



Investigating the Impact of Economic Sanctions on Iran-Ghana Trade

Mohammad Ghaffary fard¹, Alireza Habibi², Jessica Kwashie³

1. Assistant professor, Department of Economic, Ahlul-Bayt International University, Tehran, Iran.

2. Assistant professor, Department of International Business Management, Ahlul-Bayt International University, Tehran, Iran.

3. MSc Student, Department of International Business Management, Ahlul-Bayt International University, Tehran, Iran. (Corresponding Author) Email: jessicakwashie@gmail.com

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ABSTRACT

One of the most important factors influencing trade with Iran has always been economic sanctions imposed on the Iranian economy with ups and downs over the last 40 years. Economic sanctions against Iran that began in 1979, mainly imposed by the United States, have restricted and hindered many trade-related cross-border economic activities such as maritime transactions, banking, and insurance. The research is a quantitative design that use gravity model and FMOLS estimation to investigate the impact of economic sanctions on the Iran – Ghana trade. A further investigation is done on the effect of GDP, Trade Agreement on the bilateral trade. This helps in the understanding and contributes to literature on the bilateral trade between Iran and Ghana. It gives an insight on areas to focus in developing the trade between both countries. The results of the research shows that the bilateral trade between Iran and Ghana is positively correlated to GDP by 3.48%. However, it is negatively correlated to economic sanctions, and trade agreement by 1.66%, and 1.26% respectively.

KEYWORDS: Economic Sanctions, Trade, Trade Agreement, Gravity Model, GDP

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1. Introduction

Previous research has focused on the trade implications of imposed sanctions (Caruso, 2003; Hufbauer et al., 2007). The majority of studies concluded that the effect was negative. Davidsson (2011:202) proposes this definition of economic sanctions as restricting trade or cooperative financial transactions, or both, in order to weaken economic activity in a particular region. One example is the recent sanctions imposed on Russia following its invasion of Ukraine. The impact has hit the Russian economy, with a significant drop in exports to Russia from sanctioned countries and, unexpectedly, from non-sanctioned countries, especially China. Overall, Russian imports fell more than 50%, and imports from China also fell dramatically, from over \$8.1 billion per month to \$3.8 billion (Sonnenfeld et al., 2022).

The series of sanctions imposed on Iran by the United States, the UN Security Council, and the European Union over 40 years has made international trade more difficult (Ianchovichina et. al., 2016:6). However, Iran has been constantly evolving its foreign trade structure recently, including countries such as China, India, Afghanistan, Ghana, and Nigeria, which are not subject to these economic sanctions, or whose sanctions, for one reason or another, have circumvented trade ties increased trade with countries working with Iran to maintain the flow of goods needed for economic growth and development (Ishtiaq et al, 2021:30).

Ghana is currently free from international sanctions. It has the ability to trade with other countries at its own discretion. In particular, bilateral relations between Ghana and Iran date back to the 1961 Non-Aligned Movement (NAM). Despite economic sanctions against Iran, there is continued trade between Iran and Ghana. Sadati Nejad, Iranian Agriculture Minister, reported that the value of trade between Iran and Ghana increased from \$35 million in 2019 to \$370 million in 2021 (Mehr News, 2022). Despite the impact of economic sanctions against Iran, trade between Iran and Ghana is expected to increase in recent years and could get better in the future.

The primary objective of this paper is to study the impact of economic sanctions on trade between Iran and Ghana and also explore how the determinants of trade (GDP, and Trade Agreements) influence bilateral trade. This is done by the use of the gravity model and the fully modified least square method. It is devoted to analyzing and understanding this subject. The impacts identified can give a clear view of the position of the bilateral trade flow. The trend of trade flow that will be identified can be used to predict future bilateral trade direction and forecast the best route to pursue in improving it. This will consequently lead to better trade negotiations and agreements, and the expansion of a variety of goods/services involved in the bilateral trade. Both economies thereby generate more revenue for growth and development.

2. Literature Review

Economic Sanction

Economic sanctions are the withdrawal of normal trade and financial relations for foreign and security policy purposes. Sanctions can be comprehensive (i.e., ban all commercial activities related to an entire country, like the long-standing U.S. embargo on Cuba) or targeted (i.e., block trade by specific companies, groups, or individuals). They can take very different forms and fall into three categories depending on the severity of the sanctions: limited, moderate, or extensive. Limited sanctions are minor trade, financial, or travel sanctions, such as aid suspensions and travel bans, while broader trade and economic sanctions, such as asset freezes and investment bans, are classified as moderate. increase. A “broad” category is reserved for comprehensive trade and financial embargoes, such as those against Cuba, Iraq, Iran, and North Korea (Hufbauer, 2003:310).

