microeconomic framework using a constant elasticity of substitution (CES) utility function constrained by a budget and aligned with clearing market conditions. They purposed to clarify trade between two countries, denoted as i and j, in a specific sector k and time t, following the 1 equation:

$$X_{ijt}^{k} = \frac{E_{jt}^{k} Y_{it}^{k}}{Y_{t}^{k}} \left(\frac{\tau_{ijt}^{k}}{P_{jt}^{k} \Pi_{it}^{k}} \right)^{1-\sigma} \quad (1)$$

where the variable X_{ijt}^{k} is the exports of product k from country i to importer j in year t; E_{jt}^{k} is the expenditures of j country on k products in year t; Y_{it}^{k} and Y_{t}^{k} are, respectively, the quantity of k produced in i country and the aggregate international production of such products in the world, in t; Π_{it}^{k} and P_{jt}^{k} are multilateral resistance terms of trade in t; σ is the elasticity of substitution among products, τ_{ijt}^{k} represent the bilateral trade costs between i and j countries in year t for product k.

The major contribution of Anderson and van Wincoop (2003) was the consolidation of the multilateral resistance terms. The variables Π_{it}^{k} and P_{jt}^{k} were formally defined to show that bilateral trade flows are influenced not only by the trade costs between two countries but also by costs incurred with other trading partners. In other words, trade between countries i and j is affected not only by their direct costs but also by the costs between country j and a third country. Mathematically, these indices are represented by the following equations:

$$(\Pi_{it}^{k})^{1-\sigma_k} = \sum_{j} \left(\frac{\tau_{ijt}^{k}}{P_{jt}^{k}} \right)^{1-\sigma_k} \frac{E_{jt}^{k}}{Y_{t}^{k}} \quad (2)$$

$$(P_{jt}^{k})^{1-\sigma_k} = \sum_{i} \left(\frac{\tau_{ijt}^{k}}{P_{jt}^{k}} \right)^{1-\sigma_k} \frac{Y_{it}^{k}}{Y_{t}^{k}} \quad (3)$$

Π_{it}^{k} represents external multilateral resistance, indicating that exports from country *i* to country *j* depend on the trade costs between country *j* and all potential export markets. P_{jt}^{k} denotes internal multilateral resistance and reflects how country *j* imports depend on trade costs with all possible supplier countries for products *k*. The inclusion of these terms marked a significant advancement in the gravity model, allowing for more accurate estimates. According to Carneiro et al. (2022), omitting these terms is a major econometric issue that leads to biased estimates due to omitted variable bias. A common method to address this issue involves using fixed effects, which account for any variables representing potential trade frictions.

τ_{ijt}^{k} is a function of all bilateral barriers that affect trade. Literature often approximates this using a set of variables representing costs, which may be geographic or historical-institutional, such as distance, contiguity, shared language, cultural ties, or religious differences. Literature often approximates this using a set of variables representing costs, which may be geographic or historical-institutional, such as distance, contiguity, common language, cultural ties, or religious differences. Also, it can incorporate measures of trade policy, including tariffs and non-tariff barriers.

Building on this theoretical development, the gravity model has become a widely used tool in empirical studies involving trade volumes. Given that trade flows are a key element in economic relations and the necessary data for estimating the model is easily accessible, many studies have adopted the gravity model, solidifying it as one of the most utilized methods in the field of international economics (Baldwin; Taglioni, 2006; Carneiro et al., 2022).

The evolution of the model, as well as improvements in estimation techniques, as discussed by Yotov et al. (2016), has enabled the use of gravity equations to contrast the influence of trade preferences against other determinants of trade, such as distance between countries, income levels, language, borders, trade agreements, religion, among others Anderson et al. (2020), Carneiro et al. (2022) and Costa et al. (2023) employed the gravity model approach to estimate trade determinants.

Empirical model

The analysis of the relationship between beef exports and bilateral religious disparity covered the years 2000 to 2021[1]. The trade flow occurred between 21 major beef exporters and 164 trading partners, representing 95% of the global exports of the product during this period. The selection of exporters was based on countries responsible for 95% of global beef imports, similar to the methodology employed by Peci and Sanjuan (2020), who identified 40 importing countries that accounted for 80% of global pork imports.

The estimates utilized a panel data framework, analyzing information from individuals (countries) across several time points. This data structure improves estimator efficiency and parameter inference accuracy, as panel data offers increased degrees of freedom (Hsiao, 2005). Various beef products were incorporated into the panel alongside the nation and year

[1] The choice of the period between 2000 and 2021 is justified by the comprehensive and consistent availability of consolidated data, permitting a long-term observation that captures cyclical and structural variations in the beef trade. Furthermore, international statistical series referring to the years beyond 2021 may still be under revision, making it challenging to incorporate more recent information in a uniform manner. Therefore, selecting 2000–2021 ensures more reliable analyses, as standardized and comparable data are widely accessible for all countries under consideration.

measurements. The products were categorized at the six-digit level following the Harmonized Commodity Description and Coding System (HS).[2]

