Computing the Cost of U.S. Trade in GE Processed Animal Products: A Gravity Modeling Approach

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ABSTRACT

Genetic engineering of animals has become increasingly popular in recent years as an innovative way of easing the strain on food supply. The most recent U.N. report estimates the population of the globe to increase by 9.8% in 2030 and 19.8% in 2050. This will result in a rise in the demand for food and animal products. especially in emerging countries. The case of Asia is a classic example where the annual meat and dairy consumption a have increased by 3% and 5% since 2012. (Food and Agriculture Organization of the United Nations, 2012). Genetic engineering is viewed as one of the new technologies the world can adopt to feed its ever-growing population, especially given the limited supply of resources such as land and water (Dace, 2020).). Developers of the technology predicts that it will result in enormous increases in productivity.

However, public policies on meat products derived from genetically engineered animals vary widely among nations and regions, creating a fragmented market that is currently challenging the international trading regime (Isaac et al., 2004). U.S. major trading partners including the EU and Japan all have stringent regulations governing trade in GE food and agricultural products.

These stringent regulations by importing countries can lead to trade diversion, therefore, reducing U.S. exports of these products.

This paper applies Baldwin and Murray (1977) trade diversion methods to estimated import demand fixed effect gravity equations to determine the trade cost resulting from stringent regulations of U.S. exports of GE processed meat products.

A GE/GnEd index was developed for the 231 nations (including U.S.) where we could collect information on laws and acts governing the trade of GE/GnEd animals. The index assesses a country's openness to trade and consumption of GE/GnEd. Seven regulatory policies namely: Environmental Risk Assessment, Approval Process, Labeling Policies, Commercialization, and Regulatory framework based on membership of Marketing, Trading, and an international agreement. Several indicators were used to assess these rules, and each one was given a score based on how restrictive it was. From 0 (initial condition) through the total number of sub-components found for each category, a value was assigned to each component. More strict regulations are indicated by higher ratings. The highest score is given to countries that claim to be "GMO-free," signifying that no GE goods can be sold or ingested. The overall scores were calculated by averaging the results for each nation across all indicators. Overall, the greatest projected score is 32 and the least predicted score was 0 (i.e., nonrestrictive) (restrictive). Using data from the USDA-FAS Global Agricultural Trade System, gravity equations were used to analyze U.S. exports of fresh, chilled, and frozen animal products to 229 trade partners from 2000 through 2020.

Preliminary results indicate that the restriction index is negative in all the 6 processed meat product equations. Thus, stringent GE regulations on processed animals could reduce U.S. exports.

The study also found significant trade diversion effects for all frozen and fresh or chilled products. This is caused by the stringent regulations on GE processed animal of US partner countries where the diverted products were to be exported.

1. INTRODUCTION

Genetic engineering of animals involves manipulating or modifying the genetic code of selected animals to alter their characteristics and to introduce certain desired traits. Genetically engineered animals are animals created for human and animal consumption using gene manipulations, to ensure they possess specific desirable characteristics (Zarrilli, 2005). The population of the world has grown by an average of 2% annually since 1950 and is estimated to increase by 9.8% in 2030 and 19.8% in 2050. This will cause a strain on food supply across the world, GE has therefore become increasingly important as an innovative way of easing the strain on world food supply. Introducing genes from livestock has long been regarded as a promising way to ensure the continued productivity of livestock and forestry (Beringer et al. 1992, Gasser and Fraley 1989, Har- lander 1989, Jensen 1988, Lehrman 1992). A thorough evaluation of the merits of genetic engineering requires considering the ethical and economic interests at stake. Since the creation of the first G.M. livestock (Hammer et al. 1985), there has been considerable

effort to modify several aspects of farm animals to improve their cultivation. Reviewed literature indicates that livestock was created to enhance desirable characteristics in farm animals. Several researchers have highlighted these characteristics. Among the targeted traits is animal health against neonatal mortality (Lievens et al., 2015, Bleck et al., 1998; Tong et al., 2011, Whealer et al., 2001), production of disease-resistant breeds (Lievens et al.; Denning et al., 2001; Lyall et al., 2011; Richt et al., 2007), increased production of wool (Lievens et al., 2015; Bawden et al. 1995; Damak et al. 1998), Growth rate (Adam et al. 2002, Bleck et al. 1998), disease resistance in chickens (Denning et al. 2001), cattle modified for good improvement of milk composition (Brophy et al. 2003).

Since developing the first genetically engineered (GE) plants and animals for agriculture almost 25 years ago, there has been constant debate amongst scientists, regulators, and activists opposed to the introduction and use of such plants and animals in agriculture. (Hammer et al. 1985; Vaeck et al. 1987) The ongoing debate has shaped public policies on meat products derived from genetically engineered animals resulting in varying policies throughout countries and regions.

In different countries around the world regulatory policies for animal biotechnology, particularly GE or Gene-edited (GnEd) are either under development, pending or non-existent. Amongst the countries that have policies in place include Argentina, Australia, New Zealand, Brazil, Canada, Japan, the United States, and the European Union (Hallerman et al. 2022).

While Asia is struggling with issues like public acceptance, lack of funding for research and development, and technical know-how (Hallerman et al., 2022), Kenya, Nigeria, and South Africa are actively involved in developing regulatory approaches regarding GnEd products.

Japan is the only Asian country that has regulations for GE products. According to the Japanese Cartagena Act, the Japanese government designated GnEd products resulting from alterations of the SDN-1 type (i.e., guided mutation without utilizing a DNA sequence template) as not constituting LMOs in 2019. (Tsuda et al. 2019; Tsuda and Ohsawa 2020). Compared to other countries with more stringent regulations, like the European Union, Japan's regulations are more flexible. To produce GenEd products, a case-by-case analysis of gene-edited animals or animal products is conducted. The government must be notified, along with information on the editing procedures utilized and the altered genes. There is no need for any environmental or safety evaluations unless an organism possesses alien DNA. Japan, a party to the Cartagena Protocol, follows the cautious principle when admitting GE or Gene-edited (GnEd) products.

The case of India, the United Kingdom, Korea, the Philippines, Norway, and Kenya is different. They all have policies, regulations, or court rulings pending (Wray-Cahen, 2021). Major U.S. trading partners including the EU and Japan all have stringent regulations governing trade in GE food and agricultural products. These stringent regulations can lead to trade diversion, therefore, reducing U.S. exports of these products.

Trade diversion occurs when RTA members shift their imports from more efficient, nonmember producers, to less efficient partner countries within the RTA. This reduces the world's production efficiency, and hurts consumers within the RTA, who now import from high-cost members of the RTA. The concepts of trade creation and trade diversion form the core of economic analyses of RTA's - USDA ERS

Krugman, P. (1991) discusses the concept of trade diversion and its effects on international trade patterns. The study defines trade diversion as "the process by which the formation of a preferential trade agreement between two or more countries lead to a shift in trade patterns that

results in higher costs or reduced economic welfare for other countries outside of the agreement" (p. 190). The author argues that while trade diversion can occur when countries form preferential trade agreements, it is not necessarily a bad thing, as it can also lead to increased trade among the countries in the agreement and greater economic integration. Musila (2021). used the gravity model to calculate the volume of trade creation and trade diversion in the COMESA, ECCAS, and ECOWAS regions. The findings indicated that the intensity of trade creation or diversion changes from area to region and from period to period using yearly data for the years 1991 to 1998.

This paper seeks to determine the volume of U.S. trade in GE processed animal products under stringent regulations by first, estimating both Fixed Effect and gravity equations; and then use Baldwin and Murray (1977) trade diversion methods to estimate the diversion resulting from stringent regulations. The paper adds to the limited literature on GE animal products and provides information to US traders on the market opportunities for GM and GnEd meat products.

2. Methodology

Theoretical Framework of the Gravity Model

Tinbergen (1962), Poyhonen (1963) and Linneman (1966) pioneered the use of the gravity model in describing and analyzing spatial flows in the analysis of international trade. The gravity equation has historically been acknowledged for its constant empirical performance in explaining a wide range of flows, including migration, commuting, tourism, and commodities trading (Bergstrand 1985). Many researchers have adopted the model to analyze bilateral trade between a country and one or more other countries. A few highlights are the works of Martnez-Zarzoso &

Nowak-Lehmann (2003), Esmaeili & Pourebrahim (2011), Said & Shelaby (2014) and Abbas & Waheed (2015) among others. The equation's popularity is attributable not only to its reliable results but also to its comparatively short specification, which makes it desirable for studying regional and international trade agreements (Baier & Bergstrand, 2007; Glick & Rose, 2002; Grant & Lambert, 2008); Rose 2004). According to Walsh (2006), the model has conceptual simplicity, the fact that it appears to match the current data well, and the ease with which models may be estimated econometrically. The fundamental gravity model, as described by Anderson 1979, Anderson, and Marcouiller 1999, Anderson, and Smith in 1999a and 1999b, and Bergstrand 1985, utilizes Newton's law of gravitational force (GFij) between two objects: i and j. The equation form is as follows:

$$GF_{ij} = \frac{M_i \; M_j}{D_{ij}}, \quad i \neq j \qquad (1)$$

Where GF_{ij} is Newton's law of gravitational force between two objects i and j. $M_i \; and \; M_j$ are the masses of the objects i and j, and D_{ij} is the distance between the two objects. Tinbergen (1962) substituted the gravitational force with $\left(EX_{i,j}\right)$ for economic flows between two nations or exports from country i to country j. The masses in (1) can also be substituted with four other variables, namely the two nations' gross domestic product (GDP), both GDP and population (POP), GDP per capita, and a mixture of GDP and GDP per capita. The gravity model of international trade, as described by Reinert (2006) utilizing the first option, was illustrated as:

$$EX_{ij} = \frac{GDP_i \; GDP_j}{D_{ij}} \qquad (2)$$

where GDP_i and GDP_j are interpreted as the gross domestic product of exporting country and importing countries, respectively. EX_{ij} is the trade flow and Dij represents the geographical distance separating the capitals of the two trading partners. Over several decades, the theoretical foundations of the gravity model have been revised (Anderson, 1979; Bergstrand, 1985; Anderson & van Wincoop 2003).

3. Development of GE Trade Openness Index

We developed a GE trade index for 231 nations where we collected information on policies and acts governing the trade of GE animals and animal products. The GE index assesses a country's openness to trade and consumption of GE animal and animal products. Based on the seven regulations, a GE regulation index was constructed for 231 livestock and animal products destination countries of the United States. We collected information on GE regulations between 2014 to 2022. As a result, the index represents GE regulations in effect until 2022. However, it is vital to note that, particularly in developing countries, significant delays in the formulation and enforcement of GE animal regulations may occur owing to challenges with training, finance, and access to technology and technical knowledge. Currently, Kenya, Nigeria, and South Africa are the most engaged in creating regulatory approaches for GnEd animal products (Hallerman et al.,