Impact of Economic Sanction

The most studied outcome of economic sanctions is GDP since it is an indicator that efficiently summarizes the economy as a whole. In a study by Gutmann et al. (2021:15) GDP per capita of the target,

countries fell by an average of 4% in their first two years after sanctions were imposed and shows no signs of recovery for three years after sanctions are lifted. Neuenkirch and Neumeier (2015:14) also estimate a decline in GDP growth. Another visible effect of economic sanctions is the reduction of trade flows involving the target country. Afesorgbor (2018:4) found that the threat of import restrictions by shippers has a positive and significant impact on bilateral trade. His results show that the positive predictive effect of threat is strongly influenced when shippers impose import restrictions on destination goods. The impact of economic sanctions can also be seen on people's livelihoods and health is evident in the case of Venezuela, which was sanctioned by the US government in 2017. The Venezuelan economy has been robbed of billions of dollars of foreign currency needed to pay for essential goods, saving imports. According to the national living Conditions Survey (ENCOVI, Spanish acronym), all-cause mortality increased by 31% from 2017 to 2018. According to Alnasrawi (2001:214), sanctions imposed on Iraq have also led to lower life expectancy and food standards. Another impact of economic sanctions is poverty. Neuenkirch and Neumeier (2016:111) found that US sanctions had a negative impact on the poor, and as a result, the poverty gap (average below the PPP poverty line of \$1.25 per day) has changed in one dynamic.

Impact of economic sanctions on Trade

In the case of Iran, Dizaji (2018:28) confirm Caruso (2003) and Yang et al. (2004) conclusions on the positive effects of sanctions on trade with other partners. In particular their analysis of the effects of the sanctions on the bilateral agricultural trade between Iran and the EU. Kohl and Reesink (2019) found in other studies that economic sanctions are harmful consequences for international trade. Financial sanctions can also reduce trade by denying the target country investment, currency, or credit, or by increasing its credit costs. One reason for this is that financial sanctions make the settlement of trade transactions much more difficult. In extreme cases of nearly complete financial sanctions, transactions can only be settled by cash or gold, which is nearly impossible to implement when these transactions are worth billions of dollars. Similarly, sanctions on transport make it more difficult to find transport companies willing to move the cargo.

Iran and Economic Sanctions

Iran was considered the most sanctioned country until it was surpassed by Russia in 2022. It is most affected by political shocks and economic sanctions imposed by various countries, usually for political reasons, most notably the United States, and the EU (Caruso, 2003:13-14). The first sanction was imposed in 1979 by the United States after the American Embassy was seized and taken hostage. This sanction was lifted in 1981, reinstated in 1987, and expanded in 1995. In 2003, the International Atomic Energy Agency (IAEA) discovered Iran's nuclear technology and uranium enrichment projects, prompting the IAEA and the EU to urge Iranian authorities to cease nuclear-related activities. As a result, in 2006 the United States imposed sanctions on Iranian banks, restricting their access to the U.S. financial system. The permanent members of the Security Council and Germany passed the first sanctions through UN Security Council Resolution 1737 (UNSCR) (UNSC, 2006). Iranian entities and individuals associated with the nuclear program were blacklisted. The supply of any material or equipment useful to the program was prohibited. In addition, the resolution imposed a unilateral embargo on the arms trade, banning exports from Iran but banning imports. In 2007, the United Nations imposed new sanctions on Iran's investments in its oil and gas sector and trade in petroleum products as a result of Iran's claims to enrich uranium, restrictions were imposed on Iran's possession of nuclear material, and Iranian assets were also frozen during this period. In 2008, UNSCR 1803 was passed, resulting in a third round of sanctions by the Security Council (UNSC, 2008). In addition, sanctions have imposed some restrictions on Iranian financial institutions at the moment, notably two banks, Saderat and Melli. From 2010 until 2015, many other countries including Japan, India, China, South Korea, Turkey, South Africa, and Singapore cut their import of oil from Iran. and the export of petroleum products and financial transactions flowing through all authorized channels to and from Iran was banned by the EU. In 2015,

Iran's newly elected President Hassan Rouhani signed a Joint Comprehensive Plan of Action (JCPOA) with the EU and the P5+1 (US, UK, France, China, Russia, and Germany) to lift sanctions. However, this situation did not last long as the sanctions were reimposed by the United States in 2018 and expanded in 2019 and 2020 to cover the financial sector. In 2020, Iran was placed on the FATF blacklist.