The model is estimated to be using the Poisson Pseudo-Maximum Likelihood (PPML) estimator, which is appropriate for analyzing trade flows as it addresses the issue of bilateral flows equal to zero in dependent variable, indicating the absence of trade for certain country pairs, year and the product, or data missing. Around 94% of the sample contains zero or missing data. The PPML surpasses the Ordinary Least Squares (OLS) estimator, omitting observations with zero trade flows, resulting in selection bias and the loss of significant information from null flows. Besides addressing this issue, the PPML can estimate the model despite the heteroscedasticity (Santos Silva; Tenreyro, 2006). The functional specification for the estimated equation is articulated as:

$$X_{ijt}^{k} = c + \theta_{itk} + \phi_{tjk} + \beta_1 Relig_{ij} + \beta_2 lnDist_{ij} + \beta_3 Conti_{ij} + \beta_4 Rta_{ijt} + \beta_5 Col_{ij} + \beta_6 Lang_{ij} + \varepsilon_{ij} \quad (4)$$

Where X_{ijt}^{k} represents beef imports[3] from i to importing countries j of k in year t; c is the constant; θ_{itk}, ϕ_{tjk} are fixed effects of exporter-year-product and importer-year-product; $Relig_{ij}$ is an index variable that varies from 0 to 1, the closer to 1, the greater the religious proximity between countries pairs; $Dist_{ij}$ is the bilateral distance between countries of origin and destination, a proxy for transportation costs; $Conti_{ij}$ is a dummy that takes the value 1 if i and j countries share a common border and 0 otherwise; Rta_{ijt} is a dummy that takes the value 1 if i and j countries have a trade agreement in year t and 0 otherwise; Col_{ij} is a dummy indicating colonial ties between countries, with value 1 if there are colonial ties and 0 otherwise; $Lang_{ij}$ is a dummy indicating whether the countries have the same official language, assuming value equal to 1 if so and 0 otherwise; ε_{ij} is the error term.

To provide greater robustness to the model, some alternative estimations were carried out to verify whether the effect of the religious variable remains. Firstly, the estimations were categorized by product type: chilled beef, frozen beef and offal. This distinction is interesting because the trade of offal may be influenced by cultural factors, such as the prohibition against consuming residues and blood in Jewish and Muslim religions. Additionally, there is a distinction for chilled products, as their trade is less frequent than that of frozen beef due to their perishability and the transportation costs associated with maintaining refrigeration.

The second robustness strategy was to control the main exporters of Halal and Kosher-certified meat. To this, a dummy variable was implemented for the principal global exporters of these products in 2022[4] ($HalalKosher_i$)[5] (Equation 5), and an interaction between this variable and religion was analyzed (Equation 6). Also, there was an interaction between this variable and the religion variable to analyze (Equation 6). Religious slaughter involves costs associated with modifying manufacturing techniques. If these countries maintain access to consumer markets, it indicates that they have not only borne these costs but also remained competitive in international markets.

[2] HS020110, 020120, 020130, 020210, 020220, 020230, 020610, 020621, 020622, 020629, that means beef cuts (fresh/frozen) and edible offal (tongue, liver, etc.), encompassing whole carcasses or bone-in/boneless portions.
[3] Although the analysis is based on export data, import data is used for reliability. Customs authorities have greater control over import data because it is on this data that customs duties are levied.
[4] This data is a proxy for the largest exporters between 2001 and 2021. No time series were found to indicate which countries held the largest market shares for these goods. However, the inclusion of this variable allows us to associate the largest suppliers of beef with a comparative advantage in exports of meat with religious certificates.
[5] A dummy variable was not included for the largest exporters of Halal meat and another for Kosher meat because of the high correlation between the two variables (87.83%).

$$X_{ijt}^{k} = c + \theta_{itk} + \phi_{tjk} + \beta_1 Relig_{ij} + \beta_2 HalalKosher_i + \beta_3 lnDist_{ij} + \beta_4 Conti_{ij} + \beta_5 Rta_{ijt} + \beta_6 Col_{ij} + \beta_7 Lang_{ij} + \varepsilon_{ij} \quad (5)$$

$$X_{ijt}^{k} = c + \theta_{itk} + \phi_{tjk} + \beta_1 Relig_{ij} + \beta_2 HalalKosher_i + \beta_3 HalalKosher_i \times Relig_{ij} + \beta_4 lnDist_{ij} + \beta_5 Conti_{ij} + \beta_6 Rta_{ijt} + \beta_7 Col_{ij} + \beta_8 Lang_{ij} + \varepsilon_{ij} \quad (6)$$

Still to test the robustness of the estimates, the population of each exporter allocated across various religions was included in the model. The latest data for this information is from 2010 and was applied to all years of the panel as a proxy for religious representation. While the number of devotees may fluctuate over time, no significant variation in the proportion of adherents to religions is expected. Consequently, utilizing lagged data is not anticipated to pose an issue.

$$X_{ijt}^{k} = c + \phi_{tjk} + \beta_1 Relig_{ij} + \beta_2 lnChristian_{i2010} + + \beta_3 lnJewish_{i2010} + \beta_4 lnIslamic_{i2010} + \beta_5 lnDist_{ij} + \beta_6 Conti_{ij} + \beta_7 Rta_{ijt} + \beta_8 Col_{ij} + \beta_9 Lang_{ij} + \varepsilon_{ij} \quad (7)$$

$Christian_{i2010}$, $Jewish_{i2010}$, $Islamismo_{i2010}$ refer to the number of individuals in the exporting country (i) who adhered to Christianity, Judaism and Islam (Muslims) in 2010, respectively. To estimate these variables, exporter-year-product fixed effects were removed because their inclusion would lead to the omission of those variables due to multicollinearity. Importer-year-product fixed effects were maintained.