2022). The Global Agriculture Information Network (GAIN) reports on biotechnology issued by the United States Department of Agriculture's Foreign Agricultural Service (FAS) were the primary information source utilized to classify the GE regulations (USDA). We referred to official national acts and reports, as well as literature reviews (Hallerman et. al., 2022) on regulations for GE animal and animal products, to fill up the gaps regarding countries who had no (Gain) report. The links to these reports are shown in the table (TBD) in the appendix. Eight major regulations with indications were identified as follows: Environmental Risk Assessment; Approval Process; Labeling Policies; Commercialization; Food Safety Assessments, Regulatory Framework based on Membership of an International Agreement, Traceability requirement and Marketing and Trading of GE animal and animal products were all included in the index. These regulations were evaluated using several indicators, each of which was given a score based on how stringent they were. Each component was rated with a value ranging from 0 (first condition) to the total number of sub-components discovered for each category. Higher scores indicate more stringent policies. For nations that declare themselves 'GE/GMO-free' or prohibit GE animal and animal products (Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, UAE, and Yemen) we awarded the highest score, indicating that no GE products can be traded or consumed. In contrast, if no regulations have been adopted, a lower score is awarded. The use of the precautionary principle rather than the concept of substantial equivalence raises the restrictiveness of the approval process regulation. For example, the United States' approval process adheres to the idea of substantial equivalence, but EU member countries adhere to the precautionary principle which renders the US a lower score relative to the EU member countries considering this regulation. Furthermore, countries with no GE animal regulation were assigned a score of zero which is lower relative to those countries adhering to

either substantial equivalence or precautionary principles. For example, several African and Asian countries currently do not have Genome Editing regulations for animal and animal products and were scored zero for the absence of approval process (Hallerman et al., 2022). Regarding environmental risk assessment, countries that have not determined regulatory approaches for GE animal and animal products scored zero against this regulation. The European Union takes a rigorous approach to regulating gene-edited animals that effectively favors banning their introduction. It is mandatory for environmental risk assessment with no exclusions and therefore was assigned a score of 3 relative to countries (e.g., US, Canada, Australia, Argentina) with exclusion where the animal or animal products are considered a GMO or not and therefore regulated as such. This group of countries was assigned a score of 2. Countries with no labeling policies were scored zero while nations with regulatory policies determined were scored based on how relaxed the labeling policy was. Countries with voluntary labeling policies (e.g., Canada) received a score of 1, mandatory labeling policy with a threshold of more than 1% was scored 2, mandatory labeling policy with a threshold of 0.9 (EU member countries) was allocated a score of 3 and countries that were GMO-free countries scored 4. Nations that have determined regulations and have a pre-marketing approval process but far from enforcement were score 1, and those countries who have mandatory pre-marketing approval process with exclusions were scored 2, those countries who have mandatory pre-marketing approval process without exclusions (GMO only) were scored 3. Otherwise, a score of 4 if the country is GMO-free country under the commercialization regulation. With respect to food safety assessment regulation, Countries with regulations determined and have mandatory food safety assessment with exclusions were scored 2, those without exclusions were allocated a score of 3 and GMO-free country was assigned a score of 4. Comparing the European Union and the United States,

the European Union had a score of 3 and the United States had a score of 2. Two international agreements, CODEX Aliment Arius International Food Standards and the Cartagena Protocol on Biosafety, were considered for membership in international organizations regulating policy. The CODEX Aliment Arius is an international agreement aimed at ensuring safe, good food for everyone, everywhere, whereas the Cartagena Protocol on Biosafety is an international agreement aimed at ensuring the safe handling, transport, and use of living modified organisms (LMOs) resulting from modern biotechnology that may have adverse effects on biological diversity, while also considering risks to human health. The score in this category rises in proportion to the number of agreements to which the country has agreed and participates in its animal biotechnology forums. Some countries adhere and participate both agreements regarding animal biotechnology (EU), other countries adhere to one agreement (US, Canada, Australia etc.) and while countries were not adhering or participating of the agreements. The scoring system for traceability requirements is as follows: a score of 1 is assigned to countries with traceability regulations but limited enforcement, a score of 2 is given to countries with mandatory traceability requirements but with exclusions, a score of 3 is allocated to countries with mandatory traceability requirements without exclusions, and a score of 4 is assigned to countries that are GMO-free. Unlike the seven other regulations, Marketing and trade had a minimum and maximum score of 0 and 8 respectively. Marketing and trade were the major focus of this study among the regulations and therefore received a higher score. Literature on consumer acceptance of GE/GnEd animal and animal products for the respective trading partners was limited. Therefore, scoring was based on the acceptance of animal biotechnology as an indicator. Countries that have a high acceptance of animal biotechnology scored 0 (ie. Would be open to GE/ GnEd animals and animal products) whereas countries that had a low acceptance of animal

biotechnology scored 4 (not open). GMO-free countries were allocated a score of 8. The scores for each country were aggregated across all the indicators to give the total scores. Overall, the minimum predicted score is zero (i.e., most open to GE trade or consumption) and the maximum expected score is 36 (i.e., Not open to GE trade or consumption). The total scores obtained by the US and importing countries are summarized in Table 4. The exporting country (i) is the U.S. and the importing countries (j) include 230 trading partners. The U.S. had a GE score of 12 with European member countries having the second-highest GE score of 26. The GE trade openness index was then deduced using the aggregated scores of all the partners. The GE trade openness index represents the degree of difference (or distance) in GE regulation between the US and its trading countries. The index for each country was calculated as:

$$GE\ Trade\ Openness\ Index\ score\ _{ij,t} = |GE_{(i)US} - GE_{(j)Partners}|$$

Based on equation (6), the GE trade openness index scores for the partner countries resulted in 13 different index scores: 0,1,2,3,4,5,6,7,8,10,13,14 and 20.

Commented [GU1]: Don't think this section should come even before the econometric model? You have GE Trade Openness variable in the model, but you are to compute it. Does it make sense to you?

4. Empirical Model

This paper's theoretical underpinning for trade patterns is based on Krugman's basic new trade monopolistic competition, constant elasticity of substitution (CES) demand model (1980). Producers in each nation produce distinct commodities and face increasing returns to scale. Following Redding and Venables (2004), the total value of exports from nation i to country j may be stated as:

$$EX_{ij} = n_i p_i^{1-\sigma} T_{ij}^{1-\sigma} E_j P_j^{\sigma-1} \quad (3)$$

Where EX_{ij} is the total quantity of export. n_i and p_i represents the number of products and prices, respectively in country i. E_j and P_j are expenditure and price index of country j. T_{iJ} is a proxy for the distance representing transportation cost between countries. The right-hand side of this equation includes variables for both demand and supply. The term $E_j P_j^{\sigma-1}$ is country j market capacity. it gives the position of the demand curve facing each firm and it depends on total expenditure in j and on the number of competing firms and the prices they charge. On the supply side, the term $n_i p_i^{1-\sigma}$ represents the exporting country's supply capacity; it is the product of the number of enterprises and their pricing competitiveness so that doubling supply capacity (given market capacities) doubles sales value. Other trade-related studies linked equation (3) variables to traditional gravity model variables. The Gross Domestic Product (GDP) of exporter is utilized as a proxy for the "supply capacity" and the importer's GDP transformed into dollars through the exchange rate is utilized as the "market capacity" and expenditure of the importer as explained above. Similarly, the proxy for $p_i^{1-\sigma}$ and $P_j^{\sigma-1}$ is the price ratio. Finally, $D_{ij}$is a proxy for the distance representing transportation cost between countries. Thus, the enhanced gravity model can be expressed by combining equations (2) and (3) as.

$$EX_{ij,t} = \beta_0 + \beta_1 GDP_{ij} + \beta_2 GDP_{ij} + \beta_3 D_{ij} + \beta_4 EXR_{ij,t} + \beta_5 PR_i + \varepsilon_{ij,t} \quad (4)$$

This study uses gravity equations to quantify the impact of stringent GE regulations on the trade of U.S. meat products to partner nations. The study develops a composite index of regulations for

GE meat products, as there are no equivalent measures of standards. This index was based on a set of regulations, and GE trade openness was derived to assess the impact of stringent GE regulations on bilateral trade flows of meat products derived from GE animals between the United States and its trading partners., as stated in equation (4), and as a result, the price ratio could not be estimated. The study used volume as a measuring unit and therefore $EX_{ij,t}$ (export value) is expressed as export volume in equation (6). The GDP of the U.S. and its partners was replaced with GDP ratio measuring the economic size of partners relative to the U.S. The study included economic forces either aiding or resisting the movement of meat products from the U.S. to the destination countries; Ad valorem bilateral tariffs of partner countries and Regional Trade Agreement (RTA) with the U.S. were included due to their impact on bilateral trade flows of U.S. meat products to partner countries. The following are the reasons why the variables were used in this study; GDP was used as a proxy for income; This is because the import demand for meat products increases as the income of the partner countries increases and vice versa. The distance was used as a proxy for transportation costs; when transportation expenses are higher, it increases the cost and reduces the profit for meat importers. As a result, the final price of the imported meat products becomes more expensive, which negatively impacts their importation. GE trade openness index represents stringent GE regulations of partner countries relative to the US. Regarding the exchange rate. High ad valorem import taxes levied by U.S. trading partners can have a negative impact on import demand. This is due to the fact that the final cost of products becomes more expensive in the importing nations, resulting in importers being unable to sell the products, which in the long run dissuades the importation of these products. Trade Agreement between U.S. and its trading partners may strip away trade barriers, reduces or eliminates tariffs, and promotes investment and economic growth. Lastly, Common Language

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Commented [GU3]: How many times have I explained to you that import demand and demand or imports are not the same? Import demand is a model

among trading partners enhances trade and eliminates barriers such as language that can affect international trade. Countries that have English as a primary language will foster trading activities between the US and those countries. Equation (6) has been expanded to assess the welfare impact of trade (Disdier & Marette, 2010) and the importance of genetically engineered regulation on trade. The modified gravity model to be estimated for fresh or chilled and frozen meats products were expressed as below:

$$\ln EX_{ijk,t} = \beta_0 + \beta_1 \ln GDPR_{ij,t} + \beta_2 D_{ij,t} + \beta_3 \sum_0^{20} GEI_{ij,t} + \beta_4 \ln EXR_{ij,t} + \beta_5 \ln ADT_{jk,t} + \beta_6 RTA_{ij,t} + \beta_7 CL_{ij,t} + \beta_8 PR_i \varepsilon_{ijk,t} \quad (5)$$

Where EX is the export volume of meat products (Fresh or Chilled and Frozen) represented as k from country i (U.S) to j (trade partners) in time t. $GDPR$ is the Gross Domestic Products ratio which measures the economics size of trading partners relative to the U.S. D represents the geographical distance between the capital of the U.S and that of the trade partners. GEI is the GE trade openness index calculated. EXR is exchange rate and it's measured as the trading partners local currency relative to the U.S. dollar. ADT represents the Ad valorem tariffs on imported meats products by partners. RTA are regional trade agreements with the U.S. CL is common language and represents countries having English as an official language whiles ε represents the error term. $\beta's$ is a vector of coefficients capturing the effects of the variables. Pr is the price of the meat product whiles ε represents the error term. $\beta's$ is a vector of coefficients capturing the effects of the variables.

5. *Computation of Trade Diversion*

Countries with less strict GE regulations are more likely to import more GE processed meats relative to those with very stringent regulations through trade creation and trade diversion. A modified version of Baldwin and Murray (1977) and Verdoorn (1960) (model method that replaces tariffs as a restriction) was used to estimate the trade effects. Baldwin and Murray (1977) method used in the calculation of trade creation effects as follows:

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$$TC_i = X_i e_i(\frac{\triangle GE}{AGES})$$

Where:

TC_i= trade creation effect for U.S. animal products (i) by trading partners.

X_i = average U.S exports to countries with less stringent regulations

e_i = export elasticity with respect to price

$\triangle GE$ = change in quantity exported with respect to the Stringent Regulations represented by the Trade Openness Index.

GES = average GE trade openness index

For empirical applications, the use of the Baldwin and Murray method requires domestic production which is frequently unavailable (Sawyer and Sprinkle, 1989). Because of this, the Verdoorn approach has been used ex'= to calculate trade diversion (Koo and Mattson, 2001). This study estimated trade diversion following Verdoorn's (1960) and was expressed as

$$TD_i = TC_i(\frac{X_i}{XN_i + X_i})$$

Where $\frac{X_i}{XN_i+X_{i_i}}$ is the ratio of export from US to less stringent countries relative to the total US export.

XN_i = Export of commodities to countries with stringent regulations

Quantity of products diverted is measured in kilograms.

6. Data Source, Construction, and Computation

A comprehensive dataset was compiled by gathering information from various sources on the trade of meat products exported from the United States. The Global Agricultural Trade System (GATS) provided international trade statistics for agricultural, seafood, forest, and textile items. The data, spanning from 1989 to the present, was classified according to the Harmonized System (HS) coding system.

Specifically, panel data on the volume of meat products exported from the United States to 230 partner countries between 2000 and 2020 were retrieved from the FAS GATS database (https://apps.fas.usda.gov/gats/default.aspx). The data was categorized into two main groups: Fresh or Chilled and Frozen. To accomplish this, products such as Beef, Pork, and Poultry with different HS codes that fell under the Fresh or Chilled classification were grouped together, as were the Frozen products.

To Include economic factors into the analysis, data on the Gross Domestic Product (GDP) of the United States and other countries, measured in US dollars, as well as exchange rates (local currency per US dollar) were obtained from the United Nations (UN) statistical system - UNdata. (http://data.un.org/)

Information regarding trade agreements, tariffs, and import statistics, which are standardized under the HS codes, were acquired from the World Trade Organization (WTO). Tariff data specifically related to meat products was sourced from the WTO database. (http://tariffdata.wto.org/Default.aspx?culture=en-US) Additionally, data on importing countries that had Regional Trade Agreements (RTAs) with the United States was gathered from both the WTO and the Office of the United States Trade Representative. (https://ustr.gov/)

Data on the distance were retrieved from United Nations Conference on Trade and Development Stats(https://comtradeplus.un.org/). A few countries did not have geographical distance data available in their list and therefore sought for on google maps(https://www.google.com/maps) to fill in the gaps. The distance was measured in kilometers and the mode of transport used was air. Data on countries having English language as official language were also sourced from the U.S Center for Intelligence Agency(https://www.cia.gov/).