Iran Relief and Renewal

Essentially, the JCPOA deal offered Iran a gradual release from many of the sanctions imposed by the United Nations and the European Union, as well as those imposed by the United States, in exchange for continued commitment to Iran's nuclear program. The deal had provided a 10-year term and the agreement was not expected to be fully implemented by 2025. The easing of sanctions had two main phases, the first with the implementation date of 16 January 2016 and the second with the transition date of October 2023. The first phase of sanctions relief was triggered by a review by the International Atomic Nuclear Agency with which Iran has complied with her JCPOA obligations. Some of the most significant changes from an EU perspective have been the delisting of various individuals and entities, including the Islamic Republic of Iran Shipping Company, NITC, and Iran Insurance Companies, and the suspension of related bans on purchasing, importing, and transporting Iranian crude oil, petroleum products, petrochemicals, and natural gas. Further delisting and further cancellations should take place on the transition date on May 8, 2018, President Trump withdrew the United States from the trade restrictions. On August 6 and November 5, 2018, all US secondary sanctions against Iran that were removed by JCPOA has been restored. The EU remains committed to its commitments under the JCPOA despite reports that the US has withdrawn and Iran has increased its stockpile of enriched uranium in breach of the agreement. Against this background, E3 (UK, Germany, France) announced in January 2020 that he would initiate the JCPOA's dispute resolution mechanism to resolve claims of non-compliance by Iran. The E3 created, in January 2019, a new payment mechanism or special purpose entity called INSTEX to facilitate financial transactions with Iran. The E3 announced the first INSTEX successful deal to facilitate the export of medical supplies from Europe to Iran held in March 2020. In December 2020, Iran passed a new law mandating its comprehensive phase-out of nuclear activity in the first half of 2021. The E3 released a statement raising concerns about the impact of new legislation on returning to the JCPOA. Iran has assured that all activities initiated under the new law (and other violations of the JCPOA) can be reversed if sanctions against Iran are lifted. At the time of writing, the US position on Iran has not yet been established.

Impact of Sanctions on Iran

International sanctions have affected Iran's economy. The period from 2012 to 2015 (from EU endorsement of Iran's oil embargo to the nuclear deal) was the most difficult period for the country. Between 2011 and 2015, Iran's oil production and oil exports declined from 3.8 million and 2.4 million barrels per day to 2.3 million to 2.7 million and 0.9 million to 1 million barrels per day, respectively. In 2013, one year after the EU's oil trade embargo was introduced, Iran's oil revenues fell by almost 50% compared to 2011. By 2015, the decline was even greater, reaching 70%. This sharp decline inevitably led to a budget deficit in Iran, which relied heavily on the influx of petrodollars. Under these circumstances, Iran's GDP growth in 2012 was estimated at -7.4%, official inflation was 26%, and annual consumer price inflation exceeded 32%. Inflation continued to rise, reaching 40% in 2013. According to various sources, about 60% of the population lived below the poverty line in 2013. The wealth gap was wide and widening. The incomes of the three richest deciles of the population were 15 to 16 times higher than those of the three poorest deciles. The official unemployment rate was on the rise and the completion of industrial projects requiring foreign technology, investment, and equipment has only accelerated the growth. The sanctions have severely tested Iran, hurting its economy but not causing it to collapse. However, between 2013 and 2015, the country showed a trend toward economic stabilization. GDP growth in 2013 was still negative at -0.2% compared to -7.4% in 2012. In 2014, the economy showed positive growth (4.6%). Inflation has also slowed since 2014, falling below 10% in 2016. One would say

the JCOPA had a positive effect since GDP growth increased substantially as well in 2016. After, the economy run into the negatives in 2018 where GDP growth was -6% and -6.8%, and inflation shot up 18% and 40% in 2018 and 2019 respectively. By 2020, the GDP began to rise again to 3.4%, and 4.1% in 2021. However, inflation was still up.

Iran and Ghana

The Islamic Republic of Iran is a country located in Western Asia. It is bordered by Iraq and Turkey to the west, Azerbaijan and Armenia to the northwest, the Caspian Sea and Turkmenistan to the north, Afghanistan and Pakistan to the east, and the Gulf of Oman and the Persian Gulf to the south. It has 1.64 million square kilometers (630,000 square miles) of landscape and an estimated population of 86.8 million. The largest cities are the capital of Tehran, Mashhad, Isfahan, Karaj, Shiraz, and Tabriz. In addition to oil, the country is endowed with natural resources such as natural gas, coal, chromium, copper, iron ore, lead, manganese, zinc, and sulfur. The country's currency is the Rial. Iran's GDP in 2020 was US\$231.5 billion. Over the past 40 years, it has faced a series of sanctions imposed by the United States, the United Nations Security Council, and the European Union. The Republic of Ghana is a country in West Africa. It is bordered by the Gulf of Guinea and the Atlantic Ocean to the south, Ivory Coast to the west, Burkina Faso to the north, and Togo to the east. Ghana has a landscape of 238,535 square kilometers (92,099 square miles) and a population of 32.1 million. The capital is Accra and the other major cities are Kumasi, Tamale, and Sekondi-Takoradi. Ghana is endowed with abundant natural resources such as cocoa, timber, gold, diamonds, bauxite, manganese, and petroleum. The national currency is the Cedi. Ghana's GDP in 2020 was USD 70.01 billion. It is not currently subject to international sanctions.