Another strategy to test the robustness of the results is to insert the importer and exporter Gross Domestic Product [GDP] on the gravity model, replacing the time-varying unilateral fixed effects, which are replaced by fixed effects of importer, exporter, year and product (Capoani; Barlese, 2021; Nijkamp; Ratajczak, 2021; Ribeiro et al., 2019). The GDP variables are proxies for the importer's demand capacity and the exporter's supply capacity, respectively.

$$X_{ijt}^{k} = c + \beta_1 Relig_{ij} + \beta_2 PIB_{it} + \beta_3 PIB_{jt} + \beta_4 lnDist_{ij} + \beta_5 Conti_{ijt} + \beta_6 Rta_{ijt} + \beta_7 Col_{ij} + \beta_8 Lang_{ij} + \varepsilon_{ij} \quad (8)$$

PIB_{it} and PIB_{jt} represent the GDP of the exporter i and the importer j in year t, respectively. Both variables were absorbed in equation (4) by the fixed effects importer-year-product and exporter-year-product.

The religion variable did not change for the evaluated years, as it varies only between countries. For this reason, bilateral fixed effects to country pairs are not included, as their inclusion would omit the variable of interest due to multicollinearity issues. The use of time-varying unilateral fixed effects (importer-year, exporter-year) controls multilateral resistance terms in the theoretical model (Feenstra, 2015; Head & Mayer, 2014). Fally (2015) notes that estimates containing these fixed effects correspond to the structural gravity terms, which differ from the traditional gravity model. In the structural model, the time-varying unilateral fixed effects determine the expenditures and output adjusted to the actual values of production and expenditures, represented as E_{jt}^{k} and Y_{it}^{k} in the theoretical model.

One particularly useful feature of the structural gravity model for empirical applications is its separability, allowing it to be applied to different product categories. This enables the study of bilateral flows for a specific k product independently. Consequently, the unilateral fixed effects become importer-time-product and exporter-time-product fixed effects (Carneiro et al., 2022). Secondly, from a practical perspective, adding fixed effects ensures a consistent consideration of bilateral trade costs, which can be achieved in three simple steps: (i) estimating

the gravity equation using PPML; (ii) constructing bilateral trade costs for each country pair, which this study did not address due to multicollinearity issues with the variable of interest; and (iii) aggregating bilateral trade costs at the desired level using the estimates of importer and exporter fixed effects (Piemartini & Yotov, 2016).

To address step (ii), standard variables commonly used in gravity models were included. Anderson and van Wincoop (2003) highlight traditional variables used as proxies for costs in gravity models, such as bilateral distance, shared borders, language, and colonial ties—factors that represent time-invariant bilateral costs. Additionally, Yotov et al. (2016) recommend estimating the gravity model with spaced intervals, suggesting gaps of 3 to 5 years to capture adjustments in trade flows to trade policies. However, since this study does not aim to evaluate trade policies such as tariffs or non-tariff measures, the model was estimated without incorporating time gaps.

Table 1 provides a description of the variables used in econometric evaluation, including their measurement units and sources.

Table 1. Description and data source of the variables of model.

Variable		Unit	Source
X_{ijt}^{k}	Bilateral imports of beef	1.000 USD	The United Nations Comtrade
$Relig_{ij}$	Religious similarity index. Ranges from 0 to 1 and increases when the pair of countries share a common religion practiced by a large part of the population	Index (0 to 1)	CEPII Research and Expertise on the World Economy
$lnPIB_{jt}$	Importer's GDP	Current US$	World Bank
$lnPIB_{it}$	Exporter's GDP	Current US$	World Bank
RTA_{ij}	Presence of trade agreements between countries involved in trade	Dummy	Mario Larch Database
$lnDIST_{ij}$	Bilateral distance between the capitals of the countries	Kilometers	CEPII Research and Expertise on the World Economy
$Cont_{ij}$	Presence of borders between those involved in trade	Dummy	CEPII Research and Expertise on the World Economy
Col_{ij}	Common colonial ties between countries	Dummy	CEPII Research and Expertise on the World Economy
$Lang_{ij}$	Common language between countries	Dummy	CEPII Research and Expertise on the World Economy
$HalalKosher_{i}$	Largest exporters of Halal and Kosher certified meat	Dummy	The Halal Times, (2022) e Grand View Research, (2022)
$lnChristian_{i2010}$ $lnJewish_{i2010}$ $lnIslamic_{i2010}$	Exporter population adherents to the Christian, Jewish and Islamic (Muslim) religions	Number of individuals allocated to each religion (2010 data)	World Religion Data