Furthermore, data on partner countries where English is the official language was obtained from the U.S. Center for Intelligence Agency. The language variable was represented by dummy variables, assigning a value of 1 to partner countries with English as the primary language and 0 otherwise. Data for the computation of trade diversion was retrieved from the summary statistics, the Random Effect and Fixed Effect tables.

7. PRELIMINARY RESULTS

This section provides the preliminary results of trend analysis, descriptive statistics, estimated covariates; and the parameters Fixed affects gravity equations to evaluate meat products.

Figure 1. and **Figure 2**. Shows the trends in U.S. exports of fresh or chilled and frozen beef, pork, and poultry from 2000 to 2020 are depicted. The analysis reveals several noteworthy patterns.

Initially, the volume of fresh or chilled beef exported to partner countries remained relatively stable at around 400,000 tons for the first four years until 2003. However, in 2003, there was a significant decline to approximately 100,000 tons. This decline can be attributed to various factors, such as disease outbreaks like Bovine Spongiform Encephalopathy (BSE) and subsequent trade restrictions. These restrictions had a considerable impact on the export of meat products from the U.S. An example is the discovery of a BSE-infected cow in Washington in 2003, leading to bans on U.S. beef in major markets (Leuck et al., 2004).

Following this period, the export of fresh or chilled beef gradually increased from 2004 onwards, fluctuating between approximately 115,000 tons and 450,000 tons. The export volume reached 427,956 tons in 2020. This increase can be attributed to the relaxation of trade restrictions by some countries. For instance, in January 2004, Canada relaxed its ban, excluding only bone-in beef and beef from animals over 30 months old. Similarly, Mexico implemented similar restrictions in March of that year. These relaxed restrictions contributed to the growth in the export of fresh or chilled beef.

In contrast to beef, the export quantities of fresh or chilled pork and poultry remained relatively steady during the first four years. However, starting in 2003, there was a notable upsurge in the export of fresh or chilled pork and poultry. This increase can be attributed to multiple factors, including a lower-valued U.S. dollar and overall economic growth. Additionally, disease-related market restrictions for beef and poultry played a role in diverting export focus towards pork in 2004 (Leuck et al., 2004). From 2015 to 2020, the quantities of fresh or chilled pork exports were consistently higher.

Figure 2. This figure illustrates the trend of frozen meat product exports demonstrates a reduction in the export of frozen beef relative to frozen pork and poultry meat products. This decline can be attributed to the outbreak of Bovine Spongiform Encephalopathy (BSE) in 2003, as mentioned previously. Initially, the export of frozen beef was stable and higher than that of pork in the first four years.

Subsequently, from 2003, there was a noticeable decline in the export of frozen beef, which remained stable until 2006. However, from 2006 onwards, the export of frozen beef gradually started to rise again, reaching a peak export volume of approximately 558,000 tons.

On the other hand, the export of frozen pork products witnessed a rise from 2000 to 2008 and subsequently experienced fluctuations. Eventually, it reached its maximum export volume of around 1,500,000 tons in 2022.

In contrast, frozen poultry products consistently recorded the highest exports throughout the period under review. The trend of frozen poultry exports fluctuated over time, with the highest recorded exports at about 3,500,000 tons in 2008. This can be attributed to the fact that, after

trade bans were relaxed, consumers found frozen poultry products to be more affordable compared to fresh or chilled poultry products.

Table 2. Table 2 provides the covariance estimates for trading partners and different meat products. A covariance value with a |Pr > Z| value of less than 0.01 indicates a significant difference in economic size, specifically in terms of GDP, at a 1% significance level. However, there are no significant differences observed among the meat products. The only exception is seen in fresh or chilled poultry and frozen poultry products, which show significance at a 5% level.

Moreover, it is worth noting that the standard errors for the estimates vary, indicating variations in the precision of the estimates. These varying standard errors suggest that the accuracy of the estimates may differ across different trading partners and meat products.

Table 3. presents a general overview of the distribution of the data. Over the 21-year period, the average quantity of Fresh or chilled beef, pork and poultry meats products exported from the U.S to its trading partners were 2,578,419 kg (2,578 tons), 5,186,372 kg (5,186 tons), and 3,198,127 kg (3,198 tons), respectively. On the other hand, the average volume of Frozen beef, pork and poultry products were 1,659,486 kg (1,660 tons), 4,007,976 kg (4,008 tons), and 6,540,617 kg (6,541 tons), respectively. These findings indicate that U.S beef and pork exports were higher for

Fresh or chilled than for Frozen products. This is in contrast with Fresh or chilled poultry products, U.S exported more Frozen poultry products. The U.S averagely exported 22% more Fresh or chilled beef products compared to Frozen beef products. Similarly, the country exported about 13% more chilled pork products compared to Frozen. However, Frozen poultry products exports were 34% higher than Fresh or chilled poultry products. Among the Fresh or chilled meat category, pork products were the most exported followed by poultry and beef meat products. U.S on the other hand, exported more Frozen poultry products followed by pork and beef meat products. It is clearly seen that beef was the least exported in both meat categories (i.e., Fresh, or chilled and Frozen products). This is consistent with literature. Most beef produced in the U.S is consumed domestically (Drouillard, 2018). Finally, the U.S exported Fresh or chilled beef, pork, and poultry meat products to 103, 96, and 113 partners, respectively. Frozen meat products were exported to more destinations than chilled meat. Frozen beef, pork and poultry were exported to 125, 118, and 140, respectively.

Table 5. shows results of the estimated parameters for the random effect gravity equations. The results are in elasticities except common language and number of trade Agreements:

GE trade openness index for Fresh or chilled Beef and Pork products were statistically significant at 10% levels. The results show that an increase in the GE trade openness index score of 1% resulted in a decline in U.S exports by approximately 0.24 % and 0.18% respectively, all other things being equal. Fresh or chilled Poultry was not significant. It can be attributed to the fact that poultry products are not commonly genetically edited in relative to larger animals, such as pigs and bovine animals.

The constructed GDP ratio, calculated as the ratio of partners' GDP to that of the U.S., yielded positive and statistically significant results at 1% for both fresh or chilled and frozen beef, pork,

and poultry meat products. This indicates that a percentage increase in the GDP of importing partners relative to the U.S. led to a 0.49%, 0.54%, and 0.23% increase in U.S exports, all other things being equal.

Similarly, for frozen beef and pork products, a percentage increase in the GDP of importing countries resulted in an increase in U.S. exports by approximately 0.60%, 0.63%, and 0.57%, respectively, with all other factors unchanged. These findings imply that as the income of these countries grow, the U.S. exports of genetically engineered (GE) meat products increase, all things being equal.

Exchange rate was found to be statistically significant at 10% level and negative coefficient, as expected, for fresh or chilled beef meat products and frozen pork products. Additionally, it was significant at the 5% level for frozen beef meat products.

These results suggest that if the value of the importing partner's currency increases by 1% relative to the U.S. dollar, the exports of U.S. fresh or chilled beef, frozen beef, and pork meat products increase by approximately 0.12%, 0.09%, and 0.10%, respectively. This indicates that citizens of these importing countries can purchase more of these products with their own currency.

The table shows an adverse effect of Ad valorem import tariffs on the flow of meat products, either Fresh or chilled and Frozen meat products in both categories. The results indicate that if trading partners impose a 1% import tariffs on Fresh or chilled beef, pork and poultry meat products, U.S exports of these products will decrease by approximately 0.62%, 0.89% and 0.54% respectively, all other things being equal. Similarly, a 1% increase in ad valorem tariffs was associated with a 0.73%, 1.03% and 0.82% decrease in US exports of Frozen beef, pork and

poultry meat products respectively, all other things remain the same. As expected, high import taxes reduce U.S exports.

Finally, distance as expected had a negative effect on all the products except Fresh or chilled poultry products which were insignificant. Distance was a proxy for transportation costs and therefore the excessive cost of transporting these animal products adversely affect U.S exports of these meat products except Fresh or chilled poultry products.

Table 6 examines the impact of regulatory components on different types of meat products by conducting separate regressions for each product category. The estimated coefficients on the regulatory index are statistically significant and vary in direction, depending on the specific meat category.

For fresh or chilled beef and frozen beef products, the coefficient on the food safety assessment component was negative and significant at the 1% level. Similarly, for fresh or chilled pork, the food safety assessment coefficient was negative and significant at the 10% level. This suggests that as partner countries implement more stringent food safety measures, U.S. exports of fresh or chilled beef and pork products are likely to decrease.

With respect to labeling policy restrictions, the coefficient was negative and significant at 5% level for frozen pork products only. This implies that as partner countries impose stricter labeling policies, U.S. exports of frozen pork products decline.

The traceability requirement coefficient was negative and significant at the 5% level for fresh or chilled pork products and at the 1% level for frozen pork products. This indicate that as partner countries enforce stricter traceability requirements, U.S. exports of fresh or chilled pork and frozen pork products are likely to decrease.

However, Commercialization and Environmental risk came up with a strong significance for some products but with a positive effect. This means that as partner countries have stricter regulations, U.S exports of these products increase. Marketing and Trade was also significant and positive for Fresh or chilled beef and pork as well as Frozen beef, pork and poultry meat products, meaning that as consumers of partner countries' acceptance or have knowledge about GE animal products, the exports of these products from the U.S increases, all other things being equal. Overall, food safety is the most significant regulatory component that affects the extensive margin of trade for these meat products.

Table 7. presents the results of the estimated fixed effect gravity equation for GE Fresh or chilled beef meat products. The top ten destination countries had the highest positive estimates, which means that they imported the most from the U.S. Mexico is ranked first with an estimate of 5.6175, followed by the Netherlands with 4.8107 and Chile with 4.6929. These three countries have a positive estimate with a small p- values (<.0001), indicating a strong relationship with the U.S. On the other hand, the least ten countries have lower or even negative estimates, indicating a weaker relationship with the U.S Ecuador has the lowest estimate with -1.9481, followed by Haiti with an estimate of -1.7855 and Ghana with -0.8461.

Table 8. presents the results of the estimated fixed effect gravity equation for GE Fresh or chilled pork meat products. The top eight importing partners of the United States, ranked by estimate, are Mexico, China, the United Kingdom, Guatemala, Honduras, Romania, Panama, and Nicaragua. The estimates indicate the strength of the effect of imports of these countries from the U.S, with Mexico having the highest estimate of 10.553 and Nicaragua having the lowest estimate of 5.8836. The least eight importing partners of the United States, ranked by estimate, are Peru, Poland, Kenya, Portugal, Spain, Haiti, Venezuela, and Brazil. The estimates for these countries indicate weaker effects of imports from the U.S, with Peru having the lowest estimate of 5.5632 and Brazil having the highest estimate of 4.348.

Table 9. displays the outcomes of the estimated fixed effect gravity equation for GE Fresh or chilled poultry meat products. According to the rankings, the top 10 importing partners are likely to be significant trading partners for U.S GE poultry products, as they have high estimates. Mexico, Afghanistan, and Moldova being the top three partners with an estimate of 8.4929, 6.4213 and 6.0631 respectively. On the other hand, the least ten importing partners may not be as important trading partners for U.S GE poultry products, as they have lower estimates. Portugal, Jordan and Egypt were the least 3 with lowest estimates.

The outcomes of the estimated fixed-effect gravity equation for GE frozen beef meat products are presented in **Table 10**. Among the top 10 importing partners, Barbados, Bahrain, Japan, China, Jamaica, Philippines, Vietnam, Netherlands, Qatar, and Tonga have positive estimates, ranging from 1.9969 to 3.111. These estimates indicate that, on average, these partners imported more frozen beef products from the U.S. compared to other partners. The strong t-values associated with these estimates further support the significance of these relationships.

In contrast, the least 10 importing partners for beef products, namely Liberia, Paraguay, Haiti, Senegal, Bolivia, Kenya, Sierra Leone, Ukraine, Ecuador, and India, have negative estimates ranging from -2.6005 to -1.3975. These estimates imply that, on average, these partners import fewer frozen beef products from the U.S. compared to other partners. The statistically significant t-values, with p-values below 0.05, indicate the robustness of these estimates.

