Sacred birds? Religious similarity and poultry exports

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Abstract

This study investigates whether religious similarity between trading partners affects poultry exports from 2000 and 2023. For that, we employ the gravity model os trade and use the Pseudo Poisson Maximum Likelihood (PPML) estimator with different types of fixed effects. We observe that religious similarity does not have a

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statistically significant effect on poultry exports. We also verify that trade agreements, geographic distance, and a common border are relevant in determining trade. The study suggests that internal variations within religions, such as halal or kosher practices, likely have a greater impact on poultry trade than religious similarity alone

Keywords: poultry exports, religious similarity, gravity model, PPML estimator, international trade

¿Aves sagradas? Similitudes religiosas y exportaciones avícolas

Resumen

Este estudio investiga si la similitud religiosa entre socios comerciales afecta las exportaciones avícolas entre 2000 y 2023. Para ello, empleamos el modelo de gravitacional del comércio y utilizamos el estimador de Pseudo Poisson Maximum Likelihood (PPML) con diferentes tipos de efectos fijos. Observamos que la similitud religiosa no tiene un efecto estadísticamente significativo en las exportaciones avícolas. También verificamos que los acuerdos comerciales, la distancia geográfica y una frontera común son relevantes para determinar el comercio. El estudio sugiere que las variaciones internas dentro de las religiones, como las prácticas halal o kosher, probablemente tengan un mayor impacto en el comercio avícola que la similitud religiosa por sí sola.

Palabras clave: exportaciones avícolas, similitud religiosa, modelo de gravedad, estimador PPML, comercio internacional

1. Introduction

In view of the projections for the food production sector, the OECD report (2023) establishes a scenario of growth in the global consumption of animal proteins until 2032. Specifically, it predicts growth of 15%, 11%, and 10% in the consumption of poultry, pork and beef, respectively, from 2023 onwards. In addition, it points out the predominance of poultry meat consumption, which will represent more than a third (41%) of the consumption of all protein consumed among sources of animal origin. According to the report, the increase in the world population between 2022 and 2032 will put pressure on the demand for poultry meat, which will be greater not only from countries that already dominate sales in this market, such as the United States (U.S.), Brazil, the European Union (EU), and China, but will also boost other export markets, such as India, Pakistan, the Philippines and Vietnam.

Despite the favorable scenario, some nations face restrictions on international food trade, which may involve, among other aspects, religious traditions and customs. According to Segundo Guiso, Sapienza and Zingales (2009), deeply rooted cultural perceptions, which affect the perception of product quality, are important determinants in trade exchanges. Therefore, countries that share the same religious traditions tend to develop stronger trade relations, as religion promotes trust between partners.

Audu, Okorie and Orekoya (2023) and Lewer and Van den Berg (2007) postulate that religion positively influences negotiations, commercial credit and international trade flows. Its relevance is manifested in the reduction of commercial costs, as it reduces the need for complex contracts and reduces transaction costs, since the parties involved have aligned ethical and behavioral expectations. In addition, the reduction of uncertainties and the improvement of communication, resulting from religious similarities, minimize misunderstandings, which also contributes to the reduction of commercial costs.

From a different perspective, Havinga (2010) argues that religion can act as a cultural barrier that

negatively affects trade. Religious differences create trade barriers due to the need for countries to adapt products and processes to meet the religious standards of consumers in different countries. This need for adaptation can increase transaction costs and make contract negotiation more complex (Conficoni et al. 2022). Religious requirements, such as halal or kosher certifications, are examples in the food trade that require strict and continuous compliance to meet Muslim and Jewish religious rituals, respectively (Suryawan, Hisano and Jongerden 2022). In this case, the technical or financial inability to meet certain requirements can not only limit access to certain markets but also increase operating costs, hindering competitiveness. In this way, religion can act as a trade barrier, increasing the costs and complexity of international transactions (Helble 2006).

From these notes, the trade effect of religion may be different depending on the type of product being marketed. Differentiated products, which often carry more cultural and religious meaning, may be more affected by religious beliefs than homogeneous products (Helble 2006). The meat trade denotes such case, as the trade flow is deeply influenced by specific religious norms that regulate the production, preparation, and consumption of these products (Conficoni et al. 2022).

The holy books of the major monotheistic religions, such as the Bible, the Torah, and the Quran, provide detailed descriptions of practices related to the slaughter of animals, which are strictly followed by Orthodox practitioners, especially among Jews and Muslims. In the Quran, for example, foods are classified as either halal (permitted) or haram (forbidden), and every Muslim must consume only those that are halal, as instructed in the holy texts. Similarly, in the Torah, foods are considered kosher (pure) only if they meet specific categories, and animals must be slaughtered according to kosher laws to be suitable for consumption (Conficoni et al. 2022)

Halal and kosher practices are examples of how religion, as a social institution, can promote behaviors that favor specialization and exchange, based on principles of honesty and diligence. In the case of the meat trade, this could translate into more transparent and trustworthy business practices between countries that share predominantly similar religions, reducing the risk of opportunistic behavior. However, religious networks, shared by individuals who share the same faith, can be exclusive and less efficient when influenced by religious criteria rather than purely economic considerations, such as price or quality (Lewer and Van den Berg 2007).

This occurs if countries deliberately or unintentionally restrict market access to members who share the same religious beliefs, excluding those who do not (Lewer and Van den Berg 2007). A network of Muslim traders specializing in halal meat, for example, may prefer to do business only with other Muslims or suppliers who follow the same religious precepts, excluding producers who do not meet these criteria, even if they can offer halal-certified products competitively.

Such exclusivity can reduce the total volume of transactions by restricting the number of trading partners, leading to fragmented and less efficient markets, with negative implications for global economic integration and for consumers, who will face higher prices and reduced product diversity (Suryawan, Hisano and Jongerden 2022). This effect may be particularly pronounced in religions that view the consumption of meats that do not follow a certain slaughter ritual as an immoral or spiritually impure act, resulting in a lower willingness to participate in this type of trade.

Ismoyowati (2015) conducted an analysis of consumer behavior in Indonesia, seeking to understand their choices regarding processed poultry foods. The research identified religion as a central factor in the consumption decision, especially with regard to the concept of halal. However, although religion is a significant factor in explaining the consumption of this type of meat, other aspects, such as the taste of the food, are also relevant

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in determining demand.

The 2023 OECD report highlights poultry meat, showing the greatest projection of growth in the consumer market, so it becomes interesting to conduct studies based on the main product in the meat market, poultry meat. The objective of this work, therefore, is to analyze how religious similarity between trading partners can affect international trade for poultry products.

The effect of bilateral religious asymmetry on international trade can vary significantly depending on the specific norms and practices of each religion. While Islam and Judaism, for example, have clear and strict rules on the slaughter and consumption of meat, which can either restrict or specialize trade, other religions may not have such restrictions, allowing greater flexibility in trade practices. This variation creates theoretical ambiguity, which makes it difficult to formulate hypotheses, since the effect of religion on meat trade is not universal, but depends on the specific context of each religion, the exclusivity in trade flows, and the ability of countries to adapt their production processes to meet religious rituals.

Therefore, religious similarity can have ambiguous effects on trade: at times it can facilitate trade by creating channels of trust and reputation among members of the same religion, at others it can be exclusionary, potentially diverting trade from its most efficient channels and limiting opportunities for those outside the network. It is also possible to find a statistically insignificant result, because although exclusive networks can create barriers, the increasingly integrated global market, driven by technological advances and certifications that signal product quality, allows producers to adapt their products to religious requirements, mitigating these obstacles. Furthermore, economic factors such as price, quality, and logistics efficiency tend to outweigh religious considerations (Lewer and Van den Berg 2007).