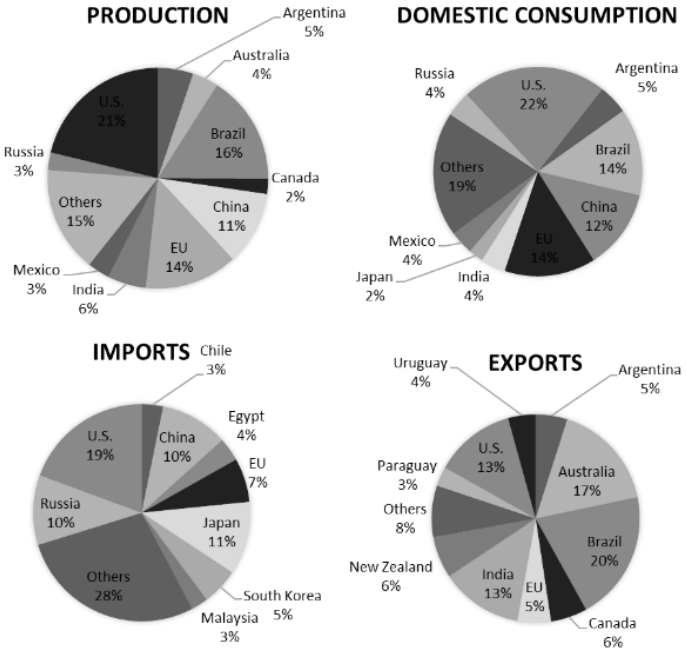
Author's elaboration.

4. Results

Before presenting the econometric results, Figure 1 presents information about the international beef market from 2000 to 2021, indicating the largest producers, importers, exporters, and consumers. The U.S. is the largest beef producer worldwide, with a cumulative production of 275,052 thousand metric tons [MT], underscoring its pivotal position in the global supply chain. Brazil (207,593 thousand MT) and the European Union [EU] (176,897 thousand MT) are the next largest producers. Brazil, with its vast agricultural land and favorable conditions for livestock farming, stands out as the leading producer in Latin America, while China and India are the major producers in Asia, accounting for 140,121 thousand MT and

72,949 thousand MT, respectively. Despite being the largest producer, the U.S. is also the top importer of beef, with 30,966 thousand MT of imports over the period, highlighting strong domestic demand. China, driven by rapid economic growth and shifting consumption patterns, imported 16,183 thousand MT. Other key markets include Japan (17,385 thousand MT) and the European Union (10,463 thousand MT), reflecting the global appetite for beef in both developed and expanding economies.

Figure 1. Main producers, importers, exporters and consumers of beef, 2000 to 2021 (in %).



Author's elaboration based on Foreign Agricultural Service, Official USDA Estimates[6].

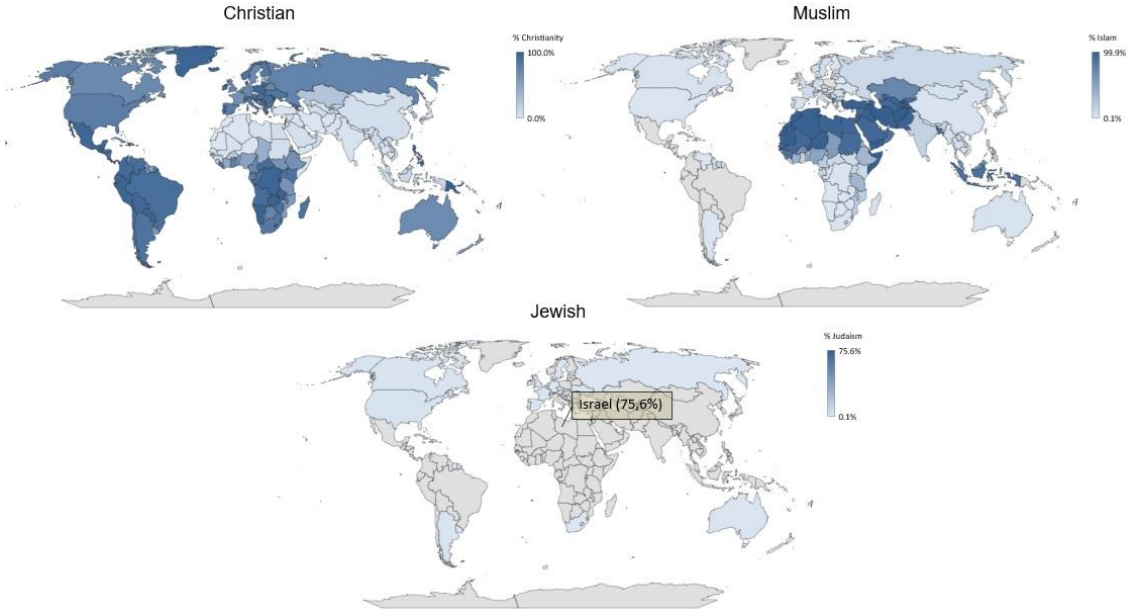
On the export side, Brazil leads with 39,318 thousand MT of beef exported, consolidating its position as one of the world's major suppliers. Australia (32,580 thousand MT), the U.S. (24,429 thousand MT), and India (24,844 thousand MT) also stand out as key suppliers to international markets. Domestic consumption trends reflect production and import patterns. The U.S., with total consumption of 281,449 thousand MT, leads the world in beef consumption, highlighting the role of domestic demand in influencing the global market. Brazil, with 169,451 thousand MT, and China, with 155,285 thousand MT, respectively, also emerge as significant consumers.

The data indicates that a few key players largely dominate the global beef trade. The U.S., Brazil, China, and the EU are major actors in both production and consumption, while Brazil, Australia, and India lead as top exporters. The growing demand in Asian markets, especially in China and Japan, suggests a shift in global consumption trends that were previously more concentrated in the U.S. and EU, with beef becoming a more important part of diets in these regions.