The outcomes of the estimated fixed-effect gravity equation for GE frozen pork meat products are presented in Table 11. Among the top ten destination countries, the Philippines takes the lead with the highest estimate of 10.0372, indicating a strong positive relationship with the U.S. in terms of importing frozen pork products. Colombia follows closely with an estimate of 9.9208, and Russia, Guatemala, and Chile are also among the top ten, with estimates ranging from 9.6511 to 9.2861.

On the other hand, among the bottom ten destination countries, Afghanistan stands out with an estimate of 4.9677, indicating a relatively weaker relationship with the U.S. when it comes to importing frozen pork products. Guinea and Pakistan follow suit with estimates of 4.8738 and 4.7028, respectively.

Table 12. presents the results of the estimated fixed effect gravity equation for GE Frozen poultry meat product. In the top 10 destination countries, Gabon has the highest positive estimate, indicating that it is the most attractive destination country for U.S poultry meat products. Similarly, in the least 10 destination countries, Paraguay has the highest negative estimate, indicating that it is the least attractive destination country for U.S GE poultry meat products.

Overall, the results of the fixed effect tables on the individual meat products suggest that the top importing partners are likely to be important trading partners for GE animal meat products, while the bottom importing partners may need more attention to improve their trade relations and harmonization in GE regulations with the U.S.

Table 13. TRADE DIVERSION

PRODUCT	TRADE CREATION (tons)	TRADE DIVERSION (tons)
FC_BEEF	64.84	**58.31**
FC_PORK	157.62	**139.28**
FC_POULTRY	83.69	**36.49**
F_BEEF	61.737	**51.37**
F_PORK	125.70	**100.71**
F_POULTRY	296.35	**157.60**

Table 13 shows the quantity (tons) of each processed meat product that was diverted as result of the stringent regulations. Frozen poultry was the most diverted meet product while fresh or chilled poultry was the least diverted. This result is consistent with the findings of this paper, Beef products were most exported, and the least was poultry products. This indicates that no

matter how stringent the regulations of a destination country might be, consumers in that would still consume the meat product preferred most.

From the table, 157.60tons of frozen poultry was diverted which cost the U. S approximately $108,745.7. Also, 139.28tons of Fresh or Chilled Pork was diverted which results in trade cost of $658,790.10. The least diverted, Fresh or chilled Poultry cost the U. S $29,924.95.

Summary and Conclusion

The paper quantifies the effect of stringent GE regulations on bilateral trade flows of meat products from the U.S to its partner countries. To measure stringent GE regulations between the U.S and its importing partners, a composite index of GE regulations including indicators was created based on eight regulatory dimensions for 231 U. S meat products trading partners. A GE trade Openness Index was then calculated using the GE regulations. Gravity equations were applied to U.S. exports of Fresh or chilled and Frozen beef, pork, and poultry products. In addition to the GE trade openness index, other variables including Common language, Distance and RTA with U.S. was included in the model to determine their impact on the bilateral trade flow of these products.

The study revealed that, except for Fresh or chilled poultry products, the predicted GE trade openness index coefficients for all other meat products were negative and statistically significant, as expected. Therefore, this suggests that these meat products are likely to be impacted by stringent GE regulations, particularly frozen ones. Regarding the effect of the regulatory components, food safety assessment appeared to be the most significant regulatory component that affects the extensive margin of trade for these meat products. Nonetheless, high acceptance

or knowledge of GE animal products would have a positive impact on the U.S export of these products.

Mexico, Netherlands, and Chile are likely top 3 markets for GE Fresh or chilled beef meat products while Ghana, Haiti and Ecuador happen to be the least countries to import these products from the U.S. For GE Fresh or chilled pork, Mexico, China, the United Kingdom are the three possible trading partners. Finally for Fresh or chilled products, Mexico, Afghanistan, and Moldova were the top 3 countries that appears to be significant partners. On the other hand, India, Brazil and Paraguay are possibly the least countries to import GE frozen beef, pork and poultry meat products respectively. The study found significant trade diversion effects for all frozen and fresh or chilled products. This is caused by the stringent regulations on GE processed animal of US partner countries where the diverted products were to be exported.

Partner nations trade considerably less when there are large GE regulatory gaps. Hence, harmonization in GE regulations for animal products is essential for trade. Stringent GE regulations could reduce U.S. exports for these animal products, especially frozen ones.

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APPENDIX

Trends in U.S Meat Products Exports 2000 to 2020.

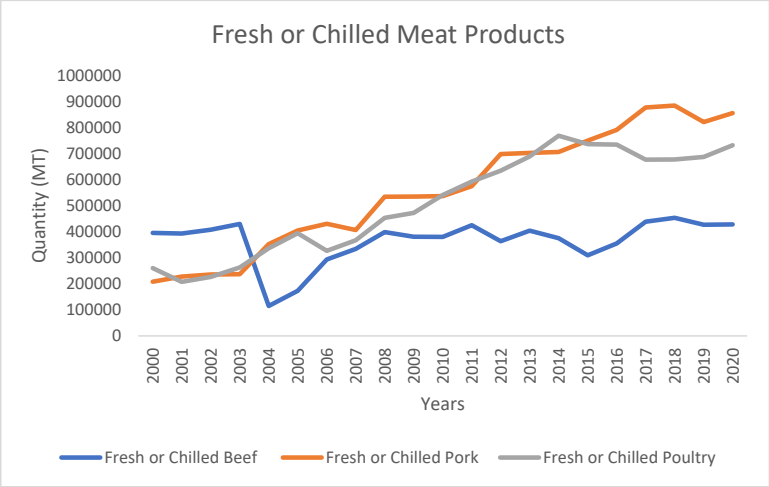

Figure 1: Fresh or Chilled Meat Exports

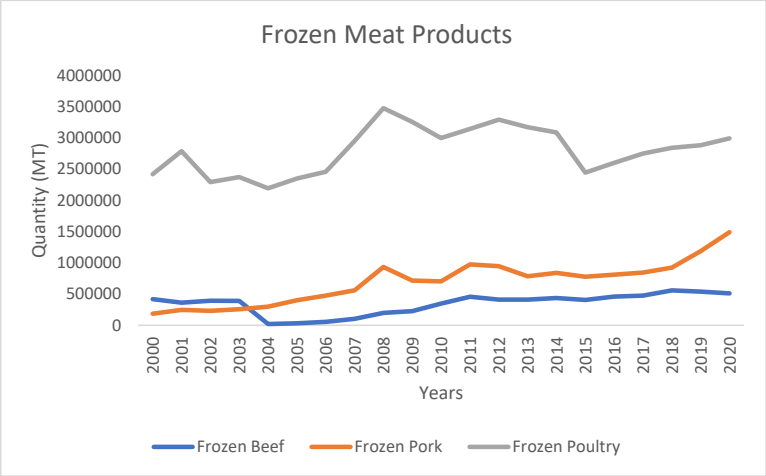

Figure 2: Frozen Meat Exports

Table 1. GE index based on Regulations, Indicators and Assigned Scores.

GE Regulatory policy	Indicators	Allocated Score
Approval process	Absence of approval process	0
	Mandatory approval process but far from enforcement	1
	Man. Approval process adopting the principle of substantial equivalence	2
	Man. Approval process adopting the precautionary principle	3
	GMO free country	4
	Absence of mandatory food safety assessment	0

Food safety assessment	Proposed food safety assessment but far from enforcement	1
	Food safety assessment with exclusions (Case by case)	2
	Mandatory food safety assessment (GMO)	3
	GMO free country	4
Commercialization	Absence of Pre-market approval	0
	Proposed pre-market approval but far from enforcement	1
	Mandatory pre-market approval with exclusions	2
	Mandatory Pre-market approval (GMO Only Policy)	3
	GMO free country	4
Environmental risk assessment	Absence of mandatory environmental risk assessment	0
	Proposed environmental risk assessment but far from Enforcement	1
	Environmental risk assessment with exclusions (Case by case)	2
	Mandatory environmental risk assessment (GMO)	3
	GMO free country	4
Labeling Policy	No labeling Policies	0
	Voluntary Labeling	1
	Mandatory GE label with threshold ≥1 %	2
	Mandatory label with threshold 0.9%	3

	GMO Free Country	4
	No traceability required	0
	GE traceability in place but far from	1
Traceability	Mandatory GE traceability with exclusions (Case by case)	2
	Mandatory GE traceability	3
	GMO free country	4
	Not member of the international agreement	0
Membership of International Agreement	Member of the International Agreement but not adhering to its policies	1
	Member of CODEX Aliment Arius	2
	Member of Cartagena Protocol	3
	Member of both international agreements.	4
	High public or consumer acceptance of animal biotech	0
Marketing &Trade	Low public or consumer acceptance of animal biotech	4
	GMO free country	8

Table 2. Covariance Parameters Estimates.

Cov Parm	Estimate	Std Error	Z- value	Pr > Z	Alpha	Lower	Upper

Fresh or chilled beef

DESCRIPTION	1.994	2.002	1.000	0.160	0.050	0.539	80.687
PARTNER	2.826 ***	0.523	5.410	<.000	0.050	2.028	4.211
Residual	2.953	0.096	30.600	<.000	0.050	2.772	3.151

Fresh or chilled pork

DESCRIPTION	0.807	0.822	0.980	0.163	0.050	0.215	35.885
PARTNER	1.918 ***	0.389	4.920	<.000	0.050	1.336	2.985
Residual	3.003	0.114	26.300	<.0001	0.050	2.791	3.239

Fresh or chilled poultry

DESCRIPTION	2.243**	1.014	2.210	0.014	0.050	1.088	7.020
PARTNER	1.832***	0.337	5.440	<.000	0.050	1.317	2.724

Residual	3.415	0.108	31.550	<.000	0.050	3.212	3.637
Frozen beef							
DESCRIPTION	2.583	2.587	1.000	0.159	0.050	0.699	102.900
PARTNER	2.017***	0.328	6.140	<.000	0.050	1.502	2.854
Residual	2.862	0.075	37.910	<.000	0.050	2.719	3.016
Frozen pork							
DESCRIPTION	3.121	3.129	1.000	0.159	0.050	0.845	125.090
PARTNER	2.736***	0.442	6.190	<.000	0.050	2.041	3.860
Residual	2.888	0.085	33.980	<.000	0.050	2.728	3.062
Frozen poultry							
DESCRIPTION	4.554**	2.053	2.220	0.013	0.050	2.213	14.186

PARTNER	3.273***	0.483	6.780	<.000	0.050	2.500	4.471
Residual	2.974	0.055	54.320	<.000	0.050	2.869	3.084

Note: "Single, double, and triple asterisks (*, **, ***) indicate [statistical] significance at the 10%, 5%, and 1% level."

Table 3. Summary Statistics of Fresh or Chilled and Frozen (Beef, Pork and Poultry) products exported from the U.S to 229 trade partner countries from 2000 to 2020.