To conduct this study, the index of religious similarity between trading partners is applied to the structural gravity model, which is suitable for obtaining estimates of trade effects. To assess the robustness of the results, the variable is applied to alternative regressions, such as equations that exclude the main importers of poultry meat from the sample and the equation without the presence of outliers in the trade flow. In addition to this effort, a descriptive analysis is also carried out to map the global poultry meat market, identifying the main suppliers and importers worldwide. The analysis covers the period from 2000 to 2023, aiming at a comprehensive analysis for two decades, ending in the most recent year with available information.

The study is organized into several sections; after this introduction, the second part addresses the review of literature relevant to the topic, followed by the third part that describes the methodology of the structural gravity model. The results obtained are discussed in the fourth part, followed by the concluding remarks in the last section.

2. Religious similarity and international trade

This section explores the effects that religious diversity can have on trade relations between countries. The analysis is based on a review of empirical studies that discuss how religious differences or similarities can influence international trade flows. The relationship between religion and international trade is complex, influenced by cultural dynamics, trust, and political factors. Some authors point out that religious differences can act as barriers to trade (Costa et al. 2023; Mehanna 2003; Hole 2018) while shared cultural traits can facilitate it (Herianingrum et al. 2024; Lee and Park 2016; Lewer and Van den Berg 2007). Other studies find no relationship between trade and religious diversity (Audu, Okorie and Orekoya 2023).

Kazantseva and Nepp (2023) offer a theoretical contribution explaining the channels through which religion influences trade flows. The first channel relates to individuals' psychological perception of God and His actions. In this context, religion shapes how entrepreneurs perceive risk, with some viewing business risk as part of a divine plan, interpreting success or failure as God's will. This belief provides them with greater confidence in their decisions, trusting that by adhering to their faith's precepts, they will be protected or blessed by divine providence. Furthermore, religion may affect the conduct of business partners, who may dread divine retribution for not fulfilling agreements, strengthening trust in business ties.

The second channel analyzes the influence of similarities and variations in religious doctrines on trade relations. Divergences in religious practices and conventions can engender problems and mistrust among commercial partners, affecting negotiations. On the other hand, similar religious principles can enhance mutual trust, promote negotiations and cultivate a more collaborative atmosphere. Religious openness and tolerance facilitate trade among nations with diverse religious traditions and the increased acceptance of varied faiths reduces cultural and religious obstacles, facilitating more efficient commerce interactions (Kazantseva and Nepp 2023).

The third channel examines institutional theories, which regard religion as an institution that impacts trade in many manners. Initially, religious competition can enhance ethical standards and foster transparency in commerce, benefitting trade. Secondly, religious institutions can serve as a replacement for ineffective state institutions, offering structure and rules to control trade, particularly in the absence of governmental oversight. Ultimately, a shared religious faith among commercial partners cultivates trust, diminishes distrust, and decreases bargaining expenses.

However, while religion can have positive effects on trade, it can also have negative impacts, depending on the context. For example, in societies where there is strong rivalry between religious groups, this competition can generate conflict and distrust, damaging the business environment. In addition, strict religious norms, such as restrictions on consumption or the marketing of certain products, can limit trade. Thus, the influence of religion on trade can be beneficial or detrimental, depending on the circumstances and the balance between the different institutional factors involved (Kazantseva and Nepp 2023).

Some studies reveal the negative effects of religious differences on international trade, particularly on the flows of cultural goods. Costa et al. (2023) use the gravity model and data from 2002 to 2015 to assess the effect of religious diversity on film trade. The results indicate that religious asymmetry within a country can act as a barrier to trade, suggesting that certain religious beliefs disapprove of behaviors associated with the consumption of cultural goods, which hinders trade exchanges. Dall'azen and Weise (2014) reinforce this conclusion, highlighting the importance of the exporting country understanding the culture, customs, and religion of the importing country to facilitate trade.

Hole (2018) examines the impact of religious discrimination on bilateral trade, focusing on overall exports and imports rather than specific products. Using the gravity model with a Poisson Pseudo Maximum Likelihood (PPML) estimator, the study analyzed data from 170 countries between 1990 and 2008, incorporating a variable measuring religious discrimination as an additional trade cost. The results reveal that discrimination against a religion present in a partner country has a statistically significant negative effect on trade flows. This impact is more severe when the exporting country practices discrimination, and it intensifies with higher degrees of discrimination and larger proportions of adherents to the discriminated religion in the importing country.

Discrimination against Christians and Muslims was found to be particularly damaging to trade.

Mehanna (2003) explores the influence of Islam on bilateral trade, focusing on overall exports and imports rather than specific products. Using the gravity model with data from 1996 to 1999 for 33 countries, 17 of which are Muslim-majority, the study controls for factors like political freedom, oil exports, regional trade agreements, and geographic proximity. The findings show that Muslim-majority countries, on average, trade less compared to countries with other dominant religions such as Christianity or Buddhism. The variable representing Islam remained significantly and negatively correlated with bilateral trade, even after accounting for other factors. This suggests that religion, particularly Islam, may act as a trade barrier, potentially due to the integration of religion and state and the influence of Sharia law on trade policies and consumer behavior in Muslim countries.

The following analyses highlight the positive effects of religion on trade flows. Herianingrum et al. (2024) used the gravity model and PPML estimator to study Indonesian seafood exports to 47 Organization of Islamic Cooperation (OIC) countries over 30 years (1992–2021). The results show that religion significantly boosts exports, with the adjusted GDP of importing countries and the Muslim population being key factors in increasing Indonesia's halal seafood exports. These findings emphasize the role of religious affinity in facilitating and strengthening trade between Indonesia and its OIC partners.

Lee and Park (2016) examined the impact of religion on international services trade for 227 exporters and 220 importers from 2000 to 2007, using the gravity model with PPML to account for heteroscedasticity and zero trade flows. Their findings indicate that religious similarity between countries enhances services trade by building trust, which lowers unobserved transaction costs from cultural and institutional differences. Interestingly, religious diversity promotes services trade even more than similarity, while a dominant religion tends to discourage it. Conversely, the presence of religious minorities encourages trade in services.

These findings align with Lewer and Van den Berg (2007), who tested the hypothesis that shared religious cultures strengthen trade networks across countries. Using the gravity model, they analyzed religion as a binary variable, assigning a value of 1 when countries share one of the following religions: Buddhist, Confucian, Hindu, Eastern Orthodox Catholic, Protestant, Roman Catholic, Islamic, or Jewish. They found a positive effect of shared religious cultures on trade, except for Roman Catholicism, which had a negative effect. This was attributed to lower levels of trust promoted by Catholicism and higher corruption levels in predominantly Catholic countries, which can hinder contract execution and trade agreements. Catholicism's emphasis on vertical ties with the Church, rather than horizontal ties between citizens, also decreases interpersonal trust, affecting trade relationships.

For Islamic and Jewish cultures, sharing these religions did not significantly promote or hinder international trade. In Islam's case, the lack of a significant effect may be related to factors such as anti-market views, high corruption in Muslim-majority countries, divisions between Sunnis and Shiites, and the prohibition of interest on loans, which complicates long-term trade contracts involving credit.

Audu, Okorie and Orekoya (2023)[1] observe that religious asymmetries do not affect trade, even considering the most and least religious countries in the world. The analysis showed that, regardless of the degree of religiosity, countries do not tend to establish trade relations based on religious similarities. Instead, other factors, such as trade reciprocity and economic considerations, are significant in determining trading partners. For example, highly religious countries, such as Israel, Saudi Arabia, and India, maintain consistent

trade relations with nations that do not share the same religious traditions, demonstrating that religion does not exert a direct influence on trade choices.