The territorial distribution of the Christian, Muslim, and Jewish religions is presented in Figure 2. Predominantly Christian countries are located in the Americas, Europe, southern Africa, and Oceania. Muslim populations are primarily concentrated in northern Africa, the Middle East, and parts of Asia. Israel is the country with the largest Jewish population, holding 75.6% of the world's Jewish population (Pew Research Center, 2024). The primary exporters of beef are predominantly Christian countries.

[6] Available at: https://apps.fas.usda.gov/psdonline/app/index.html#/app/advQuery. Accessed in February 2025.

Figure 2. Territorial distribution of the Christian, Islamic and Jewish religions in the world.



Author's elaboration based in Pew Research Center[7]. Note: Data refer to 2010, the most recent year with available data.

Table 2 presents the descriptive analysis of the variables. The religious index measures religious similarity between country pairs, where values equal to or closer to 0 indicate lower religious similarity, and values closer to 1 represent greater similarity in the religions of the populations of two countries. The mean value of 0.204103 suggests that, on average, religious similarity between country pairs is low, indicating significant differences in religious practices among most pairs. The standard deviation of 0.261002 reflects considerable variation in the data, indicating a wide variation in similarity among countries. The minimum value of 0 indicates that some country pairs have no religious similarity at all, while the maximum value of 0.960284 suggests that the most similar country pair shares 96% religious proximity.

Table 2. Descriptive analysis of variables.

Variable	Observations	Mean	Standard deviation	Minimum	Maximum
X_{ijt}^{k}	757,680	531.6	15,565.9	0.0	4,175,342.0
$DIST_{ij}$	757,680	7,967.7	4671.9	0.0	19,629.5
$Relig_{ij}$	757,680	0.204103	0.261002	0	0.960284
$Conti_{ij}$	757,680	-	-	0	1
$Lang_{ij}$	757,680	-	-	0	1
Col_{ij}	757,680	-	-	0	1
PIB_{jt}	750,330	3.83E+11	1.54E+12	7.60E+07	2.30E+13
PIB_{it}	757,680	1.78E+12	3.39E+12	7.20E+09	2.30E+13
Rta_{ijt}	757,680	-	-	0	1
$Jewish_{i2010}$	757,680	373,098.7	1,252,069	1,600	5,942,248
$Islamic_{i2010}$	757,680	8,604,929	3.39E+07	1015	1.60E+08
$Christian_{i2010}$	757,680	4.36E+07	5.75E+07	2,361,557	2.33E+08

Author's elaboration.

Based on descriptive analyses and the observation that some of the main importers consider the religious aspect as a determinant of beef consumption, this study estimates the average effect of religious similarity on trade volume. The econometric results are presented in Table 3, with each column representing the results of a different econometric equation.

[7] Available at: https://www.pewresearch.org/religion/2014/04/04/religious-diversity-index-scores-by-country/. Accessed in February 2025.

Table 3. Econometric results of the gravity model with fixed effects.

	1 Equation (4)	2 Equation (5)	3 Equation (6)	4 Equation (7)	5 Equation (9)	6 Equation (7 e 9)	7 Equation (5, 7 e 9)	8 Equation (6, 7 e 9)
PPMLHDFE (X_{ijt}^{k})	Only the religion variable	Insertion of the HalalKosher dummy	Insertion of the HalalKosher dummy and the HalalKosher and religion interaction	Insertion of the religious portion of the population	Insertion of GDP variables	Insertion of GDP and religious share variables	Insertion of GDP, religious share and HalalKosher dummy variables	Insertion of the variables GDP, religious share and the HalalKosher dummy and the interaction HalalKosher and religion
$Relig_{ij}$	1.256 (0.800)	1.392* (0.815)	1.586 (1.008)	-0.693 (0.696)	-0.007 (0.646)	-0.151 (0.743)	-0.217 (0.698)	-0.440 (0.744)
$HalalKosher_{i}$	-	-0.505 (0.445)	-0.481 (0.450)	-	-	-	1.841*** (0.322)	1.763*** (0.424)
$HalalKosher_{i} \times Relig_{ij}$	-	-	-0.278 (0.899)	-	-	-	-	0.486 (1.087)
$lnChristian_{i2010}$	-	-	-	-0.110 (0.180)	-	-0.438 (0.315)	-0.756*** (0.223)	-0.756*** (0.225)
$lnJewish_{i2010}$	-	-	-	0.363*** (0.115)	-	0.316*** (0.110)	0.211** (0.098)	0.210** (0.099)
$lnIslamic_{i2010}$	-	-	-	-0.109* (0.062)	-	-0.216** (0.096)	-0.336*** (0.067)	-0.337*** (0.068)
$lnDIST_{ij}$	-0.718*** (0.199)	-0.570** (0.226)	-0.565** (0.229)	0.296 (0.229)	0.547** (0.258)	0.327 (0.215)	-0.235 (0.163)	-0.234 (0.165)
Col_{ij}	0.825 (0.800)	0.962 (0.811)	0.968 (0.811)	2.757*** (1.013)	1.079 (0.815)	3.203*** (1.141)	1.999* (1.089)	2.035* (1.116)
$Conti_{ij}$	0.642 (0.470)	0.758 (0.486)	0.78 (0.506)	0.981** (0.476)	1.518*** (0.534)	1.036** (0.466)	0.731** (0.354)	0.727** (0.357)
$Lang_{ij}$	0.776** (0.374)	0.821** (0.381)	0.804** (0.383)	1.193*** (0.369)	1.384*** (0.365)	1.092*** (0.379)	0.853** (0.350)	0.858** (0.352)
Rta_{ijt}	0.600** (0.254)	0.683*** (0.246)	0.683*** (0.247)	0.850*** (0.317)	0.797*** (0.276)	0.774*** (0.279)	0.605** (0.245)	0.606** (0.244)
$lnPIB_{it}$	-	-	-	-	0.301*** (0.098)	0.475* (0.252)	0.671*** (0.192)	0.679*** (0.201)
$lnPIB_{jt}$	-	-	-	-	1.390*** (0.208)	1.377*** (0.206)	1.363*** (0.212)	1.365*** (0.212)
$Constante$	16.795*** (1.925)	15.659*** (2.094)	15.602*** (2.138)	5.848* (3.211)	-43.791*** (6.817)	-39.419*** (6.708)	-31.870*** (6.459)	-32.078*** (6.483)
N	243516	243516	243516	268940	655190	655190	655190	655190
R^2								
EF	Yes [a]	Yes [a]	Yes [a]	Yes [a]	Yes [a]	Yes [a]	Yes [a]	Yes [a]