Iran-Ghana Trade

Trade between Iran and Ghana continues despite economic sanctions against Iran. This is due to the existing bilateral relationship between the two countries. The Permanent Joint Committee on Cooperation between Iran and Ghana (P.J.C.C.) was established by the Iranian Cabinet under Article 138 of the Iranian Constitution as proposed by the Ministry of Foreign Affairs of the Islamic Republic of Iran in 2005. Memoranda of Understandings (MOUs) have been signed between the two countries in various fields to promote trade cooperation. From 2010 to 2021, three sessions were held: the 4th in 2010, the 5th in 2014, and the 6th in 2017. In 2019, Ghana exported \$453,000 to Iran. The main export to Iran is N/A. Over the past 23 years, exports from Ghana to Iran have declined at an annual rate of 31%, from \$2.3 million in 1996 to \$453,000 in 2019 (OEC, 2019). Iran also exported \$232,000 to Ghana in 2019. The main export to Ghana is N/A. Over the past 23 years, Iran's exports to Ghana have increased at an annual rate of 0.31% from \$215,000 in 1996 to \$232,000 in 2019 (OEC, 2019). The export of goods from the Islamic Republic of Iran to Ghana in the year 1400 (2021) is 562,000 tons in weight and 338 million US\$ in value. This shows a growth of 46% in quantity and 138% in value compared to the same period in the previous year. On the other hand, the export of goods from Ghana to the Islamic Republic of Iran in the current year is 7 million US\$ in value and 3000 tons in weight.

Regional Trade Agreement

Regional trade agreements refer to a contract signed by two or more countries to promote the free movement of goods and services across the borders of its members. The agreement contains internal rules that member countries follow among themselves. Quotas, tariffs, and other forms of trade barriers limit the movement of manufactured goods and services. Regional trade agreements help reduce or eliminate trade barriers. There are 5 types of agreements; Preferential Trade areas (lowest level of commitment to reduce internal trade barriers and have no common external trade barriers), Free trade areas (all internal trade barriers removed between members only), Customs union (member states remove internal trade barriers and adopt common external trade barriers), Common market (members remove internal barriers to trade, adopt common external barriers, and allow free movement of resources), and Economic union

(members remove internal trade barriers, establish common external barriers, allow free movement of resources, apply a set of economic policies, and use a currency). RTAs are an exception to the WTO rules since an RTA is formed by a number of countries, and articles included in this treaty only apply to its member countries, implying the discriminatory nature of RTAs (Nguyen, 2019). It stimulates economic growth, notably in the form of increased trading volumes, quality and variety of goods, production factors (labor and capital), higher employment, and market expansion.

GDP

GDP, or Gross Domestic Product, measures the monetary value of final products and services, those purchased by the final consumer and made in the country within a specified time period (e.g. quarterly or yearly) (Callen, 2008). It is the single most important indicator of these economic activities and is calculated in each country's own currency. GDP correlates with a country's imports and exports. High GDP means high productivity which leads to an increase in exports. Imports increase productivity through their competitive effects. Hallaert (2014) points out that imports contribute directly to GDP growth by stimulating productivity and indirectly by boosting the performance of exports. Werner Kristjanpoller and Olson (2014) showed that exports drive gross domestic product (GDP) growth.

Population

Population is the total number of people living in an area. Population quantity, quality, structure, distribution, and migration can help or hinder trade rates. The population of an exporting country has a positive effect on bilateral trade flows in that a larger population means more production and exports. Hassan et al. (2010), Hassan (2002), and Mehanna (2003) found positive per capita income coefficients, indicating that higher per capita income leads to more trade. Additionally, a growing population may increase the need for imports. However, population growth can have a negative impact on importing countries. This is because a growing population is expected to reduce per capita income, reducing the need for imports and possibly reducing export levels. A country's output, market size, demand, supply, and labor, a key component of GDP, are highly dependent on its population. All of these factors play a role in enabling trade with other countries.

Distance

Distance is defined as the logarithm of the kilometer distance between the capitals or ports of two countries (using latitude and longitude coordinates) (Mehl et al., 2019:17). According to this definition, distance is symmetrical (that is, the geographical distance between country A and country B is the same as the geographical distance between country B and country A), continuous, and stable over time (Beugelsdijk et al., 2018:1116). The distance effect is economically important. There is evidence that distance matters in changing international trade flows. Berman et al. (2013) show that the negative impact of the financial crisis on trade is particularly strong for long-delivery destinations. This distance also helped explain the adjustment pattern of bilateral portfolio investment positions during the global financial crisis (Galtsyan & Lane, 2013) (Mehl et al., 2019:7). The flight distance from Accra (Ghana) to Tehran (Iran) is 6,000 miles. At an average speed of 560 mph, it takes 6.93 hours to arrive. The distance from Bandar Abbas, Iran (longitude 51.43, latitude 35.67) to the port of Tema, Ghana (longitude -0.2, latitude 5.56) is 8,352 nautical miles. At a speed of 10 knots, it takes 34.8 days to arrive.