Additionally, the study reveals that in less religious countries, such as China, Japan and Sweden, religion also does not significantly affect trade relations. The research shows that these countries tend to trade with nations that have no religious or linguistic affinity, reinforcing the idea that economic factors, such as market size and the economic power of trading partners, are more important for establishing trade ties. Thus, trade is largely determined by economic interests rather than cultural or religious ties, challenging the assumption that culture, including religion, would be a key element in international trade relations.

In the case of meat trade, Ismoyowati (2015) analyzed consumer behavior in Indonesia to understand how they choose processed poultry-based foods. The author used variable religion as an important factor in the analysis of food consumption, especially in relation to the concept of halal. Religion was considered both in the form of a concern with product conformity and in consumers' perception of what constitutes halal food, such as the absence of pork and the presence of certifications.

The main results indicate that, although the halal factor is important (27% of respondents mentioned it as an influential factor), the taste of the food is the main motivator for purchasing (59%). Furthermore, the decision to purchase halal food was strongly influenced by family (60%), highlighting the importance of social ties in the choice of consumption. The sample was composed mainly of Muslims (88%), with a balanced distribution between men and women, and most respondents were young and with a relatively high level of education. The influence of religion was observed in consumption choices, with a greater emphasis in regions where Muslims were a minority, where consumers more explicitly looked for signs or guarantees that the food was halal.

Masruroh (2020) supports Ismoyowati (2015), stating that halal certification provides competitive advantages to products by not only ensuring adherence to Muslim laws but also guaranteeing quality standards, which encourages consumption among adherents. Similarly, Pazuello and Ribeiro (2021) analyzed kosher certification as a strategy for accessing new markets. They noted the growing demand for kosher products, driven not only by Jews but also by non-Jews seeking ethical, pure, and allergen-free foods. In the U.S., although only 2% of the population adheres to Judaism, over 40% of food production is kosher, reflecting consumer interest in quality and safety. The authors conclude that companies recognize kosher certification as a valuable tool for profit maximization and broader product acceptance.

3. Methodology

3.1 The gravity model of trade
The gravity model is recommended for analyzing the effect of trade policies and other determinants of trade, such as religion. This model emerged in 1962, when physicist Jan Tinbergen proposed an econometric study on the pattern resulting from relations between countries, disregarding the presence of trade barriers. The idea was to associate trade with Newton's physics, in which the attraction between bodies (countries) is directly proportional to their masses (Gross Domestic Product) and inversely proportional to their distances (geographic distance) (Prates and Pereira 2015). Despite its strong explanatory power, the first specifications of the model lacked a theoretical foundation that supported the suggested empirical relationship, which made it impossible to use the model for policymaking.

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McCallum (1995) examined the regional trade dynamics of Canadian provinces adjacent to the U.S., presenting the concept of the "border puzzle" or "border effect." The research revealed that trade among Canadian provinces was 20 times larger significant than trade between those provinces and U.S. states, underscoring the absence of a coherent theoretical framework to examine the determinants affecting bilateral commerce. The "invisible barriers" encompass language, cultural, legal, and other impediments that endure even within adjacent nations. Anderson and Van Wincoop (2003) addressed this issue by formulating an improved gravity model that integrated these variables inside a microfoundation framework. Their model examined bilateral trade barriers and the impacts of internal and external boundaries, employing a general equilibrium technique to quantify multilateral trade costs—elements affecting commerce across all areas, rather than solely between trading partners.

This enhanced scientific approach yielded a more accurate comprehension of the determinants influencing international trade, addressing the "border puzzle." Anderson and Van Wincoop (2003) enhanced the application of the gravity model in empirical studies, providing a more dependable instrument for analyzing the impact of borders on commerce (Carneiro et al. 2022).

Anderson and Van Wincoop (2003) analyzed the supply and demand functions of importing and exporting countries, assuming that consumers value variety. The demand system is based on a utility function of the CES (Constant Elasticity of Substitution) type, where, in the importing country, consumers seek to maximize their utility in relation to their budget constraint. The result of this maximization is represented by a nonlinear equation with a multiplicative error term, according to the following structures:

$$X_{ijt}^p = \frac{E_{jt}^p Y_{it}^p}{Y_t^p} \left(\frac{\tau_{ijt}^p}{P_{jt}^p \Pi_{it}^p} \right)^{1-\sigma_p} e_{it}^p \tag{1}$$

$$(\Pi_{it}^p)^{1-\sigma_p} = \sum_j \left(\frac{\tau_{ijt}^p}{P_{jt}^p} \right)^{1-\sigma_p} \frac{E_{jt}^p}{Y_t^p} \tag{2}$$

$$(P_{jt}^p)^{1-\sigma_p} = \sum_i \left(\frac{\tau_{ijt}^p}{P_{jt}^p} \right)^{1-\sigma_p} \frac{Y_{it}^p}{Y_t^p} \tag{3}$$

The model allows to explain exports carried out bilaterally, being X_{ijt}^p the exports of product p by country i in year t; E_{jt}^p is the expenditure of economy j to acquire product p in year t; Y_{it}^p and Y_t^p, respectively, are the production of p in country i and the aggregate world production of the same product in year t; τ_{ij}^p are the trade costs that exporters from country i face to export products p to country j in year t; σ_p represents the elasticity of substitution between groups of products; the random error term is represented by e_{it}^p. The variables P_{jt}^p and Π_{it}^p represent the price indices for each economy j and i, respectively, which are the multilateral resistance terms. P_{jt}^p indicates internal multilateral resistance and reflects country j's dependence on the trade costs of all possible countries supplying goods p. Π_{it}^p indicates external multilateral resistance and reflects that country i's exports to country j depend on trade costs in all possible export markets. Krugman (1995) presents a fairly intuitive analogy to explain this relationship, suggesting that two countries would have more intense trade flows between

them if they were located on Mars than if they were located in Europe. This is because in Europe there are other trading partners available, which increases multilateral resistance, while on Mars, with limited trade options between only two countries, this resistance would be lower.

As represented by equation (4), trade costs can be modeled as a function of observable variables, as stated by Anderson and Van Wincoop (2003):

$$\tau_{ijt}^p = \sum_{m=1}^{M} \left(z_{ijt}^m \right)^{ym} \tag{4}$$

Literature generally approximates the variable z_{ijt}^m as a set of variables that represent trade costs, whether they are of a geographic or historical-institutional nature, such as distance, contiguity, language, and common cultural ties, for example. Formally, z_{ijt}^m is equal to zero, in the absence of trade costs associated with the variable m. If greater than one, $z_{ijt}^m = (1,\ldots,M)$, the costs represent an ad valorem equivalent of all trade costs associated with the variable m, which are related to bilateral trade barriers between two countries (Anderson and Van Wincoop 2003).

Based on the equation of X_{ijt}^p, it is possible to linearize it (equation 5), assuming its separability. According to Anderson (2011), equation (1) can be applied to product classes separately, relating the bilateral flows of a given type of product p to the bilateral variables that affect trade in that product. The same applies to the temporal dimension: the use of panel data not only increases the efficiency of the estimators, but also allows estimating the effect of non-discriminatory policies that vary over time (Carneiro et al. 2022).

$$lnX_{ijt}^p = lnY_{it}^p + lnE_{jt}^p - lnY_t^p + \left(1 - \sigma_p\right)ym \sum_{m=1}^{M} lnz_{ijt}^m \left(1 - \sigma_p\right)[ln\Pi_{it}^p - ln\,P_{jt}^p] + \,lne_{ij}^p \tag{5}$$

The structural gravity model represents an advance over traditional versions of the gravity model, as it robustly incorporates multilateral resistance terms. Econometrically, this occurs by inserting fixed effects of the exporter and importer, from which the model is able to absorb all variables that are common to exporting and importing countries that may influence trade. This is essential to avoid omitted variable bias, which could distort estimates if resistance were not considered (Carneiro et al. 2022).