Author's elaboration. Values in parentheses refer to robust standard errors clustered by country pair. * p<0.10.** p<0.05. *** p<0.01. a EF of importer-year-product, exporter-year-product; b EF of importer-year-product; c EF of importer, year and product. Missing values in the dependent variable were replaced by zero indicating the absence of bilateral trade for the country-sector-year pair combination.

For total beef exports, the $Relig_{ij}$ variable wasn't statistically significant in trade across all regressions, except in 2 column. Various functional forms were employed to test the robustness of the effects of religious distance on trade flows, and in almost all estimations, beef trade wasn't affected by religious heterogeneity between parties. This finding is consistent with Iannaccone (1998) and Audu et al. (2023), who suggest that there is no relationship between religion and economic activity. Furthermore, the sample includes all types of meat, and there may be significant hidden heterogeneity among the beef modality heterogeneity that affects the average results.

Since the sample of countries considered in the study is quite heterogeneous, it is important to highlight specific characteristics of the exporters. When the analysis incorporates the $HalalKosher_i$ dummy (column 2), it controls for the main exporting countries of Islamic and Jewish products. In this case, religion has a positive and significant effect on trade flows, that is, the impact of religious symmetry on trade when the main exporters of Halal and Kosher certified meat are not considered. When isolating from estimates, countries with appropriate certifications to foster trust among Halal and Kosher meat consumers, the religious proximity positively affects trade flows, suggesting that the greater the religious similarity, the higher the trade flows are likely to be. On the other hand, the interaction term $HalalKosher_i \times Relig_{ij}$ (column 3) reinforces the previous finding that, for the main exporters of meat subject to religious requirements, $Relig_{ij}$ does not have significant trade effects.

To understand the effect of religion on beef trade, columns 4, 6, 7, and 8 include the proportion of religious people from different religions in the exporter country population in the estimations. In all cases, considering the religious population did not alter the non-significant effect of religious symmetry between country pairs on trade volume. To test the robustness of these estimates, the fixed effects for exporter-year-product were removed. Without any additional control variables, the results indicate that the number of Christians in the exporting country has no statistically significant relationship with trade. However, the larger the Jewish population in the exporting country, the stronger the positive relationship with beef exports, while the larger the Muslim population, the more negative the relationship with beef trade.

The results are robust when controls for the economic size of the countries are added, which includes the importer and exporter GDP (column 6), the $HalalKosher_i$ dummy variable (column 7), and the interaction term $HalalKosher_i \times Relig_{ij}$ (column 8). In the inclusion of these last variables, the Christian population, represented by ln $lnChristian_{i2010}$, showed a negative statistical relationship with trade flows, suggesting that the larger the Christian population in the exporting country, the lower trade. In 8 column, populations were re-estimated one by one. In this case, the relationship between the Christian population and trade remained non-significant, while the Jewish population ($p < 0.01$) and Muslim population ($p < 0.001$) maintained their significance and sign.

The population size can have two distinct interpretations concerning trade in the context of religious differences. First, when most of a country's population follows religions different from those in another country, this may lead to a reduction in trade transactions due to the religious requirements imposed by consumers in importing countries, which limits meat exports from countries with religiously distinct populations. A second explanation concerns countries with predominantly religious populations that follow traditional practices. In such markets, much of the meat produced is likely for domestic consumption or trade with countries sharing similar religions. This argument is supported by Irshad et al. (2018), who suggest that countries with similar religions tend to engage in more trade with one another.

The analysis for disaggregated products (Table 4) shows that frozen meat trade (column 2) and offal (column 9) are significantly influenced by the variable in some particular cases. Religious proximity between country pairs indicates a positive relationship with trade flows for frozen meat and a negative relationship for offal.

Table 4. Results of the gravity model with fixed effects, for different beef types.