Variables	Mean	N	Std. Dev	Minimum	Maximum
Fresh or chilled beef products					
Quantity	2578419.372	2978.000	15871218.239	50.000	203951691.000
GDP ratio	45421440.655	2865.000	156232199.530	4530.000	1439323776.000
Exchange rate	550.415	2865.000	2598.548	0.000	23208.368
Advalorem tariff	35.860	2978.000	41.221	0.000	200.000
Common Language	0.194	2978.000	0.395	0.000	1.000
Distance	6998.099	2978.000	4415.823	735.000	16357.000
WTO Membership	0.808	2978.000	0.394	0.000	1.000

Number of Trade Agreements	1.053	2978.000	0.642	0.000	3.000
GE Trade Openness index	8.242	2635.000	4.354	0.000	20.000
Log quantity	10.219	2978.000	2.744	3.912	19.133
Log GDP ratio	15.346	2865.000	2.643	8.419	21.087
Log exchange rate	1.947	2865.000	2.687	-11.899	10.052
Log distance	8.618	2978.000	0.729	6.600	9.702
Log advalorem tariff	3.296	2291.000	1.222	-2.303	5.298
Approval process	1.622	2635.000	0.634	0.000	2.000
Food safety	1.693	2635.000	0.570	0.000	2.000
Labeling	1.662	2635.000	0.608	0.000	2.000
Environmental Risk	1.670	2635.000	0.606	0.000	2.000
Commercialization	1.769	2635.000	0.482	0.000	2.000
Membership of int. agreement	1.539	2635.000	0.784	0.000	2.000
Traceability	0.803	2635.000	1.399	0.000	4.000
Marketing and trade	4.214	2635.000	0.900	4.000	8.000

Fresh or chilled pork

Quantity	5186372.343	2269.000	31350222.580	100.000	449067598.000
GDP ratio	56719409.347	2187.000	202101257.910	4835.000	1439323776.000
Exchange rate	462.709	2187.000	3049.014	0.000	67622.754
Advalorem tariff	36.103	2269.000	41.426	0.000	170.900
Common Language	0.210	2269.000	0.408	0.000	1.000
Distance	6428.874	2269.000	4482.064	735.000	16357.000
WTO Membership	0.799	2269.000	0.401	0.000	1.000
Number of Trade Agreements	1.029	2269.000	0.661	0.000	3.000
GE Trade Openness index	7.267	2003.000	3.352	0.000	20.000
Log quantity	10.763	2269.000	2.752	4.605	19.923
Log GDP ratio	15.342	2187.000	2.727	8.484	21.087
Log exchange rate	2.031	2187.000	2.566	-11.899	11.122
Log distance	8.507	2269.000	0.749	6.600	9.702
Log ad valorem tariff	3.283	1735.000	1.312	-2.303	5.141
Approval process	1.604	2003.000	0.661	0.000	2.000
Food safety	1.706	2003.000	0.596	0.000	2.000
Labeling	1.662	2003.000	0.623	0.000	2.000

Environmental Risk	1.630	2003.000	0.657	0.000	2.000
Commercialization	1.787	2003.000	0.463	0.000	2.000
Membership of int. agreement	1.504	2003.000	0.812	0.000	2.000
Traceability	0.527	2003.000	1.144	0.000	4.000
Marketing and trade	4.010	2003.000	0.200	4.000	8.000
Fresh or chilled poultry					
Quantity	3198126.942	3369.000	26354146.784	100.000	485443696.000
GDP ratio	37149805.065	3260.000	149471309.330	4425.000	1439323776.000
Exchange rate	251.766	3260.000	1580.089	0.000	23208.368
Ad valorem tariff	39.520	3369.000	42.322	0.000	170.900
Common Language	0.227	3369.000	0.419	0.000	1.000
Distance	6177.880	3369.000	4413.764	524.000	16357.000
WTO Membership	0.789	3369.000	0.408	0.000	1.000
Number of Trade Agreements	1.081	3365.000	0.704	0.000	3.000
GE Trade Openness index	7.406	2922.000	3.986	0.000	20.000
Log quantity	10.318	3369.000	2.605	4.605	20.001

Log GDP ratio	14.935	3260.000	2.608	8.395	21.087
Log exchange rate	1.914	3260.000	2.448	-11.899	10.052
Log distance	8.448	3369.000	0.781	6.262	9.702
Log ad valorem tariff	3.470	2548.000	1.217	-2.303	5.141
Approval process	1.698	2922.000	0.628	0.000	2.000
Food safety	1.762	2922.000	0.562	0.000	2.000
Labeling	1.736	2922.000	0.568	0.000	2.000
Environmental Risk	1.700	2922.000	0.635	0.000	2.000
Commercialization	1.875	2922.000	0.373	0.000	2.000
Membership of int. agreement	1.486	2922.000	0.821	0.000	2.000
Traceability	0.545	2922.000	1.229	0.000	4.000
Marketing and trade	4.175	2922.000	0.819	4.000	8.000
Frozen beef					
Quantity	1659485.626	4344.000	9882289.772	80.000	191941401.000
GDP ratio	39848900.920	4225.000	143671315.100	4891.000	1439323776.000
Exchange rate	511.013	4225.000	2654.367	0.000	67622.754
Ad valorem tariff	37.659	4344.000	42.655	0.000	200.000

Common Language	0.175	4344.000	0.380	0.000	1.000
Distance	7432.645	4344.000	4320.492	524.000	16972.000
WTO Membership	0.811	4344.000	0.392	0.000	1.000
Number of Trade Agreements	1.029	4339.000	0.653	0.000	3.000
GE Trade Openness index	8.213	3941.000	4.200	0.000	20.000
Log quantity	10.477	4344.000	2.642	4.382	19.073
Log GDP ratio	15.225	4225.000	2.611	8.495	21.087
Log exchange rate	1.940	4225.000	2.748	-11.899	11.122
Log distance	8.702	4344.000	0.700	6.262	9.739
Log ad valorem tariff	3.319	3396.000	1.261	-2.303	5.298
Approval process	1.635	3941.000	0.625	0.000	2.000
Food safety	1.704	3941.000	0.553	0.000	2.000
Labeling	1.678	3941.000	0.592	0.000	2.000
Environmental Risk	1.683	3941.000	0.582	0.000	2.000
Commercialization	1.749	3941.000	0.504	0.000	2.000
Membership of int. agreement	1.534	3941.000	0.799	0.000	2.000

Traceability	0.766	3941.000	1.370	0.000	4.000
Marketing and trade	4.179	3941.000	0.826	4.000	8.000
Frozen Pork					
Quantity	4007976.279	3638.000	19763151.744	100.000	421337436.000
GDP ratio	48814601.059	3526.000	180615641.080	4917.000	1439323776.000
Exchange rate	461.781	3526.000	2580.568	0.000	67622.754
Ad valorem tariff	36.055	3638.000	41.796	0.000	200.000
Common Language	0.191	3638.000	0.393	0.000	1.000
Distance	7255.298	3638.000	4465.979	524.000	16357.000
WTO Membership	0.798	3638.000	0.401	0.000	1.000
Number of Trade Agreements	1.015	3638.000	0.684	0.000	3.000
GE Trade Openness index	7.517	3261.000	3.523	0.000	20.000
Log quantity	11.333	3638.000	2.837	4.605	19.859
Log GDP ratio	15.142	3526.000	2.736	8.501	21.087
Log exchange rate	2.041	3526.000	2.581	-11.899	11.122
Log distance	8.661	3638.000	0.720	6.262	9.702
Log ad valorem tariff	3.263	2810.000	1.316	-2.303	5.298

Approval process	1.626	3261.000	0.642	0.000	2.000
Food safety	1.719	3261.000	0.563	0.000	2.000
Labeling	1.677	3261.000	0.601	0.000	2.000
Environmental Risk	1.668	3261.000	0.610	0.000	2.000
Commercialization	1.767	3261.000	0.488	0.000	2.000
Membership of int. agreement	1.500	3261.000	0.816	0.000	2.000
Traceability	0.590	3261.000	1.204	0.000	4.000
Marketing and trade	4.037	3261.000	0.382	4.000	8.000
Frozen Poultry					
Quantity	6540617.216	8983.000	37812044.378	38.000	1031732857.000
GDP ratio	41197377.946	8715.000	163444236.070	4425.000	1439323776.000
Exchange rate	479.829	8715.000	2492.061	0.000	67622.754
Ad valorem tariff	38.036	8983.000	41.426	0.000	200.000
Common Language	0.171	8983.000	0.377	0.000	1.000
Distance	7578.913	8983.000	4376.552	524.000	16972.000
WTO Membership	0.796	8983.000	0.403	0.000	1.000

Number of Trade Agreements	1.028	8963.000	0.686	0.000	3.000
GE Trade Openness index	7.750	8136.000	3.819	0.000	20.000
Log quantity	11.817	8983.000	2.981	3.638	20.755
Log GDP ratio	15.098	8715.000	2.601	8.395	21.087
Log exchange rate	2.256	8715.000	2.687	-11.899	11.122
Log distance	8.713	8983.000	0.724	6.262	9.739
Log ad valorem tariff	3.406	6925.000	1.196	-2.303	5.298
Approval process	1.715	8136.000	0.583	0.000	2.000
Food safety	1.780	8136.000	0.509	0.000	2.000
Labeling	1.746	8136.000	0.553	0.000	2.000
Environmental Risk	1.747	8136.000	0.556	0.000	2.000
Commercialization	1.836	8136.000	0.421	0.000	2.000
Membership of int. agreement	1.522	8136.000	0.806	0.000	2.000
Traceability	0.575	8136.000	1.238	0.000	4.000
Marketing and trade	4.153	8136.000	0.767	4.000	8.000

Note: Quantities of processed meat products (beef, pork, and poultry) fresh or chilled and frozen are measured in Kilograms. Exchange rate is measured as (local currency/U.S dollars). GDP is

also measured in U.S dollars. Distance measured in Kilometers. Ad valorem tariffs are in percentages. Other variables are in units.

Table 4. GE Regulation Index Score for 231 Countries.

GE Score	Number of partners	Partners

4	134	Afghanistan, Albania, Andorra Angola, Anguilla, Armenia, Aruba, Bahamas, Bahrain, Belarus, Benin, Bermuda, Bolivia, Bosnia and Herzegovina, Botswana, British Indian Ocean Territory, British Virgin, Islands, Burundi, Cabo Verde, Cameroon, Cayman Islands, Central African Republic, Chad, Chile, Christmas Islands, Cocos (Keeling) Islands, Comoros, Congo (DROC), Congo (ROC), Cote d'Ivoire, Cuba, Curacao, Djibouti, Dominican, Republic, El Salvador, Eritrea, Eswatini, Ethiopia, Falkland Islands (Islas Malvinas), Faroe Islands, Fiji, French Guiana, French Polynesia, French Southern and Antarctic Lands, Gabon, Georgia, Gibraltar, Greenland, Guadeloupe, Guinea-Bissau, Haiti, Heard Island and McDonald Islands, Holy See (Vatican City), Honduras, Iceland, India, Iran, Iraq, Kazakhstan, Kenya, Kiribati, Kosovo, Kyrgyzstan, Laos, Lebanon, Lesotho, Liberia, Libya, Liechtenstein, Macao, Madagascar, Malawi, Martinique, Mauritius, Mayotte, Micronesia, Moldova, Monaco, Mongolia, Montenegro, Montserrat, Mozambique, Myanmar, Namibia, Netherlands Antilles, New Caledonia, Nicaragua, Niger, Nigeria, Norfolk Island, North Korea, North Macedonia, Norway, Palau, Panama, Papua New Guinea, Paraguay, Peru, Pitcairn Islands, Reunion, Russia, Rwanda, Saint Helena, Saint Pierre and Miquelon, Samoa (Western Samoa), San Marino, Sao Tome and Principe, Seychelles, Sint Maarten, Somalia, Sudan, Suriname, Svalbard and Jan Mayen, Switzerland, Syria, Tajikistan, Togo, Tokelau, Tonga, Trinidad and Tobago, Turkmenistan, Turks and Caicos Islands,

		Tuvalu, Uganda, Ukraine, Uruguay, Uzbekistan, Vanuatu, Venezuela, Vietnam, Wallis and Futuna, Yugoslavia, Zambia, Zimbabwe
5	1	Jordan
6	28	Brunei Darussalam, Cambodia, Colombia, Cook Islands, Egypt, Equatorial Guinea, Gambia, Ghana, Guatemala, Guinea, Hong Kong, Israel, Malaysia, Maldives, Marshall Islands, Mauritania, Mexico, Morocco, Nepal, Pakistan, Philippines, Serbia, Singapore, South Sudan, Sri Lanka, Tanzania, Timor-Leste, Tunisia
7	10	Algeria, Antigua and Barbuda, Barbados, China, Dominica, Grenada, Guyana, Jamaica, Saint Kitts and Nevis, Saint Vincent and the Grenadines
8	12	Azerbaijan, Belize, Burkina Faso, Ecuador, Indonesia, Mali, Nauru, Saint Lucia, Senegal, Sierra Leone, Solomon Islands, South Korea
9	1	Costa Rica
10	1	Turkey

11	1	South Africa
12	2	Taiwan, Argentina, United States
13	1	Canada
15	1	Thailand
16	3	Australia Brazil Japan
17	1	Bangladesh
22	1	New Zealand,
25	1	United Kingdom
26	27	Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden
32	6	Kuwait, Oman, Qatar, Saudi Arabia, United Arab Emirates, Yemen

Table 5. Results of the Estimated Random Effect Gravity Equations: Processed Meats Products

Variables	FC beef	FC pork	FC poultry	F beef	F pork	F poultry
Intercept	1.705	6.766	4.190	0.272	7.030	0.295
	(4.838)	(4.197)	(3.966)	(3.762)	(4.532)	(4.489)
GDP ratio	0.4886***	0.538***	0.225***	0.603***	0.6285***	0.567***
	(0.099)	(0.099)	(0.084)	(0.077)	(0.094)	(0.087)
Exchange rate	-0.116*	-0.0473	-0.027	-0.086**	-0.099*	0.008
	-0.067	(0.043)	(0.056)	(0.036)	(0.044)	(0.034)
Ad valorem tariff	-0.618**	-0.886***	-0.541***	-0.732***	-1.030***	-0.823***
	(0.255)	(0.231)	(0.209)	(0.185)	(0.228)	(0.215)
Common language	0.199	-0.483	-0.566	-0.105	-0.870	0.195