Fixed effects are particularly useful in empirical analyses because they allow the model to adjust for different individuals over time, improving the accuracy of the estimates. An additional feature of the structural gravity model is its flexibility to be applied to different dimensions, such as specific products, years, and country pairs, which is particularly useful in empirical studies in the area of international trade. By introducing

the fixed effects of importer-product-year and exporter-product-year, the model can capture the variation in trade flows in relation to different types of products and for different periods. This allows a more detailed analysis of the effect of trade policies and other determinants on trade, adjusting to the particularities of each scenario analyzed (Carneiro et al. 2022).

3.2 Empirical model

To verify whether religious similarity between two countries affects poultry meat trade, this study analyzes the period from 2000 to 2023. The aim is to cover a longer period, involving at least two decades, including the most recent years, for which data are available. We considered 24 exporting countries, responsible for 95% of international poultry meat trade, and 195 importing countries, for which trade data are available (Table 1). The selection of the top 95% of exporters represents a recurrent practice in the literature; the same strategy is observed in Carneiro et al. (2022).

Table 1. *Countries considered in the sample*

24 exporting countries (accounting for 95% of exports)
Argentina, Austria, Belarus, Belgium, Brazil, Canada, Chile, China, Denmark, France, Germany, Hungary, Ireland, Italy, Netherlands, Poland, Romania, Russian Federation, South Africa, Spain, Thailand, Ukraine, United Kingdom, United States.
195 importing countries (accounting for 100% of imports)
Afghanistan, Albania, Andorra, Angola, Antigua and Barbuda, Argentina, Armenia, Aruba, Australia, Austria, Azerbaijan, Bahamas, Bahrain, Bangladesh, Barbados, Belarus, Belgium, Belize, Bermuda, Benin, Bolivia, Bosnia and Herzegovina, Germany, Botswana, Brazil, Brunei, Bulgaria, Burkina Faso, Burundi, Bhutan, Cape Verde, Cameroon, Canada, Kazakhstan, Chad, Chile, China, Colombia, Comoros, Congo, Ivory Coast, Costa Rica, Croatia, Cuba, Cyprus, Denmark, Dominica, Egypt, El Salvador, Saudi Arabia, South Africa, Slovakia, Slovenia, Spain, Equatorial Guinea, Ethiopia, Estonia, Finland, France, Gabon, Gambia, Ghana, Georgia, Grenada, Germany, Greece, Greenland, Guyana, Guatemala, Guinea-Bissau, Guinea, Haiti, United Arab Emirates, Honduras, Hungary, Cayman Islands, Cook Islands, Fiji Islands, Marshall Islands, Solomon Islands, India, Indonesia, Iran, Iraq, Ireland, Iceland, Israel, Italy, Jamaica, Japan, Jordan, Kiribati, Kosovo, Kuwait, Laos, Lesotho, Latvia, Lebanon, Liberia, Libya, Lithuania, Luxembourg, North Macedonia, Madagascar, Malaysia, Malawi, Maldives, Mali, Malta, Morocco, Mauritania, Mauritius, Mexico, Micronesia, Mozambique, Moldova, Monaco, Mongolia, Montenegro, Montserrat, Myanmar, Namibia, Nauru, Nepal, Nicaragua, Niger, Nigeria, Norway, Yemen, New Zealand, Oman, Netherlands, Palau, Panama, Papua New Guinea, Pakistan, Paraguay, Peru, Poland, Portugal, Qatar, Kenya, Kyrgyzstan, United Kingdom, Kyrgyzstan, Kyrgyzstan, Saint Lucia, Saint Kitts and Nevis, Sao Tome and Principe, Saint Vincent and the Grenadines, Senegal, Sierra Leone, Serbia, Seychelles, Singapore, Syria, Sri Lanka, Swaziland, Sudan, Sweden, Switzerland, Suriname, Thailand, Taiwan, Tajikistan, Tanzania, Timor-Leste, Togo, Tonga, Trinidad and Tobago, Tunisia, Turkmenistan, Turkey, Ukraine, Uganda, Uruguay, Uzbekistan, Vanuatu, Venezuela, Vietnam, Zambia, Zimbabwe.

Source: Own elaboration.

In the econometric estimation, the data are organized in a panel structure, which includes the importer, exporter, product, and year dimensions. Panel data are recommended for obtaining estimates of the structural gravity model for two main reasons: 1) they improve the efficiency of the estimates; 2) they allow the application of fixed effects (Yotov et al. 2016).

The selected products follow the code of the Harmonized System (HS) of classification of goods. They are: HS 020711 – fresh or chilled fowls of the species Gallus domesticus, not cut in pieces; HS 020712 – frozen fowls of the species Gallus domesticus, not cut in pieces; HS 020713 – fresh or chilled cuts and edible offal of fowls of the species Gallus domesticus; HS 020714 – frozen cuts and edible offal of fowls of the species Gallus domesticus; HS 160232 – meat or offal of fowls of the species Gallus domesticus, prepared or preserved.

To estimate the structural gravity model, it is recommended to use PPML. This estimator solves problems of heteroscedasticity, which is common in trade data. In addition, it is suitable for dealing with null or missing trade flows, which are common in analyses involving trade flows between many countries and for disaggregated products, as is the case in this study. PPML is robust to missing data because, instead of ignoring these observations, it takes advantage of the available information, dealing with null flows efficiently in the context of the analysis. This allows the model to make adequate use of the data without compromising the quality of the estimates. Another benefit of the estimator is the guarantee that the fixed effects of the gravity model correspond to the multilateral resistance terms. Additionally, it allows the calculation of the general equilibrium effects between export supply and import demand, consistent with the theory of trade policies (Yotov et al. 2016).

The estimated equation is presented by equation (6):

$$X_{ijt}^p = c + \theta_{itp} + \phi_{tjp} + \beta_1 ln(Relig_{ij} + 1) + \beta_2 lnDist_{ij} + \beta_3 Conti_{ij} + \beta_4 Fta_{ijt} + \beta_5 Col_{ij} + \beta_6 Lang_{ij} + \varepsilon_{ij}$$

(6)

X_{ijt}^p are the imports[2] of poultry meat from country i to importing countries j of good p in a given year t; c is a constant; θ_{itp} and ϕ_{tjp} represent the fixed effects of exporter-product-year and importer-product-year, and refer to the multilateral resistance terms of the structural gravity model; $ln(Relig_{ij}+1)$ is the index of religious similarity. The variable $Relig_{ij}$ is calculated from the proportions of Catholics, Protestants, and Muslims in the exporting and importing countries. $Dist_{ij}$ is the bilateral distance between the countries of origin and destination i and j, a proxy for transportation costs; $Conti_{ij}$ is a dummy and receives the value 1 if countries i and j share a common border, 0 otherwise; Fta_{ij} is a dummy and receives the value 1 if countries i and j have a free trade agreement in year t, 0 otherwise; Col_{ij} is a dummy indicating colonial ties, receiving 1 for the presence of colonial ties between two countries, 0 otherwise; $Lang_{ij}$ is a dummy for languages and receives the value 1 if the countries have the same official language, 0 otherwise; ε_{ij} is the error term.