	1 Equation (4)	2 Equation (4)	3 Equation (4)	4 Equation (6)	5 Equation (6 e 9)	6 Equation (6 e 9)	7 Equation (6, 7 e 9)	8 Equation (6, 7 e 9)	9 Equation (6, 7 e 9)
PPML (X_{ijt}^{k})	Chilled beef	Frozen beef	Offal	Chilled beef, insertion of the HalalKosher dummy, HalalKosher interaction, religion and GDP	Frozen beef, insertion of the HalalKosher dummy, HalalKosher interaction, religion and GDP	Offal, insertion of the HalalKosher dummy, HalalKosher interaction, religion and GDP	Chilled beef, insertion of religious portion, Halal Kosher dummy, Halal Kosher interaction, religion and GDP	Frozen beef, insertion of religious portion, Halal Kosher dummy, Halal Kosher interaction, religion and GDP	Offal, insertion of religious share, HalalKosher dummy, HalalKosher interaction, religion and GDP
$Relig_{ij}$	1.717 (1.140)	1.963* (1.093)	-1.502 (1.102)	-0.253 (1.211)	0.262 (0.944)	-0.563 (1.190)	0.517 (0.951)	-0.116 (0.998)	-1.722* (1.037)
$HalalKosher_{i}$	-	-	-	0.586 (0.642)	0.891** (0.386)	1.236** (0.524)	0.808 (0.779)	1.680*** (0.408)	1.876*** (0.447)
$HalalKosher_{i} \times Relig_{ij}$	-	-	-	0.983 (1.878)	1.00 (0.978)	-0.100 (1.534)	1.764 (2.123)	0.801 (0.974)	0.034 (1.507)
$lnChristian_{i2010}$	-	-	-	-	-	-	-1.409*** (0.443)	-0.449** (0.215)	-1.173*** (0.426)
$lnJewish_{i2010}$	-	-	-	-	-	-	0.624*** (0.120)	-0.013 (0.099)	0.392** (0.171)
$lnIslamismo_{i2010}$	-	-	-	-	-	-	-0.636*** (0.116)	-0.237*** (0.067)	-0.503*** (0.127)
$lnDIST_{ij}$	-1.052*** (0.211)	-0.413 (0.264)	-0.554 (0.421)	-0.189 (0.245)	-0.721*** (0.259)	-0.047 (0.368)	-0.488*** (0.174)	0.279 (0.270)	-0.702* (0.367)
Col_{ij}	2.147** (0.847)	0.727 (0.804)	-0.709 (1.350)	-0.233 (0.683)	1.167 (0.879)	2.493** (1.072)	5.030*** (1.295)	1.657 (1.022)	0.692 (1.631)
$Conti_{ij}$	1.506* (0.808)	-1.031 (0.714)	2.347*** (0.822)	1.375*** (0.529)	-0.077 (0.655)	2.274*** (0.842)	0.865* (0.462)	-0.435 (0.610)	1.161 (0.889)
$Lang_{ij}$	0.571 (0.433)	0.860** (0.437)	-0.393 (0.497)	0.988** (0.385)	1.468*** (0.421)	0.326 (0.742)	0.309 (0.391)	1.334*** (0.406)	-0.223 (0.560)
Rta_{ijt}	0.527** (0.260)	0.776*** (0.292)	-0.245 (0.457)	0.579* (0.318)	0.948*** (0.275)	-0.339 (0.389)	0.519* (0.273)	0.772*** (0.293)	-0.12 (0.354)
$lnPIB_{it}$	-	-	-	0.316*** (0.121)	0367 (0.083)	0.372*** (0.129)	1.248*** (0.452)	0.516*** (0.191)	1.140*** (0.303)
$lnPIB_{jt}$	-	-	-	1.477*** (0.221)	1.630*** (0.280)	0.540*** (0.192)	1.427*** (0.288)	1.617*** (0.282)	0.560*** (0.184)
$Constante$	18.888*** (2.200)	14.323*** (2.533)	15.332*** (3.940)	-40.554*** (7.276)	-44.461 (8.708)	-17.484** (7.772)	-37.394*** (11.113)	-42.704*** (9.172)	-11.342 (7.084)
N	70389	84085	89042	191517	192840	250400	191517	192840	250400
R^2									
EF	Yes [a]	Yes [a]	Yes [a]	Yes [a]	Yes [a]	Yes [a]	Yes [a]	Yes [a]	Yes [a]

Author's elaboration. Values in parentheses refer to robust standard errors clustered by country pair. * p<0.10.** p<0.05. *** p<0.01. a EF of importer-year-product, exporter-year-product; b EF of importer-year-product; c EF of importer, year and product. Missing values in the dependent variable were replaced by zero indicating the absence of bilateral trade for the country-sector-year pair combination.

In the frozen meat trade, the significant results occur only in the general model, the results are not consistent with the inclusion of the $HalalKosher_i$ variable, the interaction term $HalalKosher_i \times Relig_{ij}$ (column 5), and the proportion of adherents to religions variables (column 8). For offal beef, the results were only significant when the $HalalKosher_i$ controls, the interaction term $HalalKosher_i \times Relig_{ij}$, and the religious share were included.

Sharing religious norms reduces compliance costs and increases competitiveness for exporters with similar traditions as their trading partners. Stronger cultural and social ties facilitate trade and the formation of partnerships. These ties establish a greater degree of trust and mutual compliance in meat production and trade practices, easing trade transactions between partners. The frozen beef trade was particularly affected because transactions in this type of meat are more frequent than in other categories. Of the beef trade during the investigated period, 53.5% was frozen, 36.3% was chilled meat, and 10.2% was offal.