	(0.579)	(0.546)	(0.490)	(0.467)	(0.557)	(0.572)
Distance	-0.826**	-1.128***	-0.098	-0.865**	-1.748***	-0.997***
	(0.366)	(0.316)	(0.302)	(0.278)	(0.336)	(0.318)
GE Trade openness index	-0.237*	-0.177*	-0.126	-0.283**	-0.187**	-0.286***
	(0.165)	(0.146)	(0.132)	(0.113)	(0.140)	(0.139)
Price	-0.845	-1.204	-1.523	-1.059	-1.220	-1.272
	(0.050)	(0.07)	(0.042)	(0.03)	(0.06)	(0.03)
Number of Trade Agreement	-0.219	0.103	-0.095	0.006	0.539*	0.312
	(0.375)	(0.325)	(0.278)	(0.263)	(0.311)	(0.291)

Variables	**FC beef**	**FC pork**	**FC poultry**	**F beef**	**F pork**	**F poultry**
Intercept	1.705	6.766	4.190	0.272	7.030	0.295
	(4.838)	(4.197)	(3.966)	(3.762)	(4.532)	(4.489)
GDP ratio	0.4886***	0.538***	0.225***	0.603***	0.6285***	0.567***
	(0.099)	(0.099)	(0.084)	(0.077)	(0.094)	(0.087)

	-			-		
Exchange rate	0.116*	-0.0473	-0.027	0.086**	-0.099*	0.008
	-0.067	(0.043)	(0.056)	(0.036)	(0.044)	(0.034)
	-	-	-	-	-	-
Ad valorem tariff	0.618**	0.886***	0.541***	0.732***	1.030***	0.823***
	(0.255)	(0.231)	(0.209)	(0.185)	(0.228)	(0.215)
Common language	0.199	-0.483	-0.566	-0.105	-0.870	0.195
	(0.579)	(0.546)	(0.490)	(0.467)	(0.557)	(0.572)
	-	-			-	
Distance	0.826**	1.128***	-0.098	-0.865**	1.748***	-0.997***
	(0.366)	(0.316)	(0.302)	(0.278)	(0.336)	(0.318)
	-	-		-	-	-
GE Trade openness index	0.237*	0.177*	-0.126	0.283**	0.187**	0.286***
	(0.165)	(0.146)	(0.132)	(0.113)	(0.140)	(0.139)
Number of Trade						
Agreement	-0.219	0.103	-0.095	0.006	0.539*	0.312
	(0.375)	(0.325)	(0.278)	(0.263)	(0.311)	(0.291)

Note: Robust standard errors reported in parenthesis. Single, double, and triple asterisks (*, **, ***) indicate [statistical] significance at the 10%, 5%, and 1% levels respectively. FC= Fresh or

chilled, F= Frozen. All the variables are in elasticities except common language and number of trade Agreements.

Table 6. Results of the Estimated Random Effect Gravity Equations: Regulatory Component on Product Group.

Variables	FC beef	FC pork	FC poultry	F beef	F pork	F poultry
Intercept	1.705	6.766	4.190	0.272	7.030	0.295
	(4.838)	(4.197)	(3.966)	(3.762)	(4.532)	(4.489)
Approval process	-0.260	0.533	-0.016	0.322	1.4116*	-0.097
	(0.821)	(0.772)	(0.725)	(0.675)	(0.805)	(0.853)
Food Safety	-3.108***	-1.867*	-0.659	-2.425***	1.157	-0.830
	(1.129)	(1.073)	(0.920)	(0.920)	(1.133)	(1.142)
Labeling	0.299	-0.535	0.332	0.126	-1.480**	1.161***
	(0.556)	(0.556)	(0.454)	(0.421)	(0.615)	(0.464)

Environmental risk	2.070*	0.992	0.321	2.159**	-0.695	1.220
	(1.184)	(1.094)	(1.001)	(0.970)	(1.161)	(1.216)
Commercialization	2.684***	2.500***	1.992***	1.900***	1.022	2.120***
	(0.818)	(0.698)	(0.670)	(0.667)	(0.791)	(0.847)
Inter. Agreement	0.180	-0.127	-0.033	0.086	0.322	0.417
	(0.297)	(0.286)	(0.238)	(0.225)	(0.276)	(0.265)
Traceability	-0.346	-0.7767**	0.141	-0.136	-1.2878***	0.242
	(0.356)	(0.325)	(0.295)	(0.286)	(0.353)	(0.360)
Marketing & Trade	1.464**	1.0234*	0.159	1.572***	2.0827***	1.3191**
	(0.648)	(0.604)	(0.529)	(0.467)	(0.595)	(0.595)

Note: Robust standard errors reported in parenthesis. Single, double, and triple asterisks (*, **, ***) indicate [statistical] significance at the 10%, 5%, and 1% levels respectively. FC= Fresh or chilled, F= Frozen.

Table 7. Results of the Estimated Fixed Effect for Fresh or chilled beef Meat Products.

Ranking	Partners	Estimate	Std Error	t Value	Pr > |t|
	Top 10 Destination countries				
1	Mexico	5.6175	0.806	4.85	<.0001
2	Netherlands	4.8107	0.4493	6.91	<.0001
3	Chile	4.6929	0.4686	6.38	<.0001
4	Seychelles	4.1853	0.9701	2.56	0.0106
5	Congo (ROC)	4.1752	1.0193	2.42	0.0155
6	Luxembourg	4.1643	0.6221	3.95	<.0001
7	Bahrain	3.9912	0.6285	3.64	0.0003
8	Barbados	3.9357	0.6514	3.42	0.0006
9	Qatar	3.7117	0.9407	2.13	0.033
10	Gabon	3.4757	0.7642	2.32	0.0206
	Least 10 Countries				
1	Germany	3.3105	0.4873	3.3	0.001

2	Belgium	3.1888	0.4787	3.1	0.002
3	Uruguay	2.8953	0.552	2.16	0.0311
4	Nicaragua	0.3679	0.5746	-2.33	0.0201
5	Belize	0.0876	0.7371	-2.19	0.0284
6	India	-0.4607	0.8229	-2.63	0.0086
7	Venezuela	-0.4694	1.1033	-1.97	0.0489
8	Ghana	-0.8461	0.9046	-2.82	0.0048
9	Haiti	-1.7855	0.7314	-4.77	<.0001
10	Ecuador	-1.9481	0.7958	-4.59	<.0001

Table 8. Results of the Estimated Fixed Effects for Fresh or chilled Pork Products.

Ranking	Partners	Estimate	Std Error	t Value	Pr > |t|
Top 8 importing partners					
1	Mexico	10.553	0.7301	5.19	<.0001
2	China	9.1378	1.0212	2.32	0.0203
3	United Kingdom	8.9238	0.7143	3.02	0.0026
4	Guatemala	8.3209	0.5887	2.64	0.0084
5	Honduras	8.2338	0.5378	2.73	0.0064
6	Romania	8.1997	0.6312	2.27	0.0233
7	Panama	8.0414	0.5289	2.41	0.016
8	Nicaragua	5.8836	0.4547	-1.94	0.0525
Least 8 importing partners					
1	Peru	5.5632	0.4715	-2.55	0.0108

2	Poland	5.2396	0.7198	-2.12	0.0341
3	Kenya	5.0486	0.7913	-2.17	0.0301
4	Portugal	4.8435	0.8477	-2.27	0.0235
5	Spain	4.8305	0.5094	-3.8	0.0002
6	Haiti	4.5906	0.6189	-3.52	0.0005
7	Venezuela	4.3583	0.7178	-3.35	0.0008
8	Brazil	4.348	1.0500	-2.3	0.0214

Table 9. Results of the Estimated Fixed Effects for Fresh or chilled Poultry Meat Products.

Ranking	Partners	Estimate	Std Error	t Value	Pr > |t|
Top 10 importing partners					
1	Mexico	8.4929	0.6666	6.46	<.0001
2	Afghanistan	6.4213	0.6726	3.32	0.0009
3	Moldova	6.0631	0.6352	2.95	0.0032
4	China	6.04	0.946	1.96	0.0506
5	Lithuania	5.8782	0.762	2.22	0.0268
6	Tajikistan	5.7311	0.7533	2.05	0.0409
7	Slovakia	5.7289	0.628	2.45	0.0143
8	Gabon	5.6344	0.6148	2.35	0.0189
9	Georgia	5.6231	0.5195	2.76	0.0059
10	Angola	5.5907	0.5186	2.7	0.007
Least 10 importing partners					
1	France	2.8365	0.6437	-2.1	0.0356

2	Uruguay	2.7085	0.524	-2.83	0.0047
3	Italy	2.6753	0.4816	-3.14	0.0017
4	Peru	2.6454	0.461	-3.35	0.0008
5	Chile	2.6126	0.4236	-3.72	0.0002
6	United	2.5996	0.7683	-2.07	0.0386
7	Ecuador	2.5914	0.6592	-2.42	0.0154
8	Portugal	2.4127	0.8645	-2.06	0.0399
9	Jordan	2.2337	0.8218	-2.38	0.0174
10	Egypt	1.5718	0.8868	-2.95	0.0032

Table 10. Results of the Estimated Fixed Effects for Frozen Beef Meat Products.

Ranking	Partners	Estimate	Std Error	t Value	Pr > |t|
Top 10 Importing Partners					
1	Barbados	3.111	0.5333	5.32	<.0001
2	Bahrain	2.9426	0.4575	5.84	<.0001
3	Japan	2.8208	1.0691	2.38	0.0172
4	China	2.692	0.9602	2.52	0.0118
5	Jamaica	2.6071	0.5603	4.17	<.0001
6	Philippines	2.5387	0.4892	4.63	<.0001
7	Vietnam	2.3042	0.5345	3.8	0.0001

8	Netherlands	2.1552	0.3799	4.96	<.0001
9	Qatar	2.1104	0.7245	2.54	0.0112
10	Tonga	1.9969	0.61	2.83	0.0047
Least 10 Importing Partners					
1	Liberia	-1.3975	0.6917	-2.41	0.0159
2	Paraguay	-1.5297	0.8283	-2.17	0.0297
3	Haiti	-1.702	0.5635	-3.5	0.0005
4	Senegal	-1.715	0.8624	-2.3	0.0213
5	Bolivia	-1.8701	0.8205	-2.61	0.0091
6	Kenya	-1.9845	0.7642	-2.95	0.0032
7	Sierra Leone	-1.9943	0.9514	-2.38	0.0173
8	Ukraine	-2.0925	0.5815	-4.07	<.0001
9	Ecuador	-2.2701	0.5624	-4.52	<.0001
10	India	-2.6005	0.6504	-4.42	<.0001

Table 10. Results of the Estimated Fixed Effects for Frozen Pork Meat Products.

Ranking	Partners	Estimate	Std Error	t Value	Pr > |t|
	Top 10 Destination countries				
1	Philippines	10.0372	0.5607	5.36	<.0001
2	Colombia	9.9208	0.608	4.76	<.0001
3	Gabon	9.7384	0.7534	3.6	0.0003
4	China	9.6782	1.1305	2.34	0.0192
5	Japan	9.6633	1.2769	2.06	0.0393

6	Russia	9.6511	0.5737	4.57	<.0001
7	Guatemala	9.6484	0.5976	4.38	<.0001
8	Chile	9.2861	0.397	5.68	<.0001
9	Lithuania	9.2148	0.5548	3.94	<.0001
10	Tonga	8.9943	0.7081	2.77	0.0056
	Least 10 Countries				
1	Afghanistan	4.9677	0.5822	-3.54	0.0004
2	Guinea	4.8738	0.7315	-2.95	0.0032
3	Pakistan	4.7028	0.772	-3.01	0.0026
4	India	4.6957	0.7971	-2.93	0.0034
5	Egypt	4.609	0.6417	-3.77	0.0002
6	Paraguay	4.5302	0.9976	-2.51	0.0123
7	Haiti	4.2837	0.657	-4.18	<.0001

8	Portugal	4.0099	0.6056	-4.99	<.0001
9	Venezuela	3.8522	0.7608	-4.18	<.0001
10	Brazil	2.8297	1.1361	-3.7	0.0002

Table 11. Results of the Estimated Fixed Effects for Frozen Poultry Meat Products.