The religion variable is represented by an index that varies between 0 and 1, reaching its maximum value when the pair of countries share the same religion or when a single religion encompasses the vast majority of the population of both countries. The gravity model estimated with the PPML method is multiplicative, which usually requires the application of a logarithmic transformation to the independent variables to linearize the

relationship between the variables, making it easier to interpret the coefficients, in addition to helping to deal with heteroscedasticity in the data, a common problem in international trade models. To make the use of ln, the value 1 was added to the variable $Relig_{ij}$ to avoid problems with values equal to zero[3].

Alternatively, robustness equations are performed to verify whether the result of the variable of interest is stable in other econometric approaches. These analyses are important to ensure that the conclusions drawn do not depend excessively on certain assumptions or specific conditions of the model. In other words, they help to ensure that the results are consistent and robust to variations in aspects such as the model specification, the sample used or the presence of outliers. For this purpose, equations (7) to (11) are estimated.

Equation (7) estimates the gravity model with different fixed effects, θ_{it}, ϕ_{tj}, φ_p, which are, respectively, the fixed effects of exporter-year, importer-year, and product. The dimension of the multilateral resistance term was reduced. Equations (8) and (9) have the same specification as the original equation (6), the difference being that the sample is changed, removing exports to Japan (equation 8) and to Japan and the United Kingdom (equation 9), as they are the largest global importers of poultry meat. Equation (10) removes outlier observations of the dependent variable from the sample. Equation (11) uses the traditional gravity model, without the fixed effects of importer-year and exporter-year, but the fixed effects of importer (ϕ_j)., exporter (θ_i), product (φ_p), and year (ω_t); in addition, the variables GDP_{it} and GDP_{jt}, which represent the GDP of the exporter and the importer, respectively, were added.

$$X_{ijt}^p = c + \theta_{it} + \phi_{tj} + \varphi_p + \beta_1 ln(Relig_{ij} + 1) + \beta_2 lnDist_{ij} + \beta_3 Conti_{ij} + \beta_4 Fta_{ijt} + \beta_5 Col_{ij} + \beta_6 Lang_{ij} + \varepsilon_{ij} \tag{7}$$

$$X_{ijt_{except\_Japan}}^p = c + \theta_{itp} + \phi_{tjp} + \beta_1 ln(Relig_{ij} + 1) + \beta_2 lnDist_{ij} + \beta_3 Conti_{ij} + \beta_4 Fta_{ijt} + \beta_5 Col_{ij} + \beta_6 Lang_{ij} + \varepsilon_{ij} \tag{8}$$

$$X_{ijt_{except\,Japan\,and\,UK}}^p = c + \theta_{itp} + \phi_{tjp} + \beta_1 ln(Relig_{ij} + 1) + \beta_2 lnDist_{ij} + \beta_3 Conti_{ij} + \beta_4 Fta_{ijt} + \beta_5 Col_{ij} + \beta_6 Lang_{ij} + \varepsilon_{ij} \tag{9}$$

$$X_{ijt_{no\_outlier}}^p = c + \theta_{itp} + \phi_{tjp} + \beta_1 ln(Relig_{ij} + 1) + \beta_2 lnDist_{ij} + \beta_3 Conti_{ij} + \beta_4 Fta_{ijt} + \beta_5 Col_{ij} + \beta_6 Lang_{ij} + \varepsilon_{ij} \tag{10}$$

$$X_{ijt}^p = c + \theta_i + \phi_j + \varphi_p + \omega_t + \beta_1 ln(Relig_{ij} + 1) + \beta_2 lnDist_{ij} + \beta_3 Conti_{ij} + \beta_4 Fta_{ijt} + \beta_5 Col_{ij} + \beta_6 Lang_{ij} + \beta_7 GDP_{it} + \beta_7 GDP_{jt} + \varepsilon_{ij} \tag{11}$$

Table 2 shows the descriptions of the variables used in the model, as well as the units of measurement and data sources. In all models, the Regression Specification Error Test (Reset) was performed to detect specification errors in the regression models. The test checks whether there are terms not included in the original model that should have been considered, such as quadratic, cubic or other non-linear forms of the predictor variables. The null hypothesis is that the model is correctly specified.

Table 2. *Description, unit of measurement, and data source of the estimated variables*

|	Variable	Unit	Source
X_{ijt}^k	Bilateral imports of poultry meat	1.000 US$	*The United Nations Comtrade,* retirados da plataforma *World Integrated Trade Solutions* (WITS)
$Relig_{ij}$	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*
FTA_{ij}	Presence of trade agreements between countries involved in the poultry meat trade	Dummy	*Mario Larch Database*
$lnDist_{ij}$	Distance between the capitals of the countries involved in the trade	km	*CEPII Research and Expertise on the World Economy*
$Cont_{ij}$	Presence of borders between those involved in the poultry meat trade	Dummy	*CEPII Research and Expertise on the World Economy*
Col_{ij}	Colonial ties	Dummy	*CEPII Research and Expertise on the World Economy*
$Lang_{ij}$	Presence of a common official language between countries	Dummy	*CEPII Research and Expertise on the World Economy*
GDP_{it} and GDP_{jt}	Gross Domestic Product of the exporter and the importer, respectively	US$	*World Bank Database*

Source: Own elaboration.