Theoretical Framework

The Ricardian Model of International Trade

Developed by David Ricardo in 1817, this classic theory of comparative advantage simply assumes that a country has a comparative advantage in the quality of goods it produces as compared to the quality of the goods it produces. I'm here. Therefore, the model predicts that countries will specialize in commodities

with the greatest relative advantage in total factor productivity (TFP) (Morrow, 2008:2). The Ricardian model describes trade in two countries. Each country produces her two goods using a single factor of production, labor (Deardoff, 2007:2). Technology offers certain benefits to scale. That is, each country requires a certain amount of labor to produce one unit of each good's output, regardless of how much is produced in total. All markets are fully competitive. Workers are stationed in each country. It cannot be moved between countries, but it is fully movable within a country.

Heckscher-Ohlin Trading Model

Heckscher-Ohlin was proposed by two Swedish economists, Eli Heckscher (1919) and Bertil Ohlin. This model includes two states, his two factors of production such as labor and capital, and two goods. According to this model of international trade, countries benefit from specializing in the production and export of commodities that make intensive use of the country's abundant inputs (Jones, 2008:2). This model emphasizes that a country's exports depend on commodities that need to produce the country's abundant factors and are imported into commodities that consume the country's relatively few factors (Heckscher, 1919; Ohlin, 1933). Akther et. al (2022) states that while a country produces more goods and services that can be produced by factors of abundance and exports those goods and services, it does not specialize in producing goods that cannot be produced by factors of abundance.

Gravity Model of Trade

The gravity model of trade was introduced by Walter Isard in 1954. The basis of this model lies in the fact that bilateral trade flows between two countries are proportional to their economic sizes (GDP) and are inversely proportional to the geographical distance between them. It implies that trade tends to increase as GDP increases and declines as distance increases. This model has been used to analyze the determinants of bilateral trade flows, including shared borders, languages, legal systems, currencies, colonial heritage, and the effectiveness of trade agreements and institutions. It is based on the law of attraction by Isaac Newton. The analogy of attraction between two objects relates to the mass of the two objects and vice versa to the distance of both objects. So, objects with more mass are more attracted, but the greater the distance between the two objects, the less the force of attraction. The attraction force is expressed mathematically in this formula;

$$F_{ij} = G \cdot \frac{M_i M_j}{D_{ij}} \quad (2.1)$$

$$\text{Simplified as } F_{ij} = G(M_i, M_j, D_{ij}) \quad (2.2)$$

where, G is a constant, F is the force of attraction, D is the distance and M is the mass dimensions of the objects that are being measured. Therefore it implies that;

- Trade increases when a country's GDP increases.
- An increase in each country's population should also increase trade.
- However, if the distance between the two countries increases, trade should decrease. This is because distance is an approximation of shipping costs. It shows the elapsed time in transit, so the longer the transit time, the higher the risk. Ships can be lost, sunk, stormy, etc. The price expected to be received by the importer may differ from the actual price as perishable goods may break down in transit or the market may change or disappear. Long distances make communication difficult and incur transaction costs. Some industries that require face-to-face trading can be difficult despite the availability of technology that makes trading easy and fast.

Overview of Previous Related Studies

The impact of economic sanctions on trade transactions between Iran and Afghanistan over several years (1399-1380) is studied and analyzed using a fully modified least-squares method by Ishtiaq et al. (2021). According to the findings, the imposition of economic sanctions not only reduced trade between the two

countries but also increased trade between the two countries by 0.65% as sanctions (heavy, medium, and light) increased in each period.

Weisbrot and Sachs (2019) examine some of the significant effects of the economic sanctions imposed on Venezuela by the US government since August 2017. He said most of the impact of these sanctions hit civilians, not governments. Sanctions have reduced the population's caloric intake, increased disease and mortality (both in adults and infants), and caused millions of Venezuelans to flee the country as a result of worsening economic recession and hyperinflation. evacuated.

Afesorbor (2018) analyzed whether there are different effects when using different sanction instruments and whether the effects of sanctions are product-specific to do. He used a gravity model and detailed disaggregated sanctions data for the period from 1960 to 2009. The results show that the effects of threatened sanctions differ qualitatively and quantitatively from imposed sanctions. The sanctions imposed lead to a decrease in trade flows between senders and their destinations, while the threat of sanctions leads to an increase.