Ranking	Partners	Estimate	Std Error	t Value	Pr > |t|
	Top 10 Destination countries				

1	Gabon	4.2269	0.4696	8.37	<.0001
2	Lithuania	3.9205	0.5207	6.96	<.0001
3	Gambia	3.2797	0.5924	5.04	<.0001
4	Congo (ROC)	3.1285	0.36	7.87	<.0001
5	Estonia	3.1282	0.6222	4.55	<.0001
6	Angola	3.0816	0.3398	8.2	<.0001
7	Tonga	2.824	0.6068	4.17	<.0001
8	Mauritius	2.8023	0.6976	3.59	0.0003
9	Guatemala	2.7366	0.5424	4.5	<.0001
10	Greece	2.6341	0.4343	5.38	<.0001
	Least 10 Countries				
1	Cambodia	-2.2638	0.6821	-3.75	0.0002
2	Cote d'Ivoire	-2.266	0.4973	-5.15	<.0001
3	Nepal	-2.2692	0.9909	-2.59	0.0097
4	Egypt	-2.3316	0.5826	-4.51	<.0001
5	Indonesia	-2.3991	0.6826	-3.95	<.0001
6	Sweden	-2.5397	0.5945	-4.77	<.0001

7	Mali	-2.5788	1.1856	-2.42	0.0154
8	Ecuador	-2.8648	0.639	-4.95	<.0001
9	Nigeria	-2.9153	0.8	-4.01	<.0001
10	Paraguay	-3.7286	0.5518	-7.29	<.0001

Table 12. List of Fresh or chilled or Frozen Meat Products.

Products group	**HS Code**	**Description**	**Number**

Fresh or chilled Beef	20110, 20120, 20220	Carcasses and half-carcasses of bovine animals, fresh or chilled. Meat of bovine animals, cuts with bone in (other than half or whole carcasses), fresh or chilled. Meat of bovine animals, cuts with bone in (other than half or whole carcasses), frozen.	3
Fresh or chilled Pork	20311, 20312, 20319	Carcasses and half-carcasses of swine, fresh or chilled Meat of swine, hams, shoulders and cuts thereof, with bone in, fresh or chilled Meat of swine, nesoi, fresh or chilled	3
Fresh or chilled Poultry	20713, 20744, 20754, 20732, 20735, 20743, 20753, 20734, 20711,	Chicken cuts and edible offal (including livers) fresh or chilled. Cuts and offal of ducks, except fatty livers, fresh or chilled. Cuts and offal of geese, except fatty livers, fresh or chilled. Ducks, geese and guineas, not cut in pieces, fresh or chilled. Ducks, geese or guineas cuts and edible offal, nesoi, (except fatty livers) fresh or chilled.	15

	20711, 20130, 20741, 20751, 20726, 20724,	Fatty livers of ducks, fresh or chilled. Fatty livers of geese, fresh or chilled. Livers, fatty, of geese, ducks, or guinea fowls edible, fresh or chilled. Meat and edible offal of chickens, not cut in pieces, fresh or chilled. Meat and edible offal of chickens, not cut in pieces, fresh or chilled. Meat of bovine animals, boneless, fresh or chilled. Meat of ducks, fresh or chilled, not cut in pieces. Meat of geese, fresh or chilled, not cut in pieces. Turkey cuts and edible offal (including livers), fresh or chilled. Turkeys, not cut in pieces, fresh or chilled.	
Frozen Beef	20210, 20230	Carcasses and half-carcasses of bovine animals, frozen. Meat of bovine animals, boneless, frozen.	2
Frozen Pork	20321, 20322, 20329,	Carcasses and half-carcasses of swine, frozen. Meat of swine, hams, shoulders and cuts thereof with bone in, frozen.	3

		Meat of swine, nesoi, frozen.	
Frozen **Poultry**	20714, 20745, 20755, 20736, 20733, 20712, 20760, 20742, 20752, 20727, 20725	Chicken cuts and edible offal (including livers) frozen. Cuts and offal of ducks, frozen. Cuts and offal of geese, frozen. Ducks, cuts frozen. Ducks, geese and guineas, not cut in pieces, frozen. Meat and edible offal of chickens, not cut in pieces, frozen. Meat and edible offal of guinea fowls, fresh, chilled or frozen. Meat of ducks, frozen, not cut in pieces. Meat of geese, frozen, not cut in pieces. Turkey cuts and edible offal (including liver) frozen. Turkeys, not cut in pieces, frozen.	11

Table 13. Links to USDA-GAIN Reports of Trading Partners

Countries	Year	URLs
Afghanistan		N/A
Albania		N/A
Algeria	2022	https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Agricultural%20Biotechnology%20Annual_Algiers_Algeria_10-20-2019
Andorra		N/A
Angola	2022	https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Agricultural%20Biotechnology%20Annual_Luanda_Angola_AO2022-0003.pdf
Anguilla	2021	https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Agricultural%20Biotechnology%20Annual_Miami%20ATO_Caribbean%20Basin_10-20-2021

Antigua and Barbuda	2021	https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Agricultural%20Biotechnology%20Annual_Miami%20ATO_Caribbean%20Basin_10-20-2021
Argentina	2021	https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Agricultural%20Biotechnology%20Annual_Buenos%20Aires_Argentina_10-20-2021.pdf
Armenia		N/A
Aruba	2021	https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Agricultural%20Biotechnology%20Annual_Miami%20ATO_Caribbean%20Basin_10-20-2021
Australia	2022	https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Agricultural%20Biotechnology%20Annual_Canberra_Australia_AS2022-0023.pdf
Austria	2022	https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Biotechnology%20and%20Other%20New%20Production%20Technologies%20Annual_Brussels%20USEU_European%20Union_E42022-0069.pdf
Azerbaijan		N/A

Bahamas	2021	https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Agricultural%20Biotechnology%20Annual_Miami%20ATO_Caribbean%20Basin_10-20-2021
Bahrain	2014	https://apps.fas.usda.gov/newgainapi/api/report/downloadreportbyfilename?filename=Agricultural%20Biotechnology%20Annual_Dubai_United%20Arab%20Emirates_5-28-2014.pdf
Bangladesh	2022	https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Agricultural%20Biotechnology%20Annual_Dhaka_Bangladesh_BG2022-0026.pdf
Barbados	2021	https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Agricultural%20Biotechnology%20Annual_Miami%20ATO_Caribbean%20Basin_10-20-2021
Belarus		N/A
Belgium	2022	https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Biotechnology%20and%20Other%20New%20Production%20Technologies%20Annual_Brussels%20USEU_European%20Union_E42022-0069.pdf
Belize	2021	https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Agricultural%20Biotechnology%20Annual_Miami%20ATO_Caribbean%20Basin_10-20-2021

Benin		N/A
Bermuda	2021	https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Agricultural%20Biotechnology%20Annual_Miami%20ATO_Caribbean%20Basin_10-20-2021
Bolivia		N/A
Bosnia and Herzegovina	2021	https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Agricultural%20Biotechnology%20Annual_Sarajevo_Bosnia%20and%20Herzegovina_10-20-2021.pdf
Botswana		N/A
Brazil	2022	https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Agricultural%20Biotechnology%20Annual_Brasilia_Brazil_BR2022-0064.pdf
British Indian Ocean Territory		N/A
British Virgin Islands	2021	https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Agricultural%20Biotechnology%20Annual_Miami%20ATO_Caribbean%20Basin_10-20-2021

Brunei Darussalam		N/A
Bulgaria	2022	https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Biotechnology%20and%20Other%20New%20Production%20Technologies%20Annual_Brussels%20USEU_European%20Union_E42022-0069.pdf
Burkina Faso	2022	https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Agricultural%20Biotechnology%20Annual_Dakar_Senegal_SG2022-0013.pdf
Burundi		N/A
Cabo Verde		N/A
Cambodia		N/A
Cameroon		N/A
Canada	2022	https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Agricultural%20Biotechnology%20Annual_Ottawa_Canada_CA2022-0041.pdf

Cayman Islands	2021	https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Agricultural%20Biotechnology%20Annual_Miami%20ATO_Caribbean%20Basin_10-20-2021
Central African Republic		N/A
Chad		N/A
Chile	2022	https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Agricultural%20Biotechnology%20Annual_Santiago_Chile_CI2022-0024.pdf
China	2022	https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Agricultural%20Biotechnology%20Annual_Beijing_China%20-%20People%27s%20Republic%20of_10-20-2021.pdf
Christmas Islands		N/A
Cocos (Keeling) Islands		N/A

Colombia	2022	https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Agricultural%20Biotechnology%20Annual_Bogota_Colombia_CO2022-0018.pdf
Comoros		N/A
Congo (DROC)		N/A
Congo (ROC)		N/A
Cook Islands		N/A
Costa Rica	2022	https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Agricultural%20Biotechnology%20Annual_San%20Jose_Costa%20Rica_CS2022-0019.pdf
Cote d'Ivoire	2021	https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Biotechnology%20and%20Other%20New%20Production%20Technologies%20Annual_Accra_Cote%20d%27Ivoire_10-20-2021.pdf

Croatia	2022	https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Biotechnology%20and%20Other%20New%20Production%20Technologies%20Annual_Brussels%20USEU_European%20Union_E42022-0069.pdf
Cuba		N/A
Curacao	2020	https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Agricultural%20Biotechnology%20Annual_Miami%20ATO_Caribbean%20Basin_10-20-2019
Cyprus	2022	https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Biotechnology%20and%20Other%20New%20Production%20Technologies%20Annual_Brussels%20USEU_European%20Union_E42022-0069.pdf
Czech Republic	2022	https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Biotechnology%20and%20Other%20New%20Production%20Technologies%20Annual_Brussels%20USEU_European%20Union_E42022-0069.pdf
Denmark	2022	https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Biotechnology%20and%20Other%20New%20Production%20Technologies%20Annual_Brussels%20USEU_European%20Union_E42022-0069.pdf

Djibouti		N/A
Dominica	2021	https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Agricultural%20Biotechnology%20Annual_Miami%20ATO_Caribbean%20Basin_10-20-2021
Dominican Republic	2022	https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Agricultural%20Biotechnology%20Annual_Santo%20Domingo_Dominican%20Republic_DR2022-0012.pdf
Ecuador	2022	https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Agricultural%20Biotechnology%20Annual_Quito_Ecuador_EC2022-0014.pdf
Egypt	2022	https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Biotechnology%20and%20Other%20New%20Production%20Technologies%20Annual_Cairo_Egypt_EG2022-0029.pdf
El Salvador	2022	https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Agricultural%20Biotechnology%20Annual_San%20Salvador_El%20Salvador_ES2022-0009.pdf
Equatorial Guinea		N/A

Eritrea		N/A
Estonia	2022	https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Biotechnology%20and%20Other%20New%20Production%20Technologies%20Annual_Brussels%20USEU_European%20Union_E42022-0069.pdf
Eswatini		N/A
Ethiopia	2020	https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Agricultural%20Biotechnology%20Annual_Addis%20Ababa_Ethiopia_10-20-2019
Falkland Islands (Islas Malvinas)		N/A
Faroe Islands		N/A
Fiji		N/A

Finland	2022	https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Biotechnology%20and%20Other%20New%20Production%20Technologies%20Annual_Brussels%20USEU_European%20Union_E42022-0069.pdf
France	2022	https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Biotechnology%20and%20Other%20New%20Production%20Technologies%20Annual_Brussels%20USEU_European%20Union_E42022-0069.pdf
French Guiana		N/A
French Polynesia		N/A
French Southern and Antarctic Lands		N/A
Gabon		N/A

Gambia	2022	https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Agricultural%20Biotechnology%20Annual_Dakar_Senegal_SG2022-0013.pdf
Georgia		N/A
Germany	2022	https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Biotechnology%20and%20Other%20New%20Production%20Technologies%20Annual_Brussels%20USEU_European%20Union_E42022-0069.pdf
Ghana	2022	https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Agricultural%20Biotechnology%20Annual_Accra_Ghana_GH2022-0016.pdf
Gibraltar		N/A
Greece	2022	https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Biotechnology%20and%20Other%20New%20Production%20Technologies%20Annual_Brussels%20USEU_European%20Union_E42022-0069.pdf
Greenland		N/A