4. Results

4.1 Overview of poultry meat trade flows between 2000 and 2023

Figure 1 illustrates the worldwide distribution of the foremost poultry exporters. Brazil (24.4%), as illustrated in graph 1, dominates the market. Strict sanitary control and advanced technologies in meat processing contribute to Brazil's high competitiveness in the international market, positioning the country as the main exporter (Martins and Silva 2021). The majority of Brazilian exports are directed towards Asia (36.25%) and the Middle East (29.48%), including (predominantly Sunni), Israel (Jewish) and India (Buddhist), which possess varied religious demographics in contrast to mostly Catholic Brazil (Audu, Okorie, and Orekoya 2023). The U.S. ranks as the second-largest exporter, holding 13.3%, behind Brazil by 11.1 percentage points.
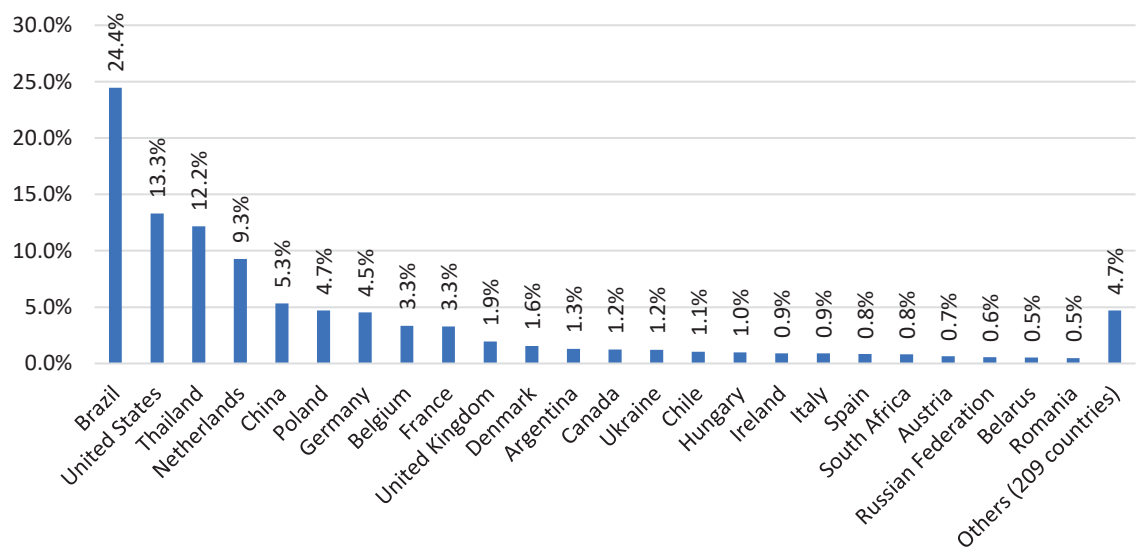
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Figure 1. *World's largest exporters of poultry meat from 2000 to 2023 (in billions of US$)*
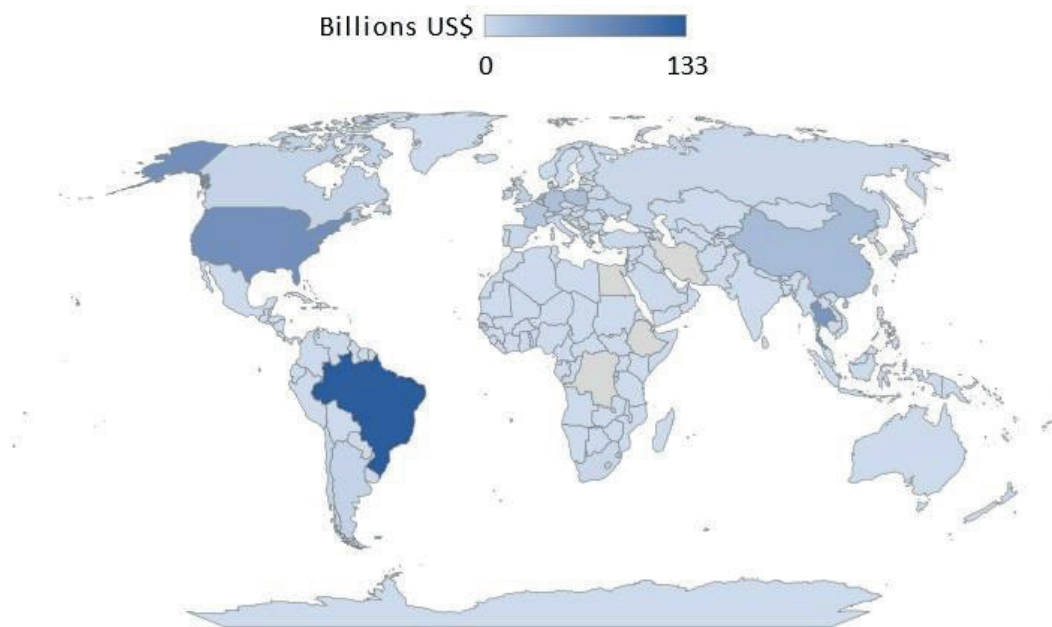
Source: Own elaboration with data from WITS[4]

Graph 1. *World exporters of poultry meat, accounting for 95% of exports from 2000 to 2023 (in %)*
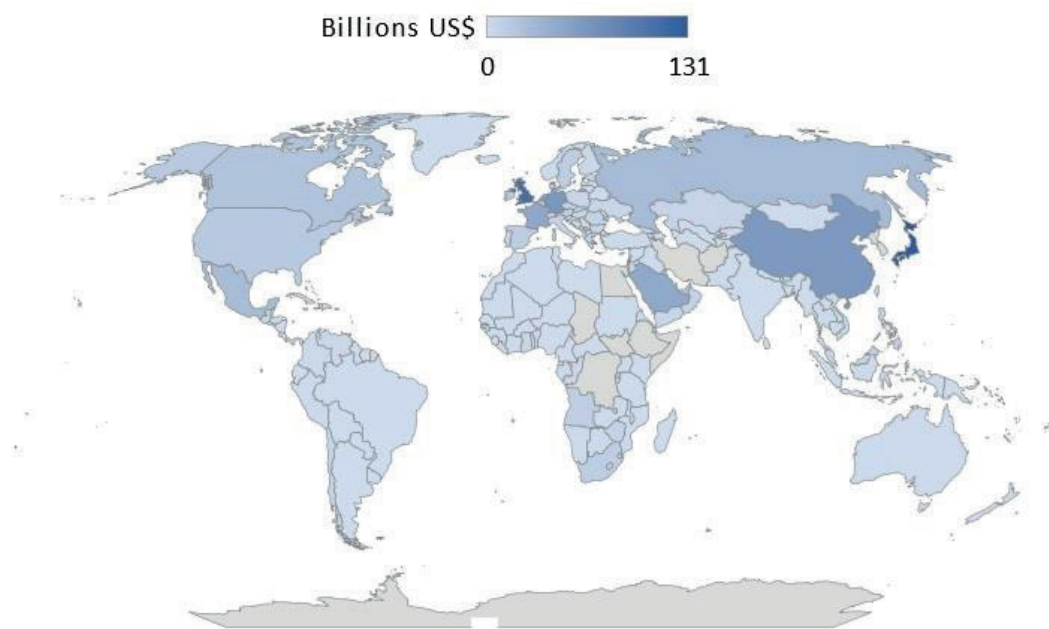

Source: Own elaboration with data from WITS

It is expected that, in 2031, poultry protein will remain the predominant livestock commodity imported worldwide (Dohlman, Hansen and Boussios 2022). Exporters have escalated their output to satisfy this demand, particularly Brazil, the U.S., and Thailand, the third largest exporter at 12.2%. In 2031, the U.S. is projected to account for 24% of worldwide chicken meat exports; yet, it will not exceed Brazil, which is anticipated to retain its position as the top in the rankings.

While graph 1 shows a high concentration of exporting countries in the Americas, graph 2 and figure 2 reveal a more dispersed distribution of importers in the world, with a greater concentration in terms of trade flows in two countries: Japan (13%) and the United Kingdom (11%). Both maintain a very similar market share in percentage terms, and are the first and second largest importers in the world, respectively. Graph 2 shows the countries responsible for 75% of imports, unlike graph 1, which shows 95% of exporters. This choice was made to improve visualization, because otherwise the graph would include many countries with very small shares in the international market as importers.

Figure 2. *Largest global importers of poultry meat from 2000 to 2023 (in bn of US$)*

Source: Own elaboration with data from WITS

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Graph 2. *World importers of poultry meat, accounting for 75% of imports from 2000 to 2023 (in %)*
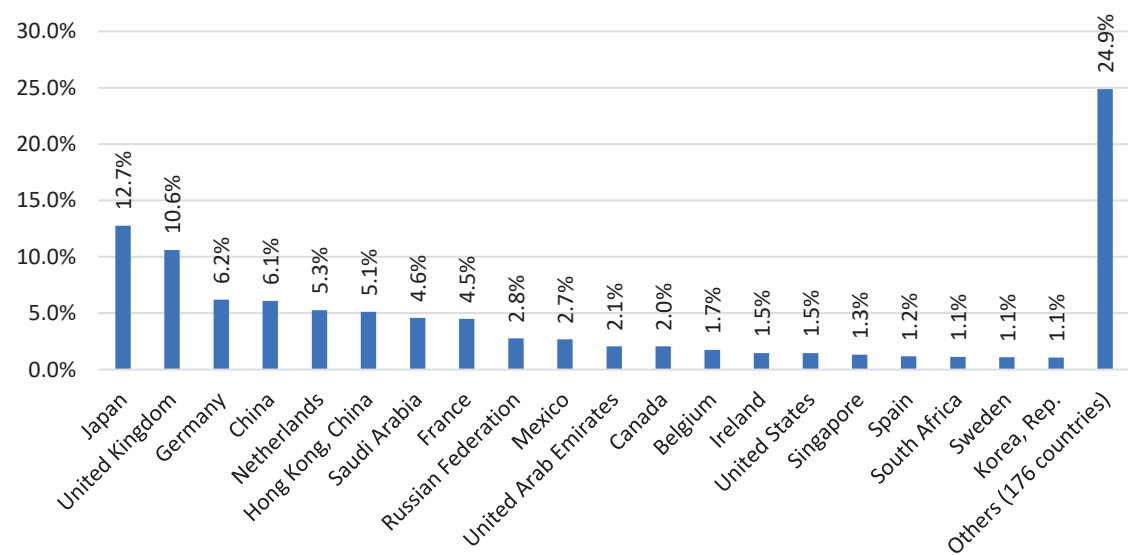
Source: Own elaboration with data from WITS