Nguyen (2019), adopted a method to analyze the impact of the RTA on the member economy and on the complementary economy. He's paper explores how regional trade has had many effects on trade between members and trade with non-members. The analysis confirmed the considerable trade-enhancing effect of the RTA on the member economy. However, they often cause business interruptions that affect the business with the other world.

Mehl, Schmitz, and Tille (2019), investigated whether distance affects the volatility of international real and financial transactions. They noted that this is in addition to its established association with the trading floor. A simple trade model using endogenous premiums shows that demand shocks have large effects on trade between more distant countries. The results show that international trade during the 2007–2009 Great Trade Collapse declined for countries farther apart along different measures, with different measures of distance amplifying each other's effects.

Shepherd, Doytchinova, Kravchenko (2019)'s user manual, *The Gravity Model of International Trade*, presents the intuition behind the gravity model, relying on descriptive statistics and graphical methods in addition to simple regression. They also present the theory behind a new, more tightly specified gravity model, focusing on the 'Gravity with gravitas' model, now a benchmark in the applied international literature. They also focus on the basic econometrics of gravity models, including estimation and testing using theory-based gravity models. In addition, they discussed alternative econometric estimators proposed in recent literature and their reasons. Finally, they concluded with a discussion of how gravity models can be used to study applied trade policy, given the numerous applications that have been applied over the past half-century.

In explaining the Ricardian model of international trade, Fally (2018) argues that countries trade with each other because of differences in the technologies used in each country and differences in the total amount of resources (including labor, capital, and land). The difference is taste, imperfect competition, and product differentiation. He also said that the reasons countries do more with some than others are the proximity of countries, lower communication/coordination costs, lower bilateral tariffs, free trade agreements, etc. He further argues that a country has a comparative advantage in producing the goods it produces best compared to the quality it produces in producing other goods and that the country has an absolute advantage.

Nuroglu (2010) examined bilateral trade flows and the determinants among six major ones in the paper "Population effects on bilateral trade flows in the case of OIC (Organization of Islamic Conference)". The paper gives particular emphasis on population impacts on a country's trade flows and approaches the problem of population size from a scientific point of view. The results show that the effect of population on bilateral trade flows is positive for exporting countries and negative for importing countries.

In the article "The Impact of International Trade on GDP" by Dziavochka, Willie, and Mohamued (2020), Evidence from Belarus examines the impact of international trade on GDP. It was concluded that international trade, especially exports, has a positive impact on GDP. They found that a 1% increase in exports resulted in a 0.43% increase. Similarly, if imports increase by 1%, GDP will decrease by 0.43%.

3. Research Methodology

The Data

The dataset used in this paper consists of time series data of GDP, economic sanctions, trade agreement and Export and Import of Iran and Ghana from 2010 to 2021. The GDP is expressed in US dollars (US\$). Data on economic sanctions and trade agreements was taken from journals and articles respectively. The data on export and import between both countries from 2010 to 2020 came from the Iran Customs – Foreign Trade data, and in 2021 from the Iran Trade Development Organization - Ministry of Industry, Mine and Trade. They are also expressed in US dollars (US\$). Finally, the literature was taken from various thesis samples, articles, journals, and books from the internet. The data was analyzed by applying the fully modified ordinary least squares, to the gravity model.

Derivation of the Gravity Model

This study uses a gravity approach to explain the impact of economic sanctions on trade between Iran and Ghana. Empirical evidence based on the gravity equation confirms that bilateral trade flows are related to country size and geographic variables. In particular, bilateral trade is said to be positively correlated with country size and negatively correlated with distance between countries. Therefore, the usual, traditional and at the same time simple model of gravity can be written as a function of (Emami and Shabani, 1390:9).

$$T_{ij} = F(GDP_i, GDP_j, DIS_{ij}) \quad (3.1)$$

We know that the volume of imports and exports of two countries is directly related to the GDP and population of the two countries and inversely proportional to the distance between the two countries. Based on this, using Newton's general gravitational relation in physics, and using the basic model of Tinbergen and Linman, we can rewrite function number 3.1 as

$$T_{ij} = A \frac{(Y_i Y_j)^\alpha}{D_{ij}^\lambda} \quad (3.2)$$

T_{ij} , trading volume D_{ij} is the geographical distance between two countries i and j . Distance between two countries with variables such as: It shows the distance between two capital cities, the distance between two ports, travel time, and transportation costs. The populations of the two exporting and importing countries are entered into the formula as explanatory variables. Based on this, we write relation (3.2) as relation (3.3).

$$T_{ij} = A \frac{(P_i Y_i)^\alpha (P_j Y_j)^\beta}{D_{ij}^\lambda} \quad \text{or} \quad T_{ij} = A \frac{(Y_i Y_j)^\alpha (P_i P_j)^\beta}{D_{ij}^\lambda} \quad (3.3)$$