Countries with similar traditions tend to have similar food preferences. Some religions impose specific dietary restrictions that prohibit the consumption of certain foods, such as offal, which may be considered impure or associated with specific ritual practices. Therefore, countries with similar religious traditions are negatively correlated with the trade of this type of meat, as they avoid consuming offal to prevent impurity and demonstrate religious respect.

The $HalalKosher_i$ variable was positive and significant in regressions (8) and (9) for frozen meat and offal, respectively. The dummy captures the largest exporters of Halal and Kosher meat may reflect characteristics or competitive advantages of these countries, making them more likely to engage in large-scale trade transactions for meats that meet religious requirements.

The $HalalKosher_i$ variable was positive and significant in regressions (8) and (9) for frozen meat and offal, respectively. This dummy variable represents the largest exporters of Halal and Kosher meat and reflects the characteristics and competitive advantages of these countries, making them more likely to engage in large-scale trade transactions for meats that meet religious requirements.

For the other variables, the trade elasticity of distance, represented by the estimated logarithmic variable, is negative and statistically significant, demonstrating its relevance as a trade resistance factor. More specifically, distance serves as a proxy for transportation costs, which may involve the need for specialized transportation, such as refrigerated containers, increasing logistical expenses over longer distances. This result aligns with Gani (2021), who argues that a 1% increase in the distance between a pair of countries causes a 0.71% decline in trade between them.

The binary variable measuring the colonial relationship between countries is not significant. This finding is consistent with Bampi et al. (2020), who argue that global integration and the evolution of trade have made colonial trade relations irrelevant. Similarly, the coefficient for contiguity is also not significant. Junior et al. (2017) suggest that the establishment of trade agreements can enhance logistical development through the incorporation of transport technology, and therefore, sharing a common border may indeed be insignificant in explaining trade.

The language variable reveals statistical significance and a positive coefficient, indicating the advantage that a common language provides in increasing trade levels (Majeed et al., 2019). A shared language facilitates communication and negotiation, reducing the language barrier and associated costs of translating packaging and labels. Moreover, it can also serve as a cultural link between countries that speak the same native language.

Membership in trade agreements, represented by the RTA variable, shows statistical significance with a positive effect on trade flows. Trade agreements facilitate trade between countries by establishing common terms and implementing less restrictive tariff policies.

Majeed et al. (2019), citing the case of Halal markets, discuss how commercial gains could be achieved if countries with similar cultural backgrounds developed a consolidated beef market, including a common certification body for Halal products. Such preferential agreements could enhance trade between religious countries while potentially limiting trade opportunities for non-member markets.

The GDP of importers and exporters countries also exhibited significance with positive parameters. The exporter's GDP indicates production capacity, while the importer's GDP reflects consumption capacity. In the context of trade influenced by religious considerations, exporting countries must adapt their production and marketing strategies to meet the cultural demands of the importing countries. These importers are expected to pay a premium for meat produced under religious certification. This aligns with the predictions of the gravity model, as noted by Gani (2021).

5. Conclusions

Although the global beef trade is concentrated among a few exporting countries, the question arose whether this trade could be influenced by religion as a cultural factor. Some studies have demonstrated that shared religious beliefs favor shipments from economies with similar religious practices. To broaden the analysis, this study investigated whether this effect persisted across a larger sample that included all beef-importing countries.

The expansion of global supply chains and the increase in international shipments require countries to adapt to the demands of foreign markets. In the beef sector, this involves navigating a complex industry where slaughtering and processing practices are often dictated by religious specifications. Emphasizing the religious aspect underscores the need to examine the various barriers to exports, as trade with specialized markets necessitates suppliers adapt their practices and obtain the appropriate certifications. This study explored beef exports through the lens of different religious beliefs, focusing on the stringent requirements imposed by Halal and Kosher consumer markets.

The results show that bilateral beef trade is influenced by factors such as distance, importer and exporter income, common language, and trade agreements. However, no statistically significant relationships were found between religion and trade flows in the analysis that includes all types of beef, particularly without specific controls for major Halal and Kosher beef exporters. This result indicates that, for a broader group of countries, not just those with specific religious requirements, cultural variables were not a determinant of trade. This finding could be consistent with two key arguments: First, not all countries strictly enforce laws on beef slaughter based on religious beliefs like those of Islam and Judaism. While these religions profoundly influence the culture and lifestyles of their followers, affecting their dietary patterns. Second, the institutions in exporting countries may be sufficiently adapted to minimize transaction costs related to religious slaughter requirements.

However, when controlling for the major exporters of Halal- and Kosher-certified beef, religion emerges as a significant factor in determining the beef trade. The statistical significance of religion variable indicates that religious similarity between countries influences animal protein shipments. Nevertheless, countries that do not share similar religious practices with their trading partners can still establish successful international negotiations by understanding the institutions that shape market behavior, including cultural customs, laws, and religious considerations of the importing country. This awareness helps exporters tailor their production decisions and prevents these factors from becoming barriers to international trade. This finding is particularly relevant for the frozen beef trade, where exports are robustly linked to religious similarities between trading partners.

Religious culture can influence the international beef trade in several ways, as it shapes dietary preferences and consumption practices regarding animal protein. Specifically, religion plays a significant role in determining beef imports for predominantly Islamic or Jewish countries in their trade with the global market. The procedures required for Halal and Kosher certification exemplify the specific standards that beef must meet to enter these markets.

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