Japan's predominant religion is Buddhism (33.2%), though a significant portion (60%) of the population identifies as non-religious (Pew Research Center, 2022). As a member of the World Trade Organization (WTO), Asia-Pacific Economic Cooperation (APEC) and with 16 bilateral trade agreements, Japan's trade relations appear more influenced by by participation in international organizations (TradeInt 2024a) than by religion. This idea supports the findings of Audu, Okorie and Orekoya (2023) who concluded that religion has little impact on trade in less religious countries like China, Japan, and Sweden, with economic factors playing a larger role.

The United Kingdom is 59.1% Christian, and historically, EU nations—mostly Christian—have been its primary trading partners, providing over 80% of poultry imports. Post-Brexit, the UK has expanded trade with the USA (75.5% Christian) and China (51.8% non-religious) (TradeInt, 2024b; Pew Research Center, 2022; Office for National Statistics, 2024; HMRC, 2024).

Germany and China, each importing 6% of global poultry meat, demonstrate that religion is not a key factor in trade volume. Germany is 66% Christian, while China has a majority non-religious population (Pew Research Center, 2022). These data suggest that the religious profile of major importers, even in countries not requiring religious rituals, does not heavily influence poultry trade. However, predominantly Muslim countries, like Saudi Arabia (5%) and the UAE (2%), require halal certification for imports (Conficoni et al. 2022). Despite religious strictness, both nations rely heavily on Brazilian poultry exports (Conficoni et al. 2022).

Turkey, which has a 98% Muslim population, is the sixth largest exporter of frozen whole poultry and is located in Asia. However, Saudi Arabia and the United Arab Emirates—also Muslim countries in Asia—import to a greater extent from Christian-majority countries such as Brazil and France. This analysis suggests that

religious asymmetry does not appear to affect the volume of global trade in poultry meat. To empirically test this hypothesis, the econometric results are analyzed in the next subsection.

4.2 Summary statistics and econometric analysis

Before presenting the econometric results, we display the descriptive statistics of the variables in the model to examine the sample composition (Table 3). The variable $Relig_{ij}$ shows significant variation in religious proximity between countries. The low average suggests that most country pairs share little religious similarity, although some pairs exhibit high proximity, as indicated by the maximum value of 0.96. The high standard deviation reflects the variability in this index, which may help explain the role of religious proximity in trade relations. Additionally, it is important to note the number of zero trade flows: out of 558,720 observations, 485,232 have zero trade flows, representing approximately 86% of the sample. This supports the use of the PPML estimator over the Ordinary Least Squares (OLS) estimator.

Table 3. *Summary statistics*

Variable	Observations	Mean	Standard deviation	Min	Max
X_{ijt}^{k}	73,488	6639.39	44676.03	0	2,237.540
$Relig_{ij}$	558,720	0.16	0.24	0	0.96
$Dist_{ij}$	558,720	7305.27	4280.03	55	19,854
Col_{ij}	558,720	0.03	0.18	0	1
$Cont_{ij}$	558,720	0.03	0.16	0	1
$Lang_{ij}$	558,720	0.10	0.31	0	1
FTA_{ij}	558,720	0.10	0.31	0	1
GDP_{it}	558,720	1,91e+12	3,87e+12	1,24e+10	2,74e+13
GDP_{jt}	558,720	3,51e+11	1,54e+12	6,52e+07	2,74e+13

Source: Research results.

The econometric results are presented in table 4. The column representing equation (6) corresponds to the results of the gravity model with fixed effects for all countries in the sample and estimated from the PPML. The other columns represent alternative econometric equations to test the robustness of the results. The objective is to assess whether, on average, bilateral religious asymmetry influences poultry trade flows.

Table 4. *Estimation results*

Equation	(6)	(7)	(8)	(9)	(10)	(11)
$\ln(Relig_{ij} + 1)$	-0.335	-0.74	-0.004	-0.062	0.603***	-0.728
	-0.913	-0.941	-0.85	-0.889	-0.214	-0.941
$lnDist_{ij}$	-1.072***	-1.125***	-1.069***	-1.076***	-0.713***	-1.122***
	-0.133	-0.143	-0.127	-0.131	-0.052	-0.145
Col_{ij}	-0.259	-0.213	-0.236	-0.266	0.144	-0.194
	-0.276	-0.273	-0.274	-0.283	-0.119	-0.279
$Cont_{ij}$	0.953***	0.978***	0.960***	0.843***	0.560***	0.911***
	-0.206	-0.214	-0.203	-0.211	-0.094	-0.216
$Lang_{ij}$	0.4	0.463*	0.266	0.332	0.261***	0.509**
	-0.245	-0.253	-0.225	-0.229	-0.088	-0.252
RTA_{ij}	0.934***	1.167***	0.933***	0.804***	-0.06	1.111***
	-0.218	-0.25	-0.208	-0.202	-0.096	-0.242
$lnGDP_{jt}$	-	-	-	-	-	0.304
						-0.308
$lnGDP_{it}$	-	-	-	-	-	0.494***
						-0.143
$Constant$	18.588***	18.297***	18.249***	18.553***	11.906***	-4,125
	-1.112	-1.196	-1.052	-1.085	-0.438	-6.612
Obs	166,447	224,325	165,009	163,611	38,203	279,375
R²	0.88	0.731	0.88	0.877	0.57	0.723
FE	Yes	Yes	Yes	Yes	Yes	Yes
Reset	0.447	0.464	0.446	0.514	0.394	0.451

Source: Research results.

The variable of interest $\ln(Relig_{ij}+1)$, did not present a statistically significant effect on the trade in poultry meat. In other words, when considering the relationship between religious proximity between countries (or the effect of religion) and the trade in poultry meat, the results indicate that religion does not appear to be a determining or influential factor for this trade flow specifically. In practical terms, the lack of statistical significance suggests that, within the context of the study, the measure of religious similarity employed does not have an effect on the volume or value of the trade in poultry meat between the countries analyzed.

This result may bring some interesting reflections. First, it is important to consider that there are different degrees of commitment and devotion among consumers to their faith — an unobservable attribute that is difficult to measure. Furthermore, within the same religion, there are groups with different levels of rigor regarding customs and rituals, which may also affect the results of the study, since it affects common decisions. For example, in Islam, the differences between Sunnis and Shiites reflect different degrees of demand regarding the behavior of believers, as is the case between Orthodox and non-Orthodox Jews and other religious groups. These intra-religious variations may, to some extent, influence the impact of religion on the trade flows analyzed.