If we take the logarithm equation from both sides, the following equation is obtained:

$$\log T_{ij} = A^* + \alpha \log(Y_i Y_j) + \beta \log(p_i p_j) + \lambda \log(D_{ij}) + \varepsilon_{ij} \quad (3.4)$$

In 3.4, A^* , the logarithm of A is the population P_i of country i and the population P_j of country j . β , α , and λ are estimated parameters, and ε is part of the normal distribution perturbation. To capture the impact of economic sanctions, a set of sanctions "dummy variables" are added to the basic gravity model. These dummies are meant to capture the "aftermath" or afterlife of sanctions. Adding a dummy variable for sanctions adopts the model or pattern previously used by adjusted gravity model equation of Frank Jonas (2017) as follows:

$$\ln Trade_{ijt} = a_i + a_j + \beta_1 \ln(TGDP_{ijt}) + \beta_2 sanc_{ijt} + \beta_3 rta_{ijt} \quad (3.5)$$

Operational definition of variables

LnTrade_{ijt} is the dependent variable. It is the amount of trade between Iran and Ghana in US dollars at the time “t” taken from the World Bank database. The data is entered into the model in its natural logarithm form.

a_i and **a_j** are special characteristics of both countries respectively.

LnTGDP_{ijt} is the product of GDP of Iran and Ghana in US dollars at consumer price in 2015 and its natural logarithm form is used in the model to ensure stationarity. This shows the economic size of the countries and their production power. The larger the economic size with a greater production capacity, the higher the production at a lower cost, and as a result, it will have a comparative advantage in the international markets. The countries’ exports will increase as well as the attraction of foreign goods. Therefore, it is expected that as the GDPs increases, the trade between the countries will increase.

sanc_{ijt} takes the value of 1 if there is a sanction in effect at year t, and zero otherwise. In order to differentiate the effects of different severity types of sanctions following Hufbauer and Oegg (2003) which has been described in the literature review.

rta_{ijt} captures regional trade agreements. Thus, the preferential trade agreement between Iran and Ghana at time ‘t’. A PTA between two large countries increases the volume of trade in more ways than a PTA between two small partners. Moreover, PTAs between large economies lead to an expansion of demand and so a larger rise in real income than PTAs between smaller countries. It is expressed as 1 in the year t where a trade agreement exists and 0 if otherwise.

4. Model Estimation Methodology

Fully Modified Ordinary Least Square

Fully Modified Least Squares Regression (FM-OLS) was first developed in the work of Phillips and Hansen (1990) to provide optimal estimates for cointegration regression. This method modifies the least-squares method to account for serial correlation effects and regressor endogeneity arising from the presence of cointegration relationships

The time series data in this study have statistical properties that change over time, resulting in inaccurate regressions in most cases. This is because the presence of trends and seasonality affects the mean, variance, and other properties at any point in time. Conclusions drawn from non-stationary processes are unreliable because these statistical properties changing constantly over time. This can be modified by taking first difference to make them stationary. However, the long-run relationship of the variables may be lost during this modification. The fully modified OLS (FM-OLS) method developed by Phillips and Hansen (1990) method is used. However, to determine the degree of co-integration of variables, a unit root test is performed first.

Unit Root Test

Table 1: Unit Root Test Results of Variables Used in the Model

Variables	Probability value	Dickey-Fuller Statistics	Critical Values			Stationary & Non-Stationary	Integration Order
			1%	5%	10%		
LnTrade _{ijt}	0.1113	-2.658500	-4.200056	-3.175352	-2.728985	Non-Stationary	I(1)
D(LnTrade _{ijt})	0.0055	-4.714774	-4.297073	-3.212696	-2.747676	Stationary	
LnTGDP	0.6262	-1.216330	-4.200056	-3.175352	-2.728985	Non-Stationary	I(1)

D(LnTGDP)	0.0092	-4.355597	-4.297073	-3.212696	-2.747676	Stationary	
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This is performed to check the stationarity of the variables at the first difference. The Dickey-Fuller test, also known as the Dickie-Pantura test, is used. It is the test to determine the presence of unit roots. The test examines the value of θ . In particular, it tests the null hypothesis that $\theta=1$ against the alternative that $\theta < 1$.

According to the table, all the variables are stationary at first difference (integrated of order 1, denoted by I(1)).

Cointegration Test

Cointegration techniques shows where there exists two or more non-stationary time series variables in the model are integrated together in a way that they cannot deviate from equilibrium in the long term. The only way to infer about the long-run relationship is to use a cointegration technique when the variables are non-stationary. If two variables, for example x_t and y_t , are both $\sim I(d)$, a linear combination of these two variables such that $u_t = x_t - \theta y_t$ in general, will also be $\sim I(d)$. However, it is an exceptional case if the constant θ yields an outcome where $u_t \sim I(d-a)$ and $a > 0$, then x_t and y_t will be cointegrated.