Grenada	2021	https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Agricultural%20Biotechnology%20Annual_Miami%20ATO_Caribbean%20Basin_10-20-2021
Guadeloupe	2021	https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Agricultural%20Biotechnology%20Annual_Miami%20ATO_Caribbean%20Basin_10-20-2021
Guatemala	2022	https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Agricultural%20Biotechnology%20Annual_Guatemala%20City_Guatemala_GT2022-0011.pdf
Guinea	2022	https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Agricultural%20Biotechnology%20Annual_Dakar_Senegal_SG2022-0013.pdf
Guinea-Bissau	2022	https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Agricultural%20Biotechnology%20Annual_Dakar_Senegal_SG2022-0013.pdf
Guyana	2021	https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Agricultural%20Biotechnology%20Annual_Miami%20ATO_Caribbean%20Basin_10-20-2021
Haiti	2021	https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Agricultural%20Biotechnology%20Annual_Miami%20ATO_Caribbean%20Basin_10-20-2021

Heard Island and McDonald Islands		N/A
Holy See (Vatican City)		N/A
Honduras	2022	https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Agricultural%20Biotechnology%20Annual_Tegucigalpa_Honduras_HO2022-0010.pdf
Hong Kong	2022	https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Agricultural%20Biotechnology%20Annual_Hong%20Kong_Hong%20Kong_HK2022-0081.pdf
Hungary	2022	https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Biotechnology%20and%20Other%20New%20Production%20Technologies%20Annual_Brussels%20USEU_European%20Union_E42022-0069.pdf
Iceland		

India	2022	https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Agricultural%20Biotechnology%20Annual_New%20Delhi_India_IN2022-0087.pdf
Indonesia	2022	https://www.fas.usda.gov/data/indonesia-agricultural-biotechnology-annual-6
Iran		N/A
Iraq		N/A
Ireland	2022	https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Biotechnology%20and%20Other%20New%20Production%20Technologies%20Annual_Brussels%20USEU_European%20Union_E42022-0069.pdf
Israel	2022	https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Agricultural%20Biotechnology%20Annual_Tel%20Aviv_Israel_IS2022-0011.pdf
Italy	2022	https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Biotechnology%20and%20Other%20New%20Production%20Technologies%20Annual_Brussels%20USEU_European%20Union_E42022-0069.pdf

Jamaica	2022	https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Agricultural%20Biotechnology%20Annual_Kingston_Jamaica_JM2022-0007.pdf
Japan	2022	https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Agricultural%20Biotechnology%20Annual_Tokyo_Japan_JA2022-0092.pdf
Jordan	2022	https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Agricultural%20Biotechnology%20Annual_Amman_Jordan_JO2022-0001.pdf
Kazakhstan	2022	https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Agricultural%20Biotechnology%20Annual_Astana%28Nur-Sultan%29_Kazakhstan%20-%20Republic%20of_KZ2022-0020.pdf
Kenya	2022	https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Agricultural%20Biotechnology%20Annual_Nairobi_Kenya_KE2022-0010.pdf
Kiribati		N/A
Kosovo		N/A

Kuwait	2022	https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Agricultural%20Biotechnology%20Annual_Riyadh_Saudi%20Arabia_SA2022-0015.pdf
Kyrgyzstan		N/A
Laos		N/A
Latvia	2022	https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Biotechnology%20and%20Other%20New%20Production%20Technologies%20Annual_Brussels%20USEU_European%20Union_E42022-0069.pdf
Lebanon		N/A
Lesotho		N/A
Liberia		N/A
Libya		N/A
Liechtenstein		N/A

Lithuania	2022	https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Biotechnology%20and%20Other%20New%20Production%20Technologies%20Annual_Brussels%20USEU_European%20Union_E42022-0069.pdf
Luxembourg	2022	https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Biotechnology%20and%20Other%20New%20Production%20Technologies%20Annual_Brussels%20USEU_European%20Union_E42022-0069.pdf
Macao		N/A
Madagascar		N/A
Malawi		N/A
Malaysia	2022	https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Agricultural%20Biotechnology%20Annual_Kuala%20Lumpur_Malaysia_MY2022-0014.pdf
Maldives		N/A
Mali	2022	https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Agricultural%20Biotechnology%20Annual_Dakar_Senegal_SG2022-0013.pdf

Malta	2022	https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Biotechnology%20and%20Other%20New%20Production%20Technologies%20Annual_Brussels%20USEU_European%20Union_E42022-0069.pdf
Marshall Islands		N/A
Martinique	2021	https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Agricultural%20Biotechnology%20Annual_Miami%20ATO_Caribbean%20Basin_10-20-2021
Mauritania	2022	https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Agricultural%20Biotechnology%20Annual_Dakar_Senegal_SG2022-0013.pdf
Mauritius		N/A
Mayotte		N/A
Mexico		N/A
Micronesia		N/A
Moldova		N/A

Monaco		N/A
Mongolia		N/A
Montenegro		N/A
Montserrat	2021	https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Agricultural%20Biotechnology%20Annual_Miami%20ATO_Caribbean%20Basin_10-20-2021
Morocco	2022	https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Agricultural%20Biotechnology%20Annual_Rabat_Morocco_MO2022-0024.pdf
Mozambique	2022	https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Agricultural%20Biotechnology%20Annual_Maputo_Mozambique_MZ2022-0003.pdf
Myanmar	2022	https://apps.fas.usda.gov/newgainapi/api/report/downloadreportbyfilename?filename=Agricultural%20Biotechnology%20Annual_Rangoon_Burma%20-%20Union%20of_1-27-2017.pdf
Namibia		N/A
Nauru		N/A

Nepal		N/A
Netherlands	2022	https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Biotechnology%20and%20Other%20New%20Production%20Technologies%20Annual_Brussels%20USEU_European%20Union_E42022-0069.pdf
Netherlands Antilles	2021	https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Agricultural%20Biotechnology%20Annual_Miami%20ATO_Caribbean%20Basin_10-20-2021
New Caledonia		N/A
New Zealand	2022	https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Agricultural%20Biotechnology%20Annual_Wellington_New%20Zealand_NZ2022-0013.pdf
Nicaragua	2022	https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Agricultural%20Biotechnology%20Annual_Managua_Nicaragua_NU2022-0011.pdf
Niger	2022	https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Agricultural%20Biotechnology%20Annual_Dakar_Senegal_SG2022-0013.pdf

Nigeria	2022	https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Biotechnology%20and%20Other%20New%20Production%20Technologies%20Annual_Lagos_Nigeria_NI2022-0010.pdf
Norfolk Island		N/A
North Korea		N/A
North Macedonia		N/A
Norway		N/A
Oman	2022	https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Agricultural%20Biotechnology%20Annual_Riyadh_Saudi%20Arabia_SA2022-0015.pdf
Pakistan	2018	https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Agricultural%20Biotechnology%20Annual_Jakarta_Indonesia_ID2022-0029.pdf
Palau		

Panama	2022	https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Agricultural%20Biotechnology%20Annual_Panama%20City_Panama_PN2022-0008.pdf
Papua New Guinea		N/A
Paraguay		N/A
Peru	2022	https://www.fas.usda.gov/data/peru-agricultural-biotechnology-annual-6
Philippines	2021	https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Agricultural%20Biotechnology%20Annual_Manila_Philippines_10-20-2021.pdf
Pitcairn Islands		N/A
Poland	2022	https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Biotechnology%20and%20Other%20New%20Production%20Technologies%20Annual_Brussels%20USEU_European%20Union_E42022-0069.pdf

Portugal	2022	https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Biotechnology%20and%20Other%20New%20Production%20Technologies%20Annual_Brussels%20USEU_European%20Union_E42022-0069.pdf
Qatar	2022	https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Agricultural%20Biotechnology%20Annual_Riyadh_Saudi%20Arabia_SA2022-0015.pdf
Reunion		N/A
Romania	2022	https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Biotechnology%20and%20Other%20New%20Production%20Technologies%20Annual_Brussels%20USEU_European%20Union_E42022-0069.pdf
Russia	2021	https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Agricultural%20Biotechnology%20Annual_Moscow_Russian%20Federation_10-20-2020.pdf
Rwanda		N/A
Saint Helena		N/A

Saint Kitts and Nevis	2021	https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Agricultural%20Biotechnology%20Annual_Miami%20ATO_Caribbean%20Basin_10-20-2021
Saint Lucia	2021	https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Agricultural%20Biotechnology%20Annual_Miami%20ATO_Caribbean%20Basin_10-20-2021
Saint Pierre and Miquelon		N/A
Saint Vincent and the Grenadines	2021	https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Agricultural%20Biotechnology%20Annual_Miami%20ATO_Caribbean%20Basin_10-20-2021
Samoa (Western Samoa)		N/A
San Marino		N/A

Sao Tome and Principe		N/A
Saudi Arabia	2022	https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Agricultural%20Biotechnology%20Annual_Riyadh_Saudi%20Arabia_SA2022-0015.pdf
Senegal	2022	https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Agricultural%20Biotechnology%20Annual_Dakar_Senegal_SG2022-0013.pdf
Serbia	2022	https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Agricultural%20Biotechnology%20Annual_Belgrade_Serbia_RB2022-0009.pdf
Seychelles		N/A
Sierra Leone		N/A
Singapore	2020	https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Agricultural%20Biotechnology%20Annual_Singapore_Singapore_10-20-2020
Sint Maarten		N/A

Slovakia	2022	https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Biotechnology%20and%20Other%20New%20Production%20Technologies%20Annual_Brussels%20USEU_European%20Union_E42022-0069.pdf
Slovenia	2022	https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Biotechnology%20and%20Other%20New%20Production%20Technologies%20Annual_Brussels%20USEU_European%20Union_E42022-0069.pdf
Solomon Islands		N/A
Somalia		N/A
South Africa	2022	https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Agricultural%20Biotechnology%20Annual_Pretoria_South%20Africa%20-%20Republic%20of_SF2022-0033.pdf
South Korea	2022	https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Agricultural%20Biotechnology%20Annual_Seoul_Korea%20-%20Republic%20of_KS2022-0024.pdf
South Sudan		N/A

Spain	2022	https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Biotechnology%20and%20Other%20New%20Production%20Technologies%20Annual_Brussels%20USEU_European%20Union_E42022-0069.pdf
Sri Lanka	2022	https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Agricultural%20Biotechnology%20Annual_Colombo_Sri%20Lanka_CE2022-0018.pdf
Sudan		N/A
Suriname		N/A
Svalbard and Jan Mayen		N/A
Sweden	2022	https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Biotechnology%20and%20Other%20New%20Production%20Technologies%20Annual_Brussels%20USEU_European%20Union_E42022-0069.pdf
Switzerland		N/A
Syria		N/A

Taiwan	2022	https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Agricultural%20Biotechnology%20Annual_Taipei_Taiwan_TW2022-0056.pdf
Tajikistan		N/A
Tanzania	2022	https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Biotechnology%20and%20Other%20New%20Production%20Technologies%20Annual_Dar%20Es%20Salaam_Tanzania_TZ2022-0005.pdf
Thailand	2022	https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Agricultural%20Biotechnology%20Annual_Bangkok_Thailand_TH2022-0071.pdf
Timor-Leste		N/A
Togo		N/A
Tokelau		N/A
Tonga		N/A
Trinidad and Tobago	2021	https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Agricultural%20Biotechnology%20Annual_Miami%20ATO_Caribbean%20Basin_10-20-2021

Tunisia	2022	https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Agricultural%20Biotechnology%20Annual_Tunis_Tunisia_TS2022-0013.pdf
Turkey	2022	https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Agricultural%20Biotechnology%20Annual_Ankara_Turkey_TU2022-0047.pdf
Turkmenistan		N/A
Turks and Caicos Islands		N/A
Tuvalu		N/A
Uganda		N/A
Ukraine	2022	https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Biotechnology%20and%20Other%20New%20Production%20Technologies%20Annual_Kyiv_Ukraine_UP2022-0078.pdf
United Arab Emirates	2022	https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Agricultural%20Biotechnology%20Annual_Riyadh_Saudi%20Arabia_SA2022-0015.pdf

United Kingdom	2021	https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Agricultural%20Biotechnology%20Annual_London_United%20Kingdom_10-20-2021.pdf
Uruguay		N/A
USA		https://www.aphis.usda.gov/aphis/ourfocus/importexport https://www.fsis.usda.gov/inspection/import-export
Uzbekistan		N/A
Vanuatu		N/A
Venezuela	2022	https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Agricultural%20Biotechnology%20Annual_Caracas_Venezuela_VE2022-0031.pdf
Vietnam	2022	https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Agricultural%20Biotechnology%20Annual_Hanoi_Vietnam_VM2022-0073.pdf
Wallis and Futuna		N/A

Yemen	2022	https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Agricultural%20Biotechnology%20Annual_Riyadh_Saudi%20Arabia_SA2022-0015.pdf
Yugoslavia		N/A
Zambia		N/A
Zimbabwe		N/A