The econometric effect is in line with the findings of Audu, Okorie and Orekoya (2023), who also did not identify a significant relationship between trade and religious diversity among trading partners. When

analyzing a sample that includes countries with high and low levels of religiosity, reflecting great religious asymmetry, the authors highlight those economic factors, such as market size and economic power, are more decisive in the formation of commercial ties than cultural variables, such as religion. Furthermore, Helble (2006) argues that religion can influence consumer preferences and trade patterns, depending on the specific context and type of product. In the case of the observed results, it is suggested that there is no relationship between religion and poultry trade.

This can be explained by a number of reasons that mitigate religious barriers in international trade. First, meat companies in countries that are not predominantly Muslim or Jewish have adopted halal and kosher certifications to access global markets where these standards are required. A notable example is Brazil, one of the world's largest meat exporters. Brazilian beef and poultry producers have invested in slaughtering processes that meet halal requirements to export to countries in the Middle East and Southeast Asia. This adaptation demonstrates how economic considerations, such as access to lucrative markets, can overcome religious barriers, allowing companies outside these religious traditions to compete successfully in these markets (Attwood et al. 2023).

Furthermore, the use of advanced traceability technologies such as blockchain allows producers to ensure and demonstrate compliance with religious standards in a transparent and verifiable manner. This technology has been particularly useful in exporting countries, as using blockchain allows consumers and authorities to verify the origin and treatment of meat at every stage of the supply chain, ensuring that religious requirements have been met. This reduces barriers to entry into religious markets by providing a reliable way to ensure compliance (Ali et al. 2021; Rejeb 2018).

Another important aspect is the ability of large global corporations to overcome initial religious restrictions through economies of scale. Leading global meat exporters that have adapted their operations to include halal and kosher production lines can eventually leverage their scale and efficiency to offer products at competitive prices, even after incurring the additional costs of certification and compliance. In this case, the ability to adapt operations to religious requirements while remaining price competitive highlights how economic factors can trump religious considerations.

As a standard for the gravity model, other cultural and geographic variables were inserted into the model. The bilateral distance between countries, $lnDist_{ij}$, is negative and significant. This means that a 1% increase in the distance between countries i and j is associated with a decrease of 1.072 units in the dependent variable. The bilateral distance represents a proxy for logistics costs. Therefore, greater geographic distance between countries hinders trade between countries, as it increases transportation costs and other logistics expenses associated with shipping goods. This result is in line with the theoretical expectations of the gravity model, which predicts that trade tends to be greater between countries that are geographically closer. The same result is found in other studies (Costa et al., 2023; Lee and Park, 2016; Lewer and Van den Berg, 2007; Mehanna, 2003).

The contiguity variable, Con_{tij}, is positive and significant and indicates that, if countries i and j share a geographic border, trade in poultry meat is, on average, 0.953 units higher than between countries that do not share a border. This result is in line with Costa et al. (2023); Hole (2018) and Mehanna (2003). Contiguity tends to facilitate trade, not only by reducing logistics costs, but also by creating stronger economic and cultural ties between the closest countries, promoting more intense trade flows.

The presence of trade agreements between countries, Fta_{ij}, is econometrically significant, with a positive

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sign. This implies that the presence of trade agreements between the countries involved in this trade increases the trade flow of poultry meat, which is expected, since countries that have trade agreements eliminate or reduce tariff and non-tariff barriers between themselves, harmonizing regulations and promoting economic cooperation. The same result is found in Lee and Park (2016) and Hole (2018).

The other variables, such as colonial ties (Col_{ij}), and the presence of a common language between countries ($Lang_{ij}$), are not significant in explaining the trade in poultry meat. This is possibly because the trade in this type of product is more sensitive to contemporary economic issues, such as transportation costs, regulation, and quality standards, than to cultural or historical factors.

The robustness of the model can be assessed by the consistency of the coefficients of the main variables across the different equations (6) to (11). In general, the coefficients of variables such as $lnDist_{ij}$, $Cont_{ij}$ and Fta_{ij} remain relatively stable in magnitude and sign across the different specifications of the model. This suggests that the results are robust and are not significantly altered by changes in the sample or in the specification of the fixed effects. The variable $ln(Relig_{ij}+1)$, however, presents a variation in significance depending on the specification. In equation (10), where outliers are removed, this variable becomes significant and positive, suggesting that the presence of atypical values may be masking the relationship between religious diversity and trade. This indicates that, in certain contexts or samples, religious diversity may have a relevant impact on trade, but this relationship is sensitive to sample composition.

The Reset test values provided for all equations show that the models are correctly specified.

5. Final remarks

This study analyzed the effect of religious similarity between trading partners on international trade in poultry meat. The methodological tool used to achieve this objective was the structural gravity model, which is suitable for obtaining robust estimates of trade effects. The estimator used was PPML, as it is more suitable for dealing with null or missing trade flows and for solving problems of heteroscedasticity, which is common in trade data. Fixed effects were also used to ensure that the empirical model corresponds to the multilateral resistance terms of the theoretical model.

The results indicate that religious differences between countries in a trade relationship do not have a significant influence on the volume of international trade in poultry meat, even when considering different samples, without including the main importing countries of poultry meat, that is, removing exports to Japan and to Japan and the United Kingdom. Factors such as the distance between countries, the existence of trade agreements and the presence of common borders play a determining role in international trade relations of poultry meat, as demonstrated by the statistical significance of the variables that represent these factors.

This result was robust, according to other econometric specifications used to verify the robustness of the model. The results of the alternative models reaffirmed that, in the context analyzed, religion is not a determinant for the trade in poultry meat.

This study contributes to the understanding of international trade relations. Despite the possibility that religion plays a relevant cultural role in trade, and may even be significant for trade involving other products or a sample of different trading partners, it was observed that in the case of poultry trade, economic considerations stand out. This is observed, for example, through the significance and sign of the variable representing a trade agreement. This suggests that the willingness of countries to liberalize trade may be a more relevant strategy

than maintaining culturally close trading partners, in religious terms.

It is possible that the non-significant result for religion can be explained by other factors. For example, the fact that a country is able to maintain halal and kosher certifications and still remain competitive in the market may be more interesting for maintaining a trade relationship than the predominant religion of a country. A viable public policy would be to encourage trade agreements that promote halal and kosher certification in exporting countries, facilitating companies' access to specific religious markets, regardless of the predominant religion in the country. In this way, companies could meet the demands of these markets and expand their commercial opportunities without compromising their competitiveness.

It is relevant, in future studies, to explore the religious influence in other sectors such as beef, pork and fish, expanding knowledge about the effect of religion on the international trade of food products. In addition, if there is information on companies that have or do not have certification for religious rituals, it could be a good empirical strategy. In addition, the inclusion of variables capable of capturing the proportion of the population that adheres to each religion could enhance the analyses.

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[1]The study employed a qualitative approach based on secondary data observation. Data from the three most religious and three least religious countries were analyzed. The variables included key trading partners, official languages, predominant religions, colonial history, and geographical proximity. The method involved examining interactions and patterns in the tabulated data to identify cultural connections, such as religion, influencing trade. There was no econometric analysis.

[2]Import data tend to be more reliable than export data. The value is more closely monitored by customs, due to the application of import tariffs. Therefore, it is advisable to use import data to construct the main dependent variable in gravity regressions (Yotov et al. 2016).

[3]The logarithmic transformation is not defined for ln(x) if x=0. Since the variable $Relig_{ij}$ can assume values between 0 and 1, it is necessary to adjust the variable to ensure that all values are positive. By adding 1 to the variable, the logarithmic transformation can be applied without restrictions, ensuring that even religious similarity values equal to zero can be included in the analysis. This allows religious similarity to be assessed on a logarithmic scale, better capturing relative variations between countries.

[4]Available at: https://wits.worldbank.org. Accessed on September 23, 2024.