Table 2: Engle Granger Test

Enger and Granger Statistics	Probability Value	Critical Value		
		10%	5%	1%
-4.112059	0.0441	-3.460791	-4.008157	-5.295384

From the table above, the residual of the regression does not have a single root. There is a long-run equilibrium between the dependent and independent variables.

Model Estimations Results

Since there is a cointegration relationship between the variables, the long-term coefficients of the model are estimated here. The Fully modified OLS (FMOLS) method is used to estimate the long-run relationship.

Table 3: Model Estimation Results

Variables	Coefficients	Standard Deviation	T-Statistics	Confidence Level
LnTGDP	3.487535	1.326005	2.630108	0.0339
RTAijt	-1.263725	0.738832	-1.710435	0.1309
Sancij	-1.668820	0.745557	-2.238355	0.0602
C	-159.4546	68.35717	-2.332668	0.0524

The economic sanction, GDP, trade agreements have their unique impact on the bilateral trade between Iran and Ghana.

More specifically, the economic sanctions on Iran have a negative coefficient which shows that every 1% increase in economic sanctions results in a 1.66 percent decrease in the bilateral trade between Iran and Ghana. This negative effect accounts for the low trade flow between both countries. Trade agreements unexpectedly, also has a negative effect on the bilateral trade. A 1% increase in trade agreement results in a 1.26 percent decrease in the bilateral trade. The bilateral trade increases by 3.48 percent at every 1% increment in GDP of both countries. The GDP has a positive influence on the ability of both countries to trade bilaterally.

Therefore, from the results of the estimation, GDP has the most effect, a positive one at that, on the bilateral trade according to ranking based on the coefficient, 3.487535. Economic sanction, and Trade agreement follow with negative effects on the bilateral trade between Iran and Ghana according to ranking based on the coefficients -1.668820, and -1.263725 respectively.

5. Discussion and Conclusion

From the results of the study, both countries need to push more effort into increasing their GDP. A 3.48% increase in trade at a 1% increase in GDP will result in the growth and development of the two economies in the process. The economic size and the population of Iran is relatively larger than that of Ghana. This may mean that in terms of infrastructure, education, technology and others, Iran stands to have a higher advantage in terms of higher total factor productivity and trade. Ghana on the other hand, has an advantage of endowment in natural resources especially vegetation. With Iran's technology and Ghana's natural resources, both countries can trade profitably. However, the obstacle of economic sanctions stands in the way of fully reaping this benefit.

Since trade is a means to increase GDP, both countries should establish policies that simplify the procedures involved in trade, encourage the availability and use of foreign products, subsidies, and fair price competition between domestic and foreign products. They should also engage in trade associations such as common markets which allows for free movement of factors of production including labor and capital. They should also invest in improving their technology and human capital. This will boost the total production factors and eventually, the GDP of the economy as well as encourage more trade.

Economic sanctions have a negative impact on the bilateral trade between Iran and Ghana. A 1% increase in economic sanctions hurts the bilateral trade by 1%. In 2016, trade was the highest after the implementation of JCPOA. The amount of bilateral trade in the years when Iran was relieved of sanctions (2016 & 2017) sum up to US\$1,636,134,652. The sum of bilateral trade in the rest of the years when sanctions existed within 2010 to 2021 is US\$1,060,831,475. There was a 54% increase in trade in the 2 years of relief from sanctions when compared to the sum of bilateral trade in the years when sanctions existed within 2010 to 2021. This is strong evidence that economic sanctions have a negative impact on the bilateral trade between Iran and Ghana.

Economic sanctions imposed on Iran currently has to be managed scrupulously. Iran must work around these sanctions to nullify its effect on the bilateral trade. Both countries have to play carefully in their economic affairs and policies in order to prevent the imposition of any form of economic sanctions. They have to maintain good political relations with other countries especially neighboring countries. This will help prevent war and forge strong alliances for aid in times of crises.

Finally, from the results of the study, 1% increase of trade agreements causes 1.26% decrease in trade. It is expected that trade agreements are to foster and increase the amount of trade between member countries. However, in 2010, 2014, and 2017 where there were Memoranda of Understandings signed to facilitate the bilateral trade between Iran and Ghana, the amount of trade was US\$35,197,689, US\$47,622,241 & US\$59,904,434 respectively. Compared to the years where there were no Memoranda of Understandings signed, trade was relatively lower. Therefore, trade agreements should be scrutinized accordingly. What is agreed upon must promote the bilateral trade but unfortunately, it is the contrary.

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Authenticity of the texts, honesty and fidelity has been observed.

CONFLICT OF INTEREST

Author/s confirmed no conflict of